



## Minutes of the Technical Group Meeting

Bergen, Norway  
Thursday, 12 June 2012

### LIST OF ATTENDEES

#### Delegates

Australia:	Clinton Foster (Vice Chair), Richard Aldous
Brazil:	Paulo Negrais Seabra
Canada:	Stefan Bachu
China:	Ping Zhong, Xiaochun Li
Denmark:	Søren Frederiksen
European Commission:	Jeroen Schuppers
France:	Didier Bonijoly, François Kalaydjian
Germany:	Jürgen-Friedrich Hake
Italy:	Giuseppe Girardi, Sergio Persoglia
Japan:	Ryo Kubo
Korea:	Chong Kul Ryu, Chang-Keun Yi
Netherlands:	Paul Ramsak
Norway:	Trygve Riis (Chair), Jostein Dahl Karlsen, Tone Skogen
Poland:	Elżbieta Wróblewska
Russia:	Mikhail Puchkov
Saudi Arabia:	Ahmed Aleidan
South Africa:	Tony Surridge (Vice Chair)
United Kingdom:	Philip Sharman
United States:	Joseph Giove, Grant Bromhal

#### Representatives of Allied Organizations

IEA GHG: Tim Dixon

#### CSLF Secretariat

John Panek, Richard Lynch

#### Invited Speakers

Menno Dillen, Research Director, Geophysics and Reservoir Technology Department, SINTEF, Norway

Gunnar Sand, Program Manager, SINTEF and UNIS, Norway

Robert Finley, Director, Advanced Energy Technology Initiative, University of Illinois, United States

Scott McDonald, Biofuels Development Director, Archer Daniels Midland, United States

Vince White, Research Associate, Energy Technology, Air Products and Chemicals, United Kingdom

**Observers**

China:	Mingyuan Li; Xiuzhang Wu
Korea:	Chonghun Han
Norway:	Arne Graue; Anne Kristen Kleiven; Claude Olsen; Åse Slagtern
United Kingdom:	Mark Crombie
United States:	Chris Babel; Mike Holmes; Jeff Jarrett; Ed Steadman

**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 Bergen, and introduced Vice Chairs Clinton Foster of Australia and Tony SurrIDGE of South Africa.

Mr. Riis provided context for the meeting by mentioning that this was one of the Technical Group's most ambitious and wide-ranging meetings, including both a project visit and a technical workshop on CO<sub>2</sub> capture. In that regard, he mentioned that there was much work to do, with four new task forces having formed and the Technical Group's Action Plan moving forward. Additionally, 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 Perth, Australia in October. Also, in addition to the business items on the agenda, there would be several presentations of interest related to carbon capture and storage (CCS) activities in Norway, which should be enlightening to all present.

**2. Welcome from the Government of Norway**

Tone Skogen, Deputy Director General of the Norwegian Ministry of Petroleum and Energy, welcomed the Technical Group to Bergen and provided a Norwegian Government perspective about deployment of CCS. Norway has ambitious goals for broad deployment of CCS and has decided that all future natural gas-fueled power plants will be CCS-compatible. The Norwegian Government has been proactive about CCS by providing funding through Gassnova and the Research Council of Norway for the CLIMIT program that is working toward accelerating the commercialization of CCS. Norway currently has two large projects (Sleipner and Snøhvit) that are storing, cumulatively, nearly two million tonnes of CO<sub>2</sub> per year in geologic structures beneath the North Sea and Barents Sea, respectively. The Norwegian Government has also closely cooperated with industry partners for carbon capture, utilization and storage (CCUS) development, and one result of this is the CO<sub>2</sub> Technology Centre at Mongstad which is a large-scale testing facility for CO<sub>2</sub> capture technologies.

Ms. Skogen closed her remarks by stating that in order for CCUS to succeed, public funding is needed for the first commercial-scale CCUS demonstration projects and that public-private cooperation is essential for success. Also, knowledge sharing and international collaboration is vital to enhance CCUS prospects globally.

**3. Introduction of Delegates and Observers**

Technical Group delegates and observers present for the session introduced themselves. Nineteen of the twenty-five CSLF Members were present at this meeting, including representatives from Australia, Brazil, Canada, China, Denmark, the European Commission, France, Germany, Italy, Japan, Korea, the Netherlands, Norway, Poland,

Russia, Saudi Arabia, South Africa, the United Kingdom, and the United States. Observers representing China, Korea, Norway, the United Kingdom, and the United States were also present.

#### **4. Adoption of Agenda**

The Agenda was adopted with the understanding that Bjørn-Erik Haugan's presentation on "CCS in Norway" would be presented during the June 13 visit to the CO<sub>2</sub> Technology Centre Mongstad project instead of at the Technical Group meeting. Also, the item on "Update on 2012 and 2013 CSLF Technology Roadmaps" was moved to near the end of the meeting.

