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CSLF-T-2011-04
Revised Draft: 30 August 2011

TECHNICAL GROUP

Revised Draft
Minutes of the CSLF Technical Group Meeting

Edmonton, Alberta, Canada
19 May 2011

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MINUTES OF THE CSLF TECHNICAL GROUP MEETING
EDMONTON, ALBERTA, CANADA
19 MAY 2011

Note by the Secretariat

Background

The Technical Group of the Carbon Sequestration Leadership Forum held a business meeting on 19 May 2011, in Edmonton, Alberta, Canada. Initial draft minutes of this meeting were compiled by the CSLF Secretariat and were circulated to the Technical Group delegates for comments. Comments received were incorporated into this revised draft. Presentations mentioned in these minutes are now online at the CSLF website.

Action Requested

Technical Group delegates are requested to approve these revised draft minutes.

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DRAFT

Minutes of the Technical Group Meeting

Edmonton, Alberta, Canada
Thursday, 19 May 2011

LIST OF ATTENDEES

Technical Group Delegates

Australia:	Clinton Foster (Vice Chair)
Brazil:	Paulo Rocha, Paulo Negrais Seabra
Canada:	Stefan Bachu, Eddy Chui
China:	Sizhen Peng, Ping Zhong
European Commission:	Jeroen Schuppers
France:	Didier Bonijoly
Germany:	Jürgen-Friedrich Hake
Italy:	Giuseppe Girardi, Sergio Persoglia
Japan:	Ryo Kubo
Korea:	Young Cheol Park, Chong Kul Ryu
Netherlands:	Harry Schreurs
Norway:	Trygve Riis (Chair)
Saudi Arabia:	Khalid Abuleif, Abdulmuhsen Al-Sunaid
South Africa:	Fred Goede (Acting Vice Chair)
United Kingdom:	Philip Sharman
United States:	Joseph Giove, George Guthrie

Representatives of Allied Organizations

Global CCS Institute:	Ian Hayhow, Kathy Hill
IEA GHG:	Ameena Camps

CSLF Secretariat

John Panek, Rich Lynch

Invited Speakers

Sandra Locke, Assistant Deputy Minister, Alberta Department of Energy, Canada
Mark Trupp, CO_2 Team Leader, Chevron Australia
Syrie Crouch, Development Manager, Shell Canada Energy
Alan Laundry, Director – Fort Nelson CCS Project, Spectra Energy, Canada
Pietro Barbucci, Senior Advisor on CCS Strategy, Enel, Italy

Observers

Canada:	Jessie Inman, Michelle Limoges, Dave Ryan
China:	Qi Li, Ruina Xu
Saudi Arabia:	Abdullah Al-Sarhan

1. Chairman's Welcome and Opening Remarks

The Chairman of the Technical Group, Trygve Riis of Norway, called the meeting to order, welcomed the delegates and observers to Edmonton, introduced Vice Chairs Clinton Foster of Australia and Fred Goede of South Africa (acting for Tony Surridge, who was unable to attend), and expressed appreciation to the Provincial Government of Alberta, and especially to Alberta Innovates – Technology Futures, for hosting this meeting.

Mr. Riis provided context for the meeting by mentioning that the upcoming CSLF Ministerial Meeting in Beijing, China, was now just four months in the future and that this meeting would help set the stage for the Ministerial Meeting. In that regard, he mentioned that delegates at this current Technical Group meeting would be reviewing three new projects that have been nominated for CSLF recognition, and if approved by the Technical Group would then be considered by the Policy Group at its meeting in Beijing. Also, in addition to the business items on the agenda, there would be a presentation from the Chinese delegation about CCS activities in China. This will serve to help set the stage for the upcoming Ministerial Meeting.

2. Welcome from the Province of Alberta

Sandra Locke, Assistant Deputy Minister in the Alberta Department of Energy, welcomed the Technical Group to Edmonton and informed meeting attendees about Alberta's firm commitment for reducing greenhouse gas (GHG) emissions. In December 2010, Alberta became the first province in Canada to pass comprehensive legislation for carbon capture and storage (CCS) with the Carbon Capture and Storage Statutes Amendment Act, which establishes the procedures for obtaining tenure to the pore space for carbon dioxide (CO_2) storage and states that the Alberta provincial government will accept long-term liability for CO_2 that is sequestered underground in CCS projects. The Alberta government is also working with experts from around the world in conducting a regulatory framework assessment for permitting and monitoring CO_2 storage operations. There is a provincial goal of reducing projected GHG emissions by 200 million tonnes by 2050, with CCS accounting for 70% of the total reduction. The Alberta government is working toward financial agreements with four large-scale CCS projects, including Shell Canada's CSLF-recognized Quest CCS Project, which will reduce Provincial CO_2 emissions by five million tonnes annually starting in 2015. These projects will demonstrate technical feasibility of large-scale CCS deployment in various sectors of Alberta's economy.

