



Minutes of the Technical Group Meeting

**Pau, France
15-16 March 2010**

LIST OF ATTENDEES

Technical Group Delegates

Australia:	Clinton Foster (Vice Chair)
Canada:	Stefan Bachu
China:	Peng Sizhen, Zhang Jiutian, Li Xiaochun
France:	Pierre Le Thiez, Didier Bonijoly
Greece:	Nikolaos Koukouzas
Italy:	Sergio Persoglia, Giuseppe Girardi
Japan:	Shinichi Terada, Nobumichi Morishita
Korea:	Chang-Keun Yi, Chong-Kul Ryu
Netherlands:	Harry Schreurs
Norway:	Trygve Riis (Chair), Jostein Dahl Karlsen
South Africa:	Tony Surridge (Vice Chair), Fred Goede
United States:	Joseph Giove, George Guthrie

Representatives of Allied Organizations

Global CCS Institute:	Bill Koppe
IEA GHG:	Neil Wildgust

CSLF Secretariat

John Panek, Rich Lynch

Invited Speakers

Jean-François Rocchi, President and CEO, BRGM, France
Luc de Marliave, Climate Change Coordinator, Total, France

Observers

Belgium:	Derek Taylor
Canada:	Wishart Robson
France:	Nicolas Aimard, Olivier Bouc, Jean Bourlée, Rabih Chammas, Jean-Claude Christophe, Anna Cournac, Pauline D'Armancourt, Hubert Favriol, Benoît Gayet, Thomas Julia, Jean-François Leandri, Marc Lescanne, Olivier Poupard, Thierry Renard, Sylvain Thibeau, Catherine Truffert, Jacques Varet
Netherlands:	Tim Bertels

Monday, 15 March 2010

1. Technical Group Chairman's Welcome

The Chairman of the Technical Group, Trygve Riis of Norway, called the meeting to order, introduced Vice Chairs Clinton Foster of Australia and Tony SurrIDGE of South Africa, and welcomed the delegates and observers to Pau. Mr. Riis expressed appreciation to France for hosting this meeting and to BRGM and Total for their valuable support, and then introduced Jean-François Rocchi for comments by the meeting host.

2. Welcome by Host Country

Jean-François Rocchi, President and CEO of BRGM, welcomed the Technical Group meeting attendees to Pau and provided information about BRGM. BRGM is the state-owned French Geological Survey which has the mission of advancing knowledge of earth sciences and providing expertise in support of public policies carried out on behalf of national and local authorities, and public institutions. BRGM is also active internationally, and has implemented projects in 44 countries as of 2009.

Mr. Rocchi stated that BRGM is a pioneer in Europe concerning carbon capture and storage (CCS), and is involved in the CSLF-recognized Lacq CCS Project in the area of safety and risk management. He stated that there are presently three main challenges for CCS: reduce costs, gain public acceptance, and establish the accountability of storage in terms of safety and security. Mr. Rocchi concluded by stating that this would be a very important meeting for the Technical Group, and he wished the delegates successful deliberations.

3. Chairman's Opening Remarks

Chairman Riis provided context for the meeting with a brief summary of the CSLF Ministerial Meeting of October 2009, in London. At that meeting the Ministers cited CCS as a key mitigation strategy that "should be appropriately recognized in international agreements, in particular, in the new agreements under the United Nations Framework Convention on Climate Change." The Ministers also emphasized that cooperation and knowledge-sharing on CCS "needs to be increased between countries".

Mr. Riis also set the stage for the meeting by stating that the Technical Group is presently building on the momentum from the October Ministerial Meeting, and that the major objective for this meeting was to develop a multi-year action plan. The Technical Group's Projects Interaction and Review Team (PIRT) held a three day working session in Canberra, Australia, at the beginning of February, hosted by Geoscience Australia, which created the initial draft of the action plan, and this would be presented later in the meeting.

Mr. Riis ended his remarks by mentioning that representatives from the Global CCS Institute and the International Energy Agency's Greenhouse Gas R&D Programme (IEA GHG) would give presentations at this meeting, which would provide further opportunity to move ahead with collaborations with these organizations. He also stated there would be presentations on the CSLF-recognized CASTOR project and the Lacq Integrated CCS Project, with a visit to the Total's Lacq Pilot Plant on Wednesday, March 17th.

4. Introduction of Delegates and Observers

Technical Group delegates and observers present for the session introduced themselves. Twelve of the 24 CSLF Members were represented at this meeting, including

representatives from Australia, Canada, China, France, Greece, Italy, Japan, Korea, the Netherlands, Norway, South Africa, and the United States. Observers representing Belgium, Canada, France, and the Netherlands were also present.

5. Adoption of Agenda

The Agenda was adopted with the understanding that the item on the IEA Technology Roadmap Update would have to be dropped. The IEA representative who was to provide the presentation could not attend this meeting. (Note: During the meeting, it was decided that the Introduction and Review of the Gorgon CO₂ Injection Project would be a separate item instead of being included as part of the Report from the PIRT.)

6. Approval of Minutes from London Meeting

The Technical Group minutes from the October 2009 meeting in London, United Kingdom, were approved as final with no changes.

7. Review of Action Items from London Meeting

John Panek of the CSLF Secretariat reported that all four action items from the London meeting had been completed.