#### **5. Approval of Minutes from Beijing Meeting**

The Technical Group minutes from the September 2011 meeting in Beijing, China, were approved as final with two minor changes to correct misspellings.

#### **6. Review of Action Items from Beijing Meeting**

John Panek of the CSLF Secretariat reported that all action items from the Beijing meeting had been completed. The Risk Assessment Task Force's Phase II Final Report was not sent out to delegates, but instead was brought before the Technical Group later in the meeting.

#### **7. Report from CSLF Secretariat**

John Panek gave a brief presentation on the November 2011 Global CCS Institute (GCCSI) / CSLF Project Integration Workshop in London. In all, there were about 50 attendees and the key feature of the Workshop was the large amount of interaction, not only between presenters and the audience, but also amongst the presenters themselves. The key messages from the Workshop were that technology integration is a real issue and that it is important to strike a proper balance between plant operation and integration, and that more work is needed in several areas, including plant heat/cooling in the CO<sub>2</sub> capture process, integration of environmental control technologies (i.e., SO<sub>x</sub>, NO<sub>x</sub>, and CO<sub>2</sub> removal) to maximize efficiency, identifying and understanding scale-up risks for CO<sub>2</sub> capture technologies, and determining the impacts of CO<sub>2</sub> composition/impurities as they apply to CO<sub>2</sub> transport and storage.

Mr. Panek called on Richard Lynch of the Secretariat to summarize the January 2012 CCUS Financing Roundtable (co-sponsored with the Global CCS Institute and Société Générale) in Paris. Mr. Lynch stated that the meeting had about 40 attendees, many from the international banking sector. The key message from the Roundtable was that the large first-of-a-kind "lighthouse" CCUS projects are having great difficulty achieving financial closure due to perceived risk. For these "lighthouse" projects, integration risk is a major concern. These first-of-a-kind projects are not so much meant to demonstrate individual technologies at large scale as to demonstrate their integration. Costs are high, in part, because technology suppliers are adding large contingency factors, largely in the form of additional onsite technical assistance. Also, warranties are being required by project sponsors that may not be necessary for future commercial-scale projects. Simplicity is best for financing plans. More moving parts in a financing plan increase the chance of show-stopping issues. However, added project complexity, in the form of polygen production, increases the revenue stream and helps alleviate project risk. This built-in contradiction is an issue that may not be easy to solve. As a result of this risk, no

“lighthouse” project can be reasonably expected to go forward without substantial governmental support (direct and/or from incentives) to close financing gaps.

Mr. Panek then called on Tony Surridge of South Africa to describe the October 2011 CCS Week in South Africa. Dr. Surridge stated that the event was hosted by the South African Centre for Carbon Capture and Storage (SACCCS) and organized by SACCCS and South Africa’s Department of Energy with financial support from the CSLF Capacity Building Fund. The objective of the event was to disseminate information around local and international CCS research and development and to showcase CCS activities currently underway in South Africa. The conference focused on the South African and the southern Africa regional CCS activities that are currently underway. There were four technical workshops focusing on important aspects of CCS: CO<sub>2</sub> injection projects; CCS legal and regulatory framework; CCS public engagement; and CCS risk assessment. Dr. Surridge stated that the main achievements of the week were the dissemination of CCS knowledge and experience among stakeholders and interested parties, as well as undertaking the first steps into risk assessment and public engagement.

Mr. Panek concluded the Secretariat Report by very briefly summarizing the March 2012 Capacity Building Workshops that were held in Mexico City, also financially supported by the CSLF Capacity Building Fund and 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<sub>2</sub> and the second week focused on CO<sub>2</sub> capture.

## **8. Update from Norway’s CO<sub>2</sub> Field Lab Project**

Menno Dillen, Research Director in SINTEF’s Geophysics and Reservoir Technology Department, gave a detailed presentation on the CSLF-recognized CO<sub>2</sub> Field Lab Project. This is a pilot-scale project, located at Svelvik, Norway, which is investigating monitoring technologies for CO<sub>2</sub> leakage detection in a well-controlled and well-characterized permeable geological formation. Relatively small amounts of CO<sub>2</sub> are being injected to obtain underground distribution data that resemble leakage at different depths. The main objective is to assure and increase CO<sub>2</sub> storage safety by obtaining valuable knowledge about monitoring CO<sub>2</sub> migration and leakage. The outcomes from this project will help facilitate commercial deployment of CO<sub>2</sub> storage by providing the protocols for ensuring compliance with regulations, and will help assure the public about the safety of CO<sub>2</sub> storage by demonstrating the performance of monitoring systems.