Ms. Locke closed her remarks by thanking meeting attendees for their leadership and commitment to the deployment of CCS technology throughout the world, and stated that it is only by working together that we will move CCS forward.

3. Introduction of Delegates and Observers

Technical Group delegates and observers present for the session introduced themselves. Sixteen of the twenty-five CSLF Members were present at this meeting, including representatives from Australia, Brazil, Canada, China, the European Commission, France, Germany, Italy, Japan, Korea, the Netherlands, Norway, Saudi Arabia, South Africa, the United Kingdom, and the United States. Observers representing Canada, China, and Saudi Arabia were also present.

4. Adoption of Agenda

The Agenda was adopted with the addition of the Jänschwalde Project as a third project to be presented under the "Approval of Projects Nominated for CSLF Recognition" item.

5. Approval of Minutes from Warsaw Meeting

The Technical Group minutes from the October 2010 meeting in Warsaw, Poland, were approved as final with no changes.

6. Review of Action Items from Warsaw Meeting

John Panek of the CSLF Secretariat reported that all action items from the Warsaw meeting had been completed or were substantially underway.

7. Report from CSLF Secretariat

John Panek gave a brief presentation that provided updates on recent CSLF events, including the March 2011 Projects Interaction and Review Team (PIRT) meeting and CSLF Projects Interactive Workshop in Al Khobar, Saudi Arabia, and the April 2011 Financing Roundtable (co-sponsored with the Asian Development Bank) in Singapore. Mr. Panek also reported that the IEA Greenhouse Gas R&D Programme (IEA GHG) has informed the Secretariat that IEA GHG reports can now be freely distributed to all member countries that are members both of IEA GHG and CSLF from their date of publication. Six months after their publication date they can be distributed to any CSLF member irrespective if they are an IEA GHG member or not.

Concerning the upcoming Ministerial Meeting, Mr. Panek mentioned that all Ministerial invitations had been sent out by the Secretariat and he previewed the general schedule for the meeting.

8. Progress Reports from CSLF-recognized Projects: Gorgon Project

Mark Trupp, CO_2 Team Leader at Chevron Australia, gave a presentation on the CSLF-recognized Gorgon Project that provided much useful information on what it takes to make a commercial-scale CCS project happen. The Gorgon Project is a joint venture between Chevron Australia and five other partners that will store approximately 120 million tonnes of CO_2 in a water-bearing sandstone formation two kilometers below Barrow Island, off the northwest coast of Australia. The CO_2 stored by the project will be extracted from natural gas being produced from the nearby Gorgon Field and injected at a rate of approximately 3.5 to 4 million tonnes per year.

The project has been under development since the mid-1990s. Since 2002, activities have focused on appraising the selected site and refining the configuration of the injection project; more than A$150 million spent on appraisal data and analysis. Project assurance processes have been extensive, and have included four rounds of independent Government due diligence by external expert panels funded by Western Australia state government. There has also been an extensive approval process lasting more than six years that included a comprehensive environmental assessment that satisfied State and Federal legislation. Legal and regulatory mechanisms for storage of CO_2 had to be developed by the Western Australia government, and experience gained in that regard has been used in framing the Australian Offshore Petroleum and Greenhouse Gas Storage Act. Detailed project commissioning and operations plans are currently being finalized for the anticipated 2014 start-up.

Mr. Trupp emphasized that data required for proper site assessment should not be underestimated and that for a project this size, significant financial investment may be required prior to project sanction. Another lesson learned was that CO_2 disposal requires the same attitude, approach and capability to that of a major capital petroleum development.