8. Report from CSLF Secretariat

John Panek gave a presentation on CSLF activities since the October 2009 CSLF Ministerial Meeting. In addition to the PIRT meeting in February (which also included a visit to the CSLF-recognized CO₂CRC Otway Project), there was a capacity building meeting at the World Bank in Washington, D.C, USA on March 2nd and a “CCS Ready” workshop in Ottawa, Canada, on March 11-12. This workshop was co-sponsored by the Global CCS Institute, the CSLF, and the IEA. Two upcoming meetings are the CSLF Capacity Building Governing Council Meeting in Oslo, Norway on March 24-25 and a CSLF Financing Roundtable in Washington, D.C., USA on April 6th. This latter meeting is being sponsored by the CSLF, the CCS Alliance, and the Global CCS Institute.

Mr. Panek concluded his presentation with the status of the CSLF Stakeholder Registry. There are now 268 stakeholders, and the number of stakeholders has been steadily growing over the past year.

9. Report from Risk Assessment Task Force

The Task Force Chair, George Guthrie of the United States, gave a presentation of task force activities. The Task Force has now 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 CO₂. Risks associated with CO₂ near-term injection processes include fracturing, fault re-activation, and induced seismicity, while risks associated with long-term processes related to impacts of CO₂ storage include health, safety, and environmental risks, potential impact on natural resources (such as groundwater, mineral resources, etc.), and return of CO₂ to the atmosphere.

One of the recommendations from the Phase I work was that risk assessment should be considered in the context of stakeholder outreach and communication. To that end, the CSLF Policy Group’s Communications Task Force set up a working group focused on risk assessment, and that working group prepared drafts of a set of five “inFocus Carbon

Capture and Storage” outreach documents, intended for posting at the CSLF website, that provide information about the safety of CCS to a non-technical audience. These five draft documents were sent to Task Force members for review and comment, and at its meeting prior to this Technical Group meeting, the Task Force recommended that the Technical Group take the following actions:

1. Endorse the Communication Task Force’s proposed five “inFocus” documents for posting to the CSLF website.
2. Provide any suggested editorial changes to these five documents to Dr. Guthrie (by April 2nd) for him to present to the Communications Task Force.
3. Suggest to the Communications Task Force that an additional communication document should be considered to clarify the distinction between geologic storage and natural CO₂ leakage scenarios, including Lake Nyos in Cameroon.

Phase II activities, authorized by the Technical Group at the London meeting, will include a gap 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. The Task Force intends to leverage its activities with those of the IEA GHG Risk Assessment Network to facilitate the completion of these two assessments.

There was consensus by the Technical Group to accept the Task Force’s three recommendations.

10. Report from Safety and Integrity Working Group

The Working Group Chair, Didier Bonijoly of France, gave a report of the Working Group’s status. This Working Group was formed at the Technical Group’s meeting in Oslo, in April 2009, to address the 14th recommendation from the G8-IEA-CSLF report on results from the 3rd Workshop on Near-Term Opportunities for CCS:

Governments working with stakeholders need to develop performance-based standards for storage site safety and integrity.

The Working Group’s mandate is to review existing procedures and guidelines in that area. In August 2009, the Working Group completed a draft of a report that included a review of technical requirements needed for the establishment of performance and safety standards, such exposure effects on human health, ecosystems, and groundwater. This report also examined various regulation approaches that could be used to guarantee the safety and integrity of the storage sites. In the time since the London meeting, the Working Group received several corrections which were used to produce a final version of the report, and this revised draft was presented to the Risk Assessment Task Force at its meeting earlier in the day.

Dr. Bonijoly stated that the Working Group’s report contains no recommendations, because the objective of the report was only to establish the status of existing procedures and guidelines. He also stated that if the Working Group is to continue its work, it should do so in the context of what the Risk Assessment Task Force is doing. He proposed that the Safety and Integrity Working Group should therefore not continue as an independent group, but instead should be merged into the Risk Assessment Task Force as a subgroup. Ensuing discussion by the delegates centered on the need for the Working Group’s activities to continue, as the Technical Group does not yet have as deep an understanding as it needs in this area. There was consensus that the Working Group be merged with the Risk Assessment Task Force.

11. Report from CCS in the Academic Community Task Force

Neil Wildgust of the IEA GHG gave a presentation about the Task Force on behalf of its Chair, Marcelo Ketzer of Brazil, who could not attend the meeting. The mission of the Task Force is to identify and engage academic programs on CCS throughout the world, and help determine path forward for CSLF in this area. The Task Force is currently in Stage 1 (reviewing CCS in academic courses). Mr. Wildgust stated that the Task Force is currently engaged in two main activities: review of postgraduate degree programs for CCS and development of a students' website for CCS.

The review of postgraduate degree programs will be done in four regional reports covering the United Kingdom, the remainder of Europe, North & South America, and Australia. Mr. Wildgust stated that the IEA GHG has completed the United Kingdom review and it has been published as an IEA GHG report. The methodology used was a combination of internet searches, email inquiries, and actual visits to discuss courses with universities. The results of the United Kingdom report are that there are only a relatively few graduate programs in CCS at the present time. Perhaps the most significant one is at the University of Edinburgh, which offers a MS degree in CCS. There is also a consortium of Birmingham, Nottingham, and Luftberry universities which has a seven year government-funded program with engineering PhD opportunities, and it is estimated that about 50 students will participate in this program over the seven year period of its existence. In addition, several other institutions offer short professional courses on CCS, including the IEA GHG itself which annually hosts a one-week summer school for postgraduate students. One other outcome from the United Kingdom review was that the postgraduate programs in CCS that are presently available have a lack of emphasis on both risk assessment and regulation, which are obviously very key areas.

The students' website is intended to facilitate information exchange, interaction and networking, discussion, and collaboration