Mr. Dillen stated that Phase 1 of the project ran from September 2009 to January 2011, and that activities in the first project phase included a baseline seismic survey in November 2009 as part of the site characterization, drilling and logging of a 300-meter deep exploration well, and updating models based on the logged data from the well. Phase 2a, which began in May 2011, has so far included a shallow CO<sub>2</sub> injection test with extensive sampling to develop a record of the behavior of the injected CO<sub>2</sub>. A deep permeability test is planned to begin in September 2012. Initial results from the Phase 2a shallow injection test reinforce the necessity of proper site characterization, as part of the monitoring system missed the plume of CO<sub>2</sub>. Based on this result, one learning from the project is that a diverse monitoring system will provide the greatest capability and flexibility for CO<sub>2</sub> leakage and migration measurements. Mr. Dillen closed his presentation by affirming that the CO<sub>2</sub> Field Lab Project is providing a good environment to test and compare monitoring technologies under controlled conditions. Mr. Dillen

noted that the nearby community was very positive about the work, and that funding was approximately €10 million for 4-5 years.

## 9. Report from Projects Interaction and Review Team (PIRT)

The PIRT Chair, Clinton Foster of Australia, gave a presentation that summarized the previous day's PIRT meeting, which resulted in the following outcomes:

- The Illinois Basin – Decatur Project, the Illinois Industrial Carbon Capture and Storage Project, and the Air Products CO<sub>2</sub> Capture from Hydrogen Facility Project were all approved by the PIRT and sent forward to the Technical Group for its consideration.
- A plan for future updates of the CSLF Technology Roadmap (TRM) was developed.
- A proposal for updating and simplifying the CSLF Project Submission Form and Gaps Analysis Checklist was discussed, but no firm conclusion was reached. As a result, approval of a revised Form and Checklist has been deferred until the next PIRT meeting, in October 2012 at the 2012 CSLF Annual Meeting in Perth, Australia.

Discussion on the TRM was temporarily deferred, as it was an agenda item for later in the meeting.

## 10. Approval of Projects Nominated for CSLF Recognition

### Illinois Basin – Decatur Project (*nominated by United States and United Kingdom*)

Robert Finley, Director of the Advanced Energy Technology Initiative in the Illinois State Geological Survey at the University of Illinois, gave a presentation about the Illinois Basin – Decatur Project. This is a large-scale carbon CCS demonstration project of the Midwest Geological Sequestration Consortium (MGSC), one of the seven Regional Partnerships organized by the United States Department of Energy (DOE). The project is being led by the Illinois State Geological Survey. Up to 1 million metric tons of CO<sub>2</sub> will be injected over a 3-year period into a Cambrian-age geological formation called the Mt. Simon Sandstone at a rate of 1,000 tonnes per day and a depth of about 2 kilometers. After three years, the injection well will be sealed and the reservoir monitored using geophysical techniques. The CO<sub>2</sub> is being captured from the fermentation process used to produce ethanol at Archer Daniels Midland Company's corn processing complex in Decatur, Illinois, in the United States. The Mt. Simon Sandstone is the thickest and most widespread saline reservoir in the Illinois Basin, with a CO<sub>2</sub> storage capacity estimated from 11 to 151 billion tonnes. Monitoring, verification, and accounting (MVA) efforts began in 2008 and include tracking the CO<sub>2</sub> in the subsurface, monitoring the performance of the reservoir seal, and continuous checking of soil, air, and groundwater both during and after injection. Operational injection of CO<sub>2</sub> began in November 2011.

The goal of this project is to demonstrate the potential of the Mt. Simon Sandstone to be a significant CO<sub>2</sub> geologic sequestration reservoir for the Illinois Basin region in the United States. The key research targets for MGSC's large-scale injection test relate to CO<sub>2</sub> injectivity and volumetric storage capacity of the saline reservoir, the integrity of the seals to contain the CO<sub>2</sub> in the subsurface, and the entire process of pre-injection characterization, injection process monitoring, and post-injection monitoring to understand the fate of the injected CO<sub>2</sub>. The focus is on demonstration of CCS project development, operation, and implementation while demonstrating CCS technology and reservoir quality.

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

Illinois Industrial Carbon Capture and Storage Project (*nominated by United States and France*)

Scott McDonald, Biofuels Development Director for project sponsor Archer Daniels Midland, gave a presentation about the Illinois Industrial Carbon Capture and Storage Project. This is a large-scale project, also located in Decatur, Illinois, which will collect up to 3,000 tonnes per day of CO<sub>2</sub> from the Archer Daniels Midland ethanol production plant in Decatur and store it in the Mt. Simon Sandstone. Mr. McDonald noted that the captured CO<sub>2</sub> generated by this industrial process was more than 99% pure, in contrast to the lesser purity of CO<sub>2</sub> streams from power plants. Project scope includes the design, construction, demonstration, and integrated operation of CO<sub>2</sub> compression, dehydration, and injection facilities, and MVA of the stored CO<sub>2</sub>. Engineering, permitting, and construction activities are underway and are scheduled to conclude by mid 2013. Operation of the CO<sub>2</sub> capture and storage facility will begin during the second half of 2013.