9. Progress Reports from CSLF-recognized Projects: Quest CCS Project

Syrie Crouch, Development Manager at Shell Canada Energy, gave a presentation on the CSLF-recognized Quest CCS Project. This is a large-scale project, located at Fort Saskatchewan, Alberta, Canada, with integrated capture, transportation, storage, and monitoring, which will capture and store 1.1 million tonnes per year of CO_2 from an oil sands upgrading unit. The CO_2 will be transported via pipeline and stored in a deep saline aquifer in the Western Canada Sedimentary Basin in Alberta. This is a fully integrated project, intended to significantly reduce the carbon footprint of the commercial oil sands upgrading facility while developing detailed cost data for projects of this nature. This will also be a large-scale deployment of CCS technologies and methodologies, including a comprehensive measurement, monitoring and verification (MMV) program.

Ms. Crouch provided key information on the Quest Project's conceptual storage plan with regard to optimization of injection well spacing, storage reservoir characteristics, optimization of pore space utilization, and other storage aspects. The project is on track for a 2015 initiation of CO_2 capture and storage activities.

10. Report from PIRT

The PIRT Chair, Clinton Foster of Australia, gave a presentation that summarized the previous two PIRT meetings of 03 March 2011 (in Al Khobar, Saudi Arabia) and 18 May 2011 (in Edmonton). The Al Khobar meeting resulted in the following outcomes:

- A schedule for updating the CSLF Technology Roadmap was developed.
- There was consensus to terminate the Technology Readiness Level analysis of CSLF-recognized projects.
- The Wandoan Project was approved by the PIRT and sent forward to the Technical Group for its consideration.

The following outcomes resulted from the Edmonton meeting:

- The Task Force to Assess Progress on Technical Issues affecting CCS was separated from the PIRT and will now report directly to the Technical Group.
- The PIRT will re-examine the CSLF Gaps Analysis Checklist as used in the CSLF Project Submission Form with an aim to simplify the Checklist.
- There was agreement to streamline the procedure for presentation of projects nominated for CSLF recognition with regard to the amount of technical information presented at each of the approval stages. The most information about a newly-proposed project would be provided during the PIRT meeting via the Project Submission Form and a presentation by the project sponsor. Following approval by the PIRT, a summary of salient information about the project would be provided during the Technical Group meeting via a brief presentation by the Technical Group delegate of the country hosting the project. Following approval by the Technical Group, the Technical Group Chairman would then present the project to the Policy Group in a single summary viewchart.

- The Zero Emission Porto Tolle (ZEPT) Project and the Jänschwalde Project were approved by the PIRT and sent forward to the Technical Group for its consideration.
- Nomination of two additional projects, from the Netherlands and France, is expected in time for the upcoming Ministerial Meeting. These will be shepherded through the approval process by the procedure described above.
- In light of the success of the recent storage-themed Projects Interactive Workshop in Saudi Arabia, there was a discussion of possible future workshop topics, perhaps based on lessons learned. There was agreement that knowledge sharing and capacity building could be key attributes of any future workshop, but no plans were put in place for any specific events.

There was considerable discussion on the topic of future workshops. Khalid Abuleif of Saudi Arabia suggested that since issues related to storage and monitoring appear to have the most importance especially where commercialization is concerned, 'Monitoring' would be a good topic for a future workshop. Stefan Bachu of Canada mentioned that storage issues are handled at other conferences, but project integration (of CO_2 capture, pipeline transportation, storage, and monitoring) does not seem to be very well addressed; therefore it might be good idea to have a workshop on how to put together an entire project. There was general agreement on the need for more of these projects workshops but timing is problematic, at least for the remainder of 2011. Philip Sharman of the United Kingdom offered that there are already several other conferences and workshops already in development to which many Technical Group delegates are already committed. Several timeframe options were offered up by the delegates, but in the end there was consensus that the Technical Group Executive Committee and the Secretariat should consider all the possibilities and come up with a plan for future workshops that can be presented to the delegates at the next Technical Group meeting.

11. Reports from the Task Force to Assess Progress on Technical Issues Affecting CCS

The Task Force Chair, Clinton Foster, gave a brief presentation that described the function of the Task Force and its makeup. The Task Force consists of four Working Groups: Capture Technologies (chaired by George Guthrie of the United States), Transport and Infrastructure (chaired by Harry Schreurs of the Netherlands), Storage and Monitoring (chaired by Stefan Bachu of Canada), and Integration (chaired by Klaas van Alphen of the Global CCS Institute). Dr. Foster mentioned that there has been strong stakeholder interest in the Task Force outcomes, but that not all stakeholders who have joined the Working Groups have been contributors. As a result, the progress of this Task Force has been slowed. Therefore, in order to move forward, the four Working Group Chairs have been requested to reaffirm to their members that these Working Groups were formed to conduct technical assessments, and to make adjustments to their membership lists if necessary. All outcomes from this Task Force will be available to CSLF stakeholders.