The goals of this project are to design, construct, and operate a new CO<sub>2</sub> collection, compression, and dehydration facility capable of delivering up to 2,000 tonnes of CO<sub>2</sub> per day to the injection site; to integrate the new facility with an existing 1,000 tonnes of CO<sub>2</sub> per day compression and dehydration facility to achieve a total CO<sub>2</sub> injection capacity of 3,000 tonnes per day (or one million tonnes annually); to implement deep subsurface and near-surface MVA of the stored CO<sub>2</sub>; and to develop and conduct an integrated community outreach, training, and education initiative. Unlike the Illinois Basin – Decatur Project, which focuses on research aspects of large-scale CCS, this project is intended to be an industrial commercialization project. A significant feature of the project is its “negative carbon footprint”, meaning that there will be a net reduction of atmospheric CO<sub>2</sub>. There is also a possibility that CO<sub>2</sub> from this and other Archer Daniels Midland ethanol facilities could be used in the future for enhanced oil recovery (EOR), as the Illinois Basin is a petroleum producing region.

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

Air Products CO<sub>2</sub> Capture from Hydrogen Facility Project (*nominated by United States, Netherlands, and United Kingdom*)

Vince White, Research Associate in Air Products and Chemicals Inc.’s Energy Technology Division, gave a presentation about the Air Products CO<sub>2</sub> Capture from Hydrogen Facility Project. This is a large-scale commercial project that will demonstrate a state-of-the-art system to concentrate CO<sub>2</sub> from two steam methane reformer (SMR) hydrogen production plants, and purify the CO<sub>2</sub> to make it suitable for sequestration by injection into the existing West Hastings Field oil reservoir as part of an ongoing EOR project. To accomplish this, Air Products plans to retrofit its two Port Arthur SMRs with two vacuum swing adsorption (VSA) systems to separate the CO<sub>2</sub> from the process gas streams at these facilities so that the CO<sub>2</sub> can be compressed, dried, and delivered by pipeline. Air Products’ carbon capture processes would convert the initial gas streams, which contain more than 10% CO<sub>2</sub>, to greater than 97% CO<sub>2</sub> purity with negligible impact on the efficiency of hydrogen production. The technology would remove more than 90% of the CO<sub>2</sub> from the process gas stream.

The commercial goal of the project is to recover and purify approx. 1 million tonnes per year of CO<sub>2</sub> for pipeline transport to Texas oilfields for use in EOR. The technical goal is to capture at least 75% of the CO<sub>2</sub> from a treated industrial gas stream that would otherwise be emitted to the atmosphere. A financial goal is to demonstrate real-world CO<sub>2</sub> capture economics.

After brief discussion, there was consensus by the Technical Group to recommend CSLF recognition for the project. Also, the United States delegation was requested to provide a revised Project Submission Form with enhanced details about this project, and the Secretariat was asked to send this information to all Technical Group delegates.

#### **11. Report from Task Force to Assess Progress on Technical Issues Affecting CCS**

The task force Chair, Clinton Foster, gave a brief presentation that described the background and activities of the task force. This task force was established by the CSLF Technical Group on recommendation by the PIRT. The objective was to complement the PIRT's assessment of the CCS readiness of the CSLF-recognized projects. The task force is comprised of four working groups: Capture Technologies (chaired by the United States), Transport and Infrastructure (chaired by Australia), Storage and Monitoring (chaired by Canada), and Integration (developed in cooperation with, and reported by the Global CCS Institute).

Dr. Foster reported that the task force has submitted its final report and recommended that the task force be discontinued. Technical findings from the task force would be used to assist new task forces and also as input for revisions to the TRM. Grant Bromhal of the United States mentioned that a section on Capture Technologies had been completed too late to make it into the final report. After brief discussion, Dr. Foster agreed that the task force final report would be revised to incorporate the updated Capture Technologies section. There was also consensus that the task force be ended. Dr. Foster expressed his appreciation to the chairs of the four working groups and also thanked the Research Council of Norway and the Global CCS Institute for providing additional resources.

#### **12. Report from Risk Assessment Task Force (RATF)**

Grant Bromhal, who had recently replaced George Guthrie as RATF Chair, gave a brief presentation that described the background and activities of the RATF. The RATF was formed at the November 2006 Technical Group meeting in London with the mandate to examine risk-assessment standards, procedures, and research activities relevant to unique risks associated with the injection and long-term geologic storage of CO<sub>2</sub>. The RATF Phase I Report, completed in 2009, 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<sub>2</sub>. The Phase I Report included an overview of risk assessment methodologies for engineered geologic systems, a literature review of risk assessment for CO<sub>2</sub> 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 Task Force on Risk and Liability which will call on the Technical Group for assistance as needed.

Dr. Bromhal reported that RATF has submitted its Phase II Report, which includes a gaps assessment to identify CCS-specific tools and methodologies that will be needed to support risk assessment and a description of risk-assessment considerations related to

various phases of a CO<sub>2</sub> storage project. Appendices to the report include a collection of five “inFocus” outreach documents (developed by the CSLF Communications and Outreach Task Force) and a paper on “Performance-based Standards for Site Safety and Integrity”. The Phase I Report had also recommended that the RATF gather information on what other organizations are doing in the area of technical risk and also conduct a feasibility assessment of developing general technical guidelines for risk assessment that could be adapted to specific sites and, local needs. However, both these activities were left undone, the former because it was deemed that the result would be a report that would very quickly become obsolete and of marginal use and the latter because the new Task Force on Risk and Liability would most likely include this as part of its mission.

Dr. Bromhal stated his intention of converting the Phase II Report into an article for the *Journal of Greenhouse Gas Control* and concluded his presentation by stating that the RATF had completed its mission and recommended that it be discontinued. There was consensus to end the RATF, and Dr. Bromhal was asked to pursue the idea of publishing the Phase II Report as a journal article.

### 13. Overview of Technical Group Action Plan

John Panek gave a short presentation that summarized progress on the Technical Group Action Plan since it was approved at the 2011 CSLF Ministerial Meeting in Beijing. In all there are twelve separate Actions, and the Secretariat polled Technical Group delegations to determine relative priorities. The highest ranked Action was “Storage and Monitoring for Commercial Projects”, which has since been renamed as “Monitoring Geologic Storage for Commercial Projects”, and a new task force chaired by Norway has formed on this Action.

Mr. Panek stated that three other Actions had also resulted in new task forces: “Technology Gaps Closure” (ranked second highest; new task force chaired by Australia), “Technical Challenges for Conversion of CO<sub>2</sub>-EOR to CCS” (ranked fifth highest; new task force chaired by Canada), and “CO<sub>2</sub> Utilization Options” (ranked eighth highest; new task force chaired by the United States). The highest ranked Actions that do not currently have new task forces are “Risk and Liability” (ranked third highest) and “Energy Penalty Reduction” (ranked fourth highest).

Ensuing discussion did not result in the formation of any additional task forces or suggestions for additional Actions. There was interest in the Action on “Competition of CCS with Other Resources”, but consensus was reached that the Technical Group should wait to see the forthcoming report from a similar IEA GHG study before considering a new task force on this topic. Philip Sharman of the United Kingdom stated that the Actions on “Energy Penalty Reduction” and “CCS with Industrial Emission Sources” were of interest but that he would need to check with the United Kingdom’s Department of Energy and Climate Change (DECC) before he could volunteer to Chair a new task force for either of these. Clinton Foster indicated that the Global CCS Institute had shown some interest in the “Best Practice Knowledge Sharing” Action, and there was consensus that he contact the Institute to determine if it would like to lead a task force. Alternatively, CSLF members could access the Institute’s work in this area. Finally, it was decided that no activity be undertaken on the “Risk and Liability” Action unless/until the Policy Group’s task force in this area requests Technical Group assistance.

Mr. Panek stated that the Secretariat would provide a progress report on the Technical Group Action Plan for the next Technical Group meeting.

#### **14. Report from Technical Challenges for Conversion of CO<sub>2</sub>-EOR to CCS Task Force**

Stefan Bachu of Canada, the Chair of this new task force, gave a short update on its mandate, timeline, and membership. EOR is a proven method for geologic storage of CO<sub>2</sub> and there are currently approximately 120 CO<sub>2</sub>-EOR projects in the world, of which 112 are in the United States. The objective of the task force is to review, compile and report on technical challenges that may constitute a barrier to the broad use of CO<sub>2</sub> for EOR and to the conversion of CO<sub>2</sub>-EOR operations to CCS operations. Dr. Bachu stated that economic and policy barriers are outside the scope of the task force.

Dr. Bachu stated that the task force's intention is to complete its activities and produce a final report in the third quarter of 2013, in time for the next CSLF Ministerial Meeting. Before that, the task force will have finalized its scope (i.e., identified subjects and produced a table of contents) by the 2012 CSLF Annual Meeting in October, produced a first draft of its report in time for the 2013 Technical Group meeting. Task force membership currently consists of Canada (as Chair), China, Norway, Mexico, Saudi Arabia, and the United States. Dr. Bachu mentioned that there was still time for other CSLF delegations to join if they would add to the expertise of the task force.