Dr. Foster stated progress made by all Working Groups in the Task Force. There has been an initial attempt to assess technical gaps described in the CSLF Technology Roadmap by the Working Groups, but there has not been a consensus on how these gaps should be assessed. Dr. Foster will work with the Working Group Chairs to provide some clarity in that regard and develop a schedule of deliverables for the Task Force.

The Working Group Chairs each provided brief updates. Dr. Guthrie stated that work is ongoing for updating the gaps checklist for CO_2 capture, and that the Capture

Technologies Working Group is considering if its activities should be limited only to CSLF-recognized projects or instead to look beyond these and include significant CCS projects that are not yet part of the CSLF projects portfolio. Mr. Schreurs and Dr. Bachu also stated that work is also ongoing for updating the gaps checklist in their Working Groups. Dr. Bachu welcomed the directive for Working Group Chairs to make adjustments in their membership, as this will speed up the activities of the Working Groups.

Kathy Hill of the Global CCS Institute, attending the meeting in place of Klaas Van Alphen, gave a presentation that summarized the activities of the Integration Working Group. Project Integration Challenges is one of the Institute's four Thematic Groups. In addition to examining Integration-related gaps, the CSLF Integration Working Group will work in collaboration with the Institute's Project Integration Thematic Group to address the need for whole of CCS project integration of risk management and dependencies, and to inform the proponents and prospective funders of early stage project proposals, to enable them to incorporate key learnings from prior projects into their plans and schedules. This would include non-proprietary information from projects that have failed and key decisions not made in their project development cycles. The Institute's "OpenCCS" project development guide for sharing lessons learned and best practices is being used, and next steps include identification of project timings, inter-dependencies, and critical paths. A Working Group meeting is anticipated before the end of 2011.

12. Approval of Projects Nominated for CSLF Recognition

Wandoan Project (nominated by Australia, United States, and Canada)

Clinton Foster, representing project sponsor the Wandoan Power Consortium, gave a presentation about the Wandoan Project. This is a large-scale integrated gasification combined cycle (IGCC) power plant, located in southeastern Queensland, Australia, which will demonstrate industrial-scale, integrated application of technologies for commercial coal-fueled power generation with CCS. Goals of the project are to establish a low-carbon benchmark (of approx. 90% CO_2 capture) for commercial fossil-fueled power plants, prove successful integration of power generation and CCS, provide data for determination of storage capacity of the local geologies for possible use by other future CCS projects, and demonstrate global leadership for the further deployment of CCS technology. Power production by the project will be approx. 400 megawatts and CO_2 storage by the project will be approx. 2.5 million tonnes per year into a deep saline aquifer.

After brief discussion, there was consensus by the Technical Group to recommend CSLF recognition for the Wandoan Project.

ZEPT Project (nominated by Italy and European Commission)

Pietro Barbucci, Senior Advisor on CCS Strategy for project sponsor Enel, gave a presentation about the ZEPT Project. This is a large-scale project, located in northeastern Italy, which will demonstrate post-combustion CCS on 40% of the flue gas from one of the three 660 megawatt units of the existing Porto Tolle Power Plant (which is being converted from heavy oil fuel to coal). The goal of the project is to demonstrate industrial application of CO_2 capture and geological storage for the power sector at full commercial scale. The demonstration plant will be operated for an extended period (approx. 10 years) in order to fully demonstrate the technology on an industrial scale, clarify the real costs of CCS, and prove the retrofit option for high-efficiency coal fired

units which will be built (or replaced) in the coming 10-15 years. Storage of approx. 1 million tonnes per year of CO_2 will take place in a deep saline aquifer beneath the seabed of the Adriatic Sea approx. 100 kilometers from the project site.

After brief discussion, there was consensus by the Technical Group to recommend CSLF recognition for the ZEPT Project.