#### **15. Report from CO<sub>2</sub> Utilization Options Task Force**

Joseph Giove of the United States, the Chair of this new task force, gave a short update on its mandate, timeline, and membership. The purpose of the task force is to identify/study the most economically promising CO<sub>2</sub> utilization options that have the potential to yield a meaningful, net reduction of CO<sub>2</sub> emissions. There will be two phases of activity. The first phase (to be completed by the time of the 2012 CSLF Annual Meeting) will result in a summary of existing information regarding CO<sub>2</sub> utilization options, including a description of the state of each relevant technology and application; a preliminary assessment of the relative value of the utilization option to make a meaningful impact on CO<sub>2</sub> emission reduction; and an indication regarding the economic viability of such technologies. The second phase will provide a more thorough discussion of the most attractive CO<sub>2</sub> utilization options, based on economic promise and CO<sub>2</sub> reduction potential, possibly including an assessment of current and potential economic viability, the CO<sub>2</sub> reduction potential at various price points, the potential for co-production, and a discussion of research, development and demonstration (RD&D) needs.

Mr. Giove stated that the task force was looking at both consumptive and non-consumptive uses for CO<sub>2</sub>, including as feedstock for chemicals and synthetic cement-like materials industries. In the short term, the task force decided the focus should not be solely on EOR, as a different task force already has that mission. As the new Technical Challenges for Conversion of CO<sub>2</sub>-EOR to CCS task force scopes out its mission in greater detail in the future, it will be better known what elements of EOR can/should be covered by the CO<sub>2</sub> Utilization Options task force. Phase 1 activities would include a literature review, and a Phase 1 report is intended to be a deliverable at the upcoming 2012 CSLF Annual Meeting. Task force membership currently consists of the United States (as Chair), China, Germany, Netherlands, Saudi Arabia, South Africa, and the United Kingdom. Mr. Giove mentioned that the task force was open for other participants as well.

#### **16. Report from Monitoring Geologic Storage for Commercial Projects Task Force**

Lars Ingolf Eide of Norway, the Chair of this new task force, was unable to attend so Trygve Riis provided a short update on the scope, schedule, and membership. The

objective of the task force is to perform initial identification and review of new and updated standards for storage and monitoring of injected CO<sub>2</sub>, and the application of such standards should inform CO<sub>2</sub> crediting mechanisms. The planned scope includes identification and review of existing standards for geological CO<sub>2</sub> storage and monitoring on an annual basis; identification and review of existing guidelines for communication with and engagement of involved communities and regulators on an annual basis; identification of shortcomings and/or weaknesses in standards/guidelines; communication of findings to the ISO's CCS Working Group (that has already been established); production of annual summaries of new as well as updated standards, guidelines and best practice documents regarding geological storage of CO<sub>2</sub> and monitoring of CO<sub>2</sub> sites; and following the work of other CSLF task forces related to CO<sub>2</sub> storage.

Mr. Riis stated that the task force's intention was to complete an initial compilation of standards (based on a literature review) in time for the 2012 CSLF Annual Meeting. A final report on standards and guidelines would be finished in the third quarter of 2013, in time for the next CSLF Ministerial Meeting. At that time, a decision would be made on whether to continue the task force, and such a decision could depend on progress made by the ISO's CCS Working Group in this area. Current membership in this task force consists of CSLF delegates and stakeholders from Norway (including the Chair), China, Denmark, the European Commission, France, Germany, the United Kingdom, and the United States. Mr. Riis mentioned that additional members are welcome who can add to the expertise of the task force.

## **17. Report from Technology Gaps Closure Task Force**

Richard Aldous of Australia, the Chair of this new task force, gave a short update on its mandate, timeline, and membership. The purpose of the task force is to identify and monitor key CCS technology gaps and related issues and recommend any R&D and demonstration activities (both short term and long term) that address these gaps and issues. The intention is to build on some of the results from the Task Force to Assess Progress on Technical Issues Affecting CCS, with results from this task force feeding into future versions of the TRM. The planned scope includes determining technology areas and sub-areas of interest, identifying gaps and opportunities in each area, and developing recommendations for faster progress in addressing these gaps. This could possibly include identifying opportunities for international collaboration on technology development.

Dr. Aldous stated that the intention was to have a preliminary report in time for the upcoming 2012 CSLF Annual Meeting that would list technology areas of interest to the task force, and identify and rank technology gaps in each of these areas. By the time of the 2013 Technical Group meeting, the task force would produce a draft report that would focus on the most important gaps, with recommendations how these gaps could be closed. This report would then be finalized by the third quarter of 2013, in time for the next CSLF Ministerial Meeting. Current membership in this task force consists of Australia (as Chair), Korea, Norway, and the United States, and Dr. Aldous stated his preference that each of these CSLF delegations appoint one expert on CO<sub>2</sub> capture and one expert on CO<sub>2</sub> storage.

Ensuing discussion centered on the name of this task force, and there was general agreement that the word 'gaps' was not precise enough, in that 'issues' were also part of the task force's mission. In the end, there was consensus that Dr. Aldous, as Chair of the task force, should determine a more descriptive name for this task force.

## 18. Presentation on the CCS Activities of University Centre in Svalbard

Gunnar Sand, Program Manager for SINTEF and Project Manager of CCS Activities for the University Centre in Svalbard (UNIS) CO<sub>2</sub> Lab, gave a short presentation about the CO<sub>2</sub> Lab and other CCS-related activities on the islands of Svalbard. Mr. Sand pointed out that Svalbard's community of Longyearbyen, at +78°13' latitude and with a population of just over 2,000, is the world's northernmost settlement and as such, makes an excellent research base for studying and monitoring climate change. Svalbard is actually an uplifted part of the Barents Sea and is made up of sedimentary rocks, including coal seams. There is coal mining there and also a coal-fueled power plant, the only one in Norway. The UNIS CO<sub>2</sub> Lab was established in 2007 with a vision of following the CO<sub>2</sub> from the source to the solution, turning Longyearbyen into a high profile green showcase demonstrating the CO<sub>2</sub> value chain, and developing high level field-based university studies in CCS. Mr. Sand stated that the geology of Svalbard is conducive for storage testing of CO<sub>2</sub> from the power plant, and initial activities of the UNIS CO<sub>2</sub> Lab have focused on storage reservoir characterization. Future activities are intended to include medium scale CO<sub>2</sub> injection with several monitoring wells.

Mr. Sand mentioned that the UNIS CO<sub>2</sub> Lab is also a partner in the European 'Euroscoops' Program that is proposing to implement permanent geological CO<sub>2</sub> storage at an industrial scale at five sites in Europe, including Longyearbyen. The activities at Longyearbyen will include developing/refining monitoring and modeling tools, conducting two injection campaigns (using water and gas), and conducting an extensive outreach program. It is anticipated that there will also be a visitor centre established at Longyearbyen to assist in these activities.

## 19. Update on 2012 and 2013 CSLF Technology Roadmaps

Clinton Foster provided a synopsis of the discussion on this topic from the previous day's PIRT meeting. There had been agreement on the overall importance of the TRM and that it needed updating. There has already been agreement, at the 2011 Technical Group meeting in Beijing, that the country-specific information from Module 2 of the TRM would be migrated to the CSLF website. A proposal for a new model of the TRM, based on suggestions by Richard Aldous, would chart CCUS pathways as far into the future as 2050. The current TRM only goes as far as 2020. Dr. Aldous stated that the reason for this lengthened timeline is that some countries have developed CCUS objectives that extend that far into the future. Proposed key elements for the next major revision of the TRM would include an executive summary, a relatively brief module that describes the current state of the technology, a module that describes possible scenarios for meeting long-term CCUS objectives, and a set of recommendations to national governments concerning actions needed to realize the most favorable scenarios. Dr. Foster stated that the intention is that the next major revision of the TRM would be a deliverable at the 2013 CSLF Ministerial Meeting.

There was general agreement that the TRM is one the most important products of the Technical Group, and that the Technical Group should put forth effort into getting a good, major revision completed in time for the next Ministerial Meeting. Ensuing discussion resulted in a consensus that the Technical Group was not yet ready to describe possible CCUS pathways beyond 2020, so the next major revision of the TRM would maintain that timeline. There was also consensus that, because this 2013 TRM would likely be a major undertaking, the Technical Group should focus on that and not produce a 2012 TRM. However, agreement was not reached on what the structure of the 2013 TRM

should be, or the process for completing it. Several suggestions were offered concerning the TRM structure, including that the TRM should conclude with recommendations to policy makers about actions that should be taken to increase the technical knowledge base, which will lead to large scale CCUS deployment by the TRM target dates. Another suggestion was that this major revision of the TRM should be structured much like the one we have now, but not including the country and projects presentation, and with more concise descriptions of technologies.

Dr. Foster recommended that a TRM Steering Committee/Editorial Board, chaired by the Technical Group Chairman, be established to work out all details concerning the structure and schedule, and to oversee the development of the new TRM. There was consensus to do so, and that this new group would also include the Technical Group Vice Chairs, Task Force Chairs, and the CSLF Secretariat. Chairman Riis suggested that possible collaboration with other organizations (primarily the Global CCS Institute) should also be investigated.

## **20. Discussion of Ideas for Future Technical Group Workshops**

Meeting attendees were reminded by Chairman Riis about the CO<sub>2</sub> Capture Interactive Workshop, which would take place in Bergen two days hence. Concerning future workshops, Stefan Bachu proposed that the topic of “Monitoring of CO<sub>2</sub> Storage” would be appropriate as there is knowledge to be gained from the experience of existing projects and from technological developments, and it would make for an interesting, informative, and useful event. After brief discussion, there was consensus for adopting this theme for the next technical workshop, and that it should be held in conjunction with the 2013 Technical Group meeting.

## **21. Date and Location of Next Technical Group Meeting**

John Panek mentioned that the next CSLF Technical Group meeting would be part of the 2012 CSLF Annual Meeting in Perth, Australia. The actual date of the Technical Group meeting will be Thursday, October 25, with task force meetings scheduled for Wednesday, October 24. Preliminary information about the 2012 Annual Meeting is already available at the CSLF website ([www.cslforum.org](http://www.cslforum.org)).