Jänschwalde Project (nominated by Germany and European Commission)

Jürgen-Friedrich Hake of Germany, representing project sponsor Vattenfall, gave a presentation about the Jänschwalde Project. This is a large-scale lignite-fueled project, located in southeastern Germany, which will technically and economically validate the complete CCS chain, including demonstration of two capture technologies (oxyfuel and post-combustion capture). The goals of the project are to transfer knowledge from an existing pilot plant to a full-scale demonstration, prove and evaluate the suitability of different storage alternatives. Two of the 250 megawatt units at the existing Jänschwalde Power Plant will be converted for this project, one for oxyfuel operation and one for post combustion capture of CO_2. Storage sites for the approx. 1.7 million tonnes per year of CO_2 are being determined and will be evaluated during the course of the project, and may include both deep saline aquifers and depleted gas fields.

Mr. Hake also provided a short synopsis on recent developments concerning CCS in Germany. In the near term, Germany is exploring the options for CCS and supports the construction of highly efficient CCS-ready fossil fuel power plants. However, new CCS legislation, which is expected to be enacted before the end of 2011, would limit the deployment of CCS to a few demonstration projects, where the annual CO_2 storage amount cannot exceed 3 million tonnes per storage site and a total of 8 million tonnes in Germany. Further, areas within Germany can be designated where demonstration projects could take place, and other areas can be designated where such projects are not allowed. Also, by 2017 there would be a comprehensive evaluation which would decide if CCS can be considered as a climate change mitigation measure in Germany.

After brief discussion, there was consensus by the Technical Group to recommend CSLF recognition for the Jänschwalde Project.

13. Update on the Fort Nelson CCS Project

Alan Laundry, Director of the CSLF-recognized Fort Nelson CCS Project for Spectra Energy Canada, gave a luncheon presentation about the project and its activities. This is a large-scale project in northeastern British Columbia, Canada, which will permanently sequester up to 2 million tonnes of CO_2 per year from a large natural gas processing plant into deep saline formations of the Western Canada Sedimentary Basin. Goals of the project are to verify and validate the technical and economic feasibility of using brine-saturated carbonate formations for large-scale CO_2 injection and demonstrate that robust monitoring, verification, and accounting (MVA) of a brine-saturated CO_2 sequestration project can be conducted cost-effectively.

Mr. Laundry stated that initial project activities have characterized the storage potential and characteristics of the deep saline formation intended for use. Near-term next steps include confirmation of a commercial model in the absence of a clear market price for carbon, design of a MVA regime, continuation of reservoir evaluation, and coordination with the Province of British Columbia to clarify long term liability. Longer-term next steps include completion of work and analyses required to prove formation injection capabilities over the expected life of the project and working with the British Columbia

Oil & Gas Commission to carry out the CCS Scheme Approval Process. The goal is for the project to be in-service by mid 2015.

14. Report from Risk Assessment Task Force (RATF)

The Task Force Chair, George Guthrie, gave a brief update on the RATF. The RATF has completed its Phase I activities, which centered on examination of risk-assessment standards, procedures, and research activities relevant to unique risks associated with the injection and long-term storage of CO_2. The RATF's Phase I Report is online at the CSLF website and includes an overview of risk assessment methodologies for engineered geologic systems, a literature review of risk assessment for CO_2 storage, identification of key potential risks, an overview of monitoring & mitigation options that support risk assessment, and a summary of ongoing and emerging activities in CSLF countries. One of the recommendations from the Report was that the link between risk assessment and liability should be recognized and considered. As a result, the CSLF Policy Group has formed a Joint Task Force on Risk and Liability with the Technical Group.

Dr. Guthrie stated that RATF Phase II activities, now underway, include a gaps assessment to identify CCS-specific tools and methodologies that will be needed to support risk assessment, and a feasibility assessment of developing general technical guidelines for risk assessment that could be adapted to specific sites and local needs. These two sections will be incorporated into the Task Force's Phase II Report. Drafts of these two sections are now complete and have been circulated to Task Force members for comment. A final draft of the Phase II Report is expected by early August.

15. Report from CCS in the Academic Community Task Force

The Acting Task Force Chair, Ameena Camps of the IEA GHG, gave a brief update on the Task Force. Currently the Task Force is in Stage 1 of its program; the two main activities are assembling a database of information about academic institutions around the world that offer postgraduate degree programs involving CCS, and development of a student website where online forums about CCS can be held. Dr. Camps stated that development of the website has proven difficult, and that the Secretariat is currently exploring options for how to get it implemented. As for the worldwide mapping of academic institutions with postgraduate CCS programs, a draft report has been completed by Brazil's Carbon Storage Research Center (CEPAC) that includes academic programs in Argentina, Brazil, Canada, Chile, Colombia, Ecuador, Italy, Mexico, the Netherlands, Portugal, South Africa, Spain, the United Kingdom, the United States, Uruguay, and Venezuela. Information about other countries is needed so that this report can be made as comprehensive as possible in time for the upcoming Ministerial Meeting. The draft report has been sent to Task Force members and comments are needed by the end of June 2011 to maintain the schedule for completing the report.

Dr. Camps outlined the forward work plan for the Task Force. Once Stage 1 is completed as much as it can be, the next stage would be to review the status of CCS academic programs and to perform a gaps analysis to identify where the CSLF could best target its efforts. An example of this would be to develop strategic course material for use in these programs. Another useful activity would be to map the progress of CCS in academia, for example, by charting the increase in the number of academic programs and graduating students; this would assist in any decision making on where to target Task Force activities, and would help to better align the interests and activities of this Task Force

with the CSLF Capacity Building Task Force. A five-year strategic plan for the Task Force will be developed via electronic correspondence between Task Force members.

16. Update on the Carbon Capture, Utilization and Storage (CCUS) Activities in China

Sizhen Peng of China gave a presentation that summarized ongoing CCUS-related activities there. Since 2006, one of China's energy production goals has been "to develop efficient, clean and near-zero emission fossil energy utilization technologies". In that regard, CCUS technology has been included as one of the key GHG mitigation technologies to be developed. Currently there are many government-supported areas of activity, including post-combustion capture research and demonstration, oxyfuel research and demonstration, CO_2 conversion to biofuels via microalgae, CO_2 mineralization research, industrial CCS (in the iron and steel sector), and enhanced oil recovery (EOR).

Dr. Peng stated that there are presently three capture technologies pilot plants in operation, including the China Huaneng Group's 120,000 tonne per year facility in Shanghai, with another three in planning or under construction. The main storage pilot plant is the Shenhua Group's facility in Inner Mongolia, which began injection operations in 2010; in that demonstration, up to 100,000 tonnes per year CO_2 captured from a coal liquefaction plant are being stored in a deep saline aquifer. There are four main CO_2 utilization pilot plants in China, one each for EOR, enhanced coal-bed methane production (ECBM), CO_2-to-biofuels, and CO_2-to-chemicals. Based on positive results from the biofuels pilot, the ENN Group is constructing a facility in Inner Mongolia that will use microalgae to absorb 320,000 tonnes per year of CO_2 from a coal-to-methanol facility for production of bio-diesel and other biofuels.

In addition to these, Dr. Peng stated that China is actively involved in full-chain CCUS demonstration, including Sinopec's operational 30,000 tonnes per year CO_2 capture and EOR Pilot (at the Shenli oilfield), Huaneng's "GreenGen" 400 megawatt IGCC Power Plant with CCS for EOR (under construction at Tianjin), and Sinopec's planned 1 million tonnes per year CO_2 flue gas capture and EOR Demonstration (at the Shenli oilfield).

Dr. Peng also mentioned that China is involved in many bilateral and multilateral collaborations related to CCUS, including the CSLF. There has been an ongoing effort to assess and characterize China's CO_2 storage capacity and a CCUS technology roadmap for China is under development with the aim of guiding CCUS technology development to the year 2030. Dr. Peng closed his presentation by mentioning that there are still some gaps in China's approach to CCUS, such as the relatively less amount of attention and resources being committed to the CCS-related supporting environment such as regulatory, environmental impacts, and risk management compared to the technology challenges.

17. Discussion of 2011 CSLF Ministerial Meeting

Chairman Riis inquired with the Secretariat if there had been any further ideas concerning the upcoming CSLF Ministerial Meeting. John Panek responded that since there were no recently-completed CSLF-recognized projects, the world's three largest commercial-scale CCS projects could receive CSLF Recognition Awards in Beijing. These three projects, the Sleipner Project in Norway, the Weyburn Project in Canada, and the In Salah Project in Algeria, had each reached significant milestones with sustained operation demonstrating the capture, injection, and storage of several millions of tonnes of CO_2. After brief discussion there was consensus that the Technical Group will make this recommendation to the Ministerial Steering Committee.