Sergio Persoglia of Italy stated that there was interest in his country to have the 2013 Technical Group meeting and Technical Workshop in Rome, sometime in the first half of the year. Chairman Riis thanked Dr. Persoglia for the information and asked him to further explore this possibility and inform the Technical Group at its next meeting in Perth.

## **22. New Business**

Chairman Riis called on Tim Dixon of the IEA GHG to briefly describe his organization’s recent activities that are relevant to the Technical Group. Mr. Dixon stated that a study had been completed on “Geological Storage of CO<sub>2</sub> in Basalts”, and the final report was available to Technical Group delegates. Mr. Dixon was asked to provide the report to the CSLF Secretariat, and the Secretariat was requested to send the report to all Technical Group delegates. Mr. Dixon also informed the Technical Group that at the November 2011 United Nations COP17 Conference in South Africa, there was agreement that CCS would be included as part of the Clean Development Mechanism (CDM). Mr. Riis thanked Mr. Dixon and stated that this information might possibly be factored into future CSLF activities such as the TRM.

### 23. Review of Consensuses Reached, Action Items, and Next Steps

Consensus was reached on the following:

- The Illinois Basin – Decatur Project, the Illinois Industrial Carbon Capture and Storage Project, and the Air Products CO<sub>2</sub> Capture from Hydrogen Facility Project are all recommended by the Technical Group to the Policy Group for CSLF recognition.
- The Task Force for Assessing Progress on Technical Issues Affecting CCS is discontinued.
- The RATF is discontinued.
- Activity on the “Competition of CCS with Other Resources” Action in the Technical Group Action Plan is deferred pending review of a forthcoming IEA GHG report on this topic.
- Activity on the “Risk and Liability” Action in the Technical Group Action Plan is deferred unless/until there is a request for assistance from the Policy Group’s Risk and Liability Task Force.
- The next major revision of the TRM, planned for completion in time for the 2013 CSLF Ministerial Meeting, would keep the 2020 timeline described in the current TRM.
- There will not be a 2012 version of the TRM.
- The next CSLF Technical Workshop, anticipated during the first half of 2013, will have a “Monitoring of CO<sub>2</sub> Storage” theme.

Action items from the meeting are as follows:

Item	Lead	Action
1	Technical Group Chair	Provide the Technical Group’s recommendation to the Policy Group that the Illinois Basin – Decatur Project, the Illinois Industrial Carbon Capture and Storage Project, and the Air Products CO <sub>2</sub> Capture from Hydrogen Facility Project be recognized by the CSLF.
2	United States	Prepare a revised version of the Project Submission Form for the Air Products CO <sub>2</sub> Capture from Hydrogen Facility Project with enhanced details about the project.
3	CSLF Secretariat	Send the revised Project Submission Form for the Air Products CO <sub>2</sub> Capture from Hydrogen Facility Project to all Technical Group delegates.
4	Chair of Task Force to Assess Progress on Technical Issues Affecting CCS	Revise the task force final report to incorporate the updated Capture Technologies section.
5	Chair of RATF	Pursue the possibility of publishing the RATF Phase II Report as a journal article.
6	Australia	Contact the Global CCS Institute to determine if it would like to lead a new task force on “Best Practices Knowledge Sharing”.
7	CSLF Secretariat	Provide a progress report on the Technical Group Action Plan for the next Technical Group meeting.
8	Chair of Technical Gaps Closure Task Force	Determine a more descriptive name for the task force.

Item	Lead	Action
9	Technical Group Chair	Establish and Chair a TRM Steering Committee/Editorial Board, to also include the Technical Group Vice Chairs, Task Force Chairs, and CSLF Secretariat.
10	Italy	Explore the possibility of Italy hosting the 2013 CSLF Technical Group meeting and next Technical Workshop.
11	IEA GHG	Provide a copy of the IEA GHG final report on “Geological Storage of CO <sub>2</sub> in Basalts” to the CSLF Secretariat
12	CSLF Secretariat	Send the IEA GHG final report on “Geological Storage of CO <sub>2</sub> in Basalts” to all Technical Group delegates.

## 24. Closing Remarks / Adjourn

Chairman Riis thanked the delegates, observers, and Secretariat for their hard work. John Panek expressed the Secretariat’s appreciation to Mr. Riis for acting as meeting host in addition to his Chairman’s role, and Mr. Riis called out Anne Kristin Kleiven, Åse Slagtern, and Aage Stangland of the Research Council of Norway as the people who helped to make it all happen.

Mr. Riis reminded attendees of the upcoming visit to the CSLF-recognized CO<sub>2</sub> Technology Centre Mongstad Project on Wednesday, June 13<sup>th</sup>, and adjourned the meeting.