Philip Sharman mentioned that at the 2009 CSLF Ministerial Meeting in London, the sponsor of the CO_2 Capture Project, which received a Recognition Award at that meeting, was also provided the opportunity for a presentation about the project during the Ministerial's Technical Group meeting. In that regard, perhaps the sponsors of the Sleipner, Weyburn, and In Salah projects should be provided the same opportunity. There was consensus on this suggestion, and Mr. Panek stated this message would also be carried forward to the Ministerial Steering Committee.

Peng Sizhen suggested that the Ministerial Meeting would be an appropriate time for the Technical Group to make known to the Ministers that ongoing research has greatly reduced the energy penalty for CCS technologies, that CCS technologies will be less expensive in the future, and that geologic storage of CO_2 is safe and effective. Stefan Bachu concurred, and mentioned that the Technical Group could also show the spread of CCS technologies since publication of the Intergovernmental Panel on Climate Change (IPCC) report in 2005. Jeroen Schuppers of the European Commission agreed, and suggested that the Ministers be provided some examples on what is being done on global scale. In response to these suggestions, Mr. Sharman suggested that the Technical Group could present on a theme basis on what progress has been made. This might be more useful than presentations by separate projects. Mr. Panek responded that there may not be any slots open during the Conference of Ministers but there may be a possibility for pass-through of information from the Technical Group during the Conference.

18. Update on CCS Activities in Canada

Stefan Bachu gave a presentation that summarized ongoing CCS-related activities in Canada. Dr. Bachu prefaced his remarks by stating that Canada's economy is resource-based and located in a cold climate with relatively large distances between population centers, hence the need for energy for resource production, power generation / heating, and transportation. Because of this, energy production with the associated development of Canada's fossil fuel resources is a critical component of the Canadian economy. Canada is currently ranked 9th in the world in terms of its GHG emissions, accounting for approx. 1.6% of the world's total. These emissions have been trending upward over the past two decades, and Canada has set a target of reducing its GHG emissions by 17% below 2005 levels. CCS has been endorsed by the Canadian federal government as one element of achieving this goal.

Dr. Bachu mentioned that Canada's overall approach toward GHG reduction is multi-faceted. There is a federal focus on legislation for reduction of GHG emissions without affecting economic recovery and development of Canada's resources. Development of the legislative and regulatory framework for CO_2 storage is taking place at the provincial level, and support of large-scale, integrated demonstration projects that will prove CCS technologies is shared between both the provincial and federal governments.

Dr. Bachu stated that Canada's CCS activities are mostly focused in the provinces of Alberta, Saskatchewan, British Columbia, and Nova Scotia, partly because there are large stationary sources of CO_2 in these provinces but mainly because of the presence of large sedimentary basins in these provinces where CO_2 can be stored. Alberta has established a Climate Change and Emission Management Fund into which industry pays C$15 per tonne of CO_2 emitted over emissions targets, to be used for technology development. Alberta's provincial government has also established a C$2 billion fund (topped with additional money from the Canadian federal government) for supporting four large CCS demonstration projects in the province that will each inject at least 1 million tonnes CO_2

per year by 2015. Initiatives by the British Columbia's provincial government include establishment of a carbon tax on gasoline of C$0.01 per liter, and financial support of the CSLF-recognized Fort Nelson CCS Project. Saskatchewan's provincial government is providing financial support to the CSLF-recognized IEA GHG Weyburn-Midale Monitoring and Storage Project and to the Boundary Dam CO_2 Capture Project in the southern part of the province, and is amending its Oil and Gas Conservation Act to accommodate CCS development. And in Nova Scotia, work in underway to identify a suitable site for future storage of CO_2 captured from one of the coal-fueled power plants there.

Dr. Bachu concluded his presentation by mentioning that CCS may be applicable on a small scale in other provinces, but the main impact of applying CCS will be in Canada's western provinces. The Canadian government has affirmed its support of CCS by implementing a new C$1 billion Clean Energy Fund that includes C$650 million for large scale CCS demonstration projects. Overall, Canada's goals concerning CCS are for deployment of integrated large-scale demonstration projects, development of the proper legal and regulatory framework for CCS implementation, knowledge sharing, and public engagement.

19. Development of Work Plan in Support of CCUS Action Group Recommendations

Chairman Riis reported that at the recent Clean Energy Ministerial in the United Arab Emirates, the CSLF along with the International Energy Agency (IEA) and the Global CCS Institute was requested by the Ministers to develop a work plan to support the implementation of recommendations presented to the Ministers by the CCUS Action Group. In all, seven recommendations were made, but only three of them pertain to the CSLF Technical Group. They are:

- Support and encourage the development of best practice knowledge-sharing from early mover projects, in particular those with public funding;
- Review key gaps in storage data coverage and knowledge including capacity assessment; and
- Recognize the potential of CCS for industrial emission sources and review demonstration opportunities.

Ensuing discussion did not lead to a clear way forward, so there was consensus that Mr. Riis should meet with representatives of the IEA and Global CCS Institute to determine a plan for addressing recommendations of CCUS Action Group. Mr. Riis mentioned that other Technical Group delegates were welcome to join him in this endeavor.

20. International Activities Round-Up

Chairman Riis called on Ameena Camps of the IEA GHG and Kathy Hill of the Global CCS Institute to briefly describe their organizations' recent activities that are relevant to the Technical Group. Dr. Camps provided information on studies that have been commissioned by the IEA GHG. The CSLF-proposed study on CO_2 storage in shales was accepted, but the proposed study on CO_2 storage in basalt is awaiting technical review. The next IEA GHG Executive Committee meeting will be in London at the end of July.

Ms. Hill provided information on the Global CCS Institute's technical areas. It is currently working with IEA GHG on gaps analysis and managing impacts on ground water, among other things. The Institute has been extended by the Australian Government for an additional two years, but there have been budget reductions.

21. New Business

Chairman Riis mentioned that Norway is interested in hosting the 2012 Technical Group meeting, perhaps in Bergen so that a visit to the CSLF-recognized Mongstad CCS Project could be made. Delegates expressed their appreciation to Norway, and there was consensus for the Secretariat and Chairman to work out details.

John Panek mentioned that the 2011 CSLF Technology Roadmap update was ongoing, and that the Secretariat had previously requested that Technical Group delegates provide comments and corrections to the country-specific information contained in Module 2. Mr. Panek stated that many CSLF Members had not yet provided their updates so there was consensus for the Secretariat to send out a reminder.

Mr. Riis reported that the Ministerial Meeting Steering Committee has requested that the Technical Group develop a new five-year action plan that can be incorporated into the CSLF Strategic Plan that is currently being revised. Ensuing discussion did not lead to a clear way forward, so there was consensus that the Technical Group Executive Committee would develop a draft in time for the next Technical Group meeting.

22. Review of Action Items and Next Steps

Item	Lead	Action
1	Technical Group Executive Committee and Secretariat	Develop a plan for holding future CSLF Projects workshops.
2	Task Force to Assess Progress on Technical Issues Affecting CCS	Develop a schedule of deliverables.
3	Technical Group Chairman	Provide the Technical Group's recommendation to the Policy Group that the Wandoan Project, the ZEPT Project, and the Jänschwalde Project be recognized by the CSLF. *(note: Secretariat will coordinate with the ZEPT Project sponsor regarding status of the project.)*
4	Risk Assessment Task Force	Complete the Task Force's Phase II Report.
5	CCS in Academic Community Task Force	Complete the Task Force's Stage 1 Report on worldwide CCS postgraduate programs.
6	Technical Group Executive Committee	Recommend to the CSLF Ministerial Steering Committee that the Sleipner, Weyburn, and In Salah Projects each receive a CSLF Recognition Award at the 2011 CSLF Ministerial Meeting, and that these projects be presented an opportunity to make presentations during the Meeting.
7	Technical Group Chairman	Meet with IEA and Global CCS Institute to determine a plan for addressing recommendations of CCUS Action Group.

Item	Lead	Action
8	Secretariat and Technical Group Chairman	Work out details concerning the proposed 2012 Technical Group Meeting in Norway.
9	Secretariat	Send reminder to the Technical Group delegates for them to submit their country updates for the 2011 CSLF Technology Roadmap.
10	Technical Group Executive Committee	Develop a draft five-year action plan for the Technical Group.

23. Closing Remarks / Adjourn

Chairman Riis thanked the delegates, observers, and Secretariat for their hard work, expressed his appreciation to the Alberta Provincial Government, Alberta Innovates, and other meeting sponsors. John Panek expressed the Secretariat's appreciation to Stefan Bachu for acting as meeting host, and Dr. Bachu pointed out Michelle Limoges of Alberta Innovates as the person who made it all happen.

Mr. Riis reminded attendees of the upcoming visit to the CSLF-recognized Quest CCS Project on Friday, May 20th, and adjourned the meeting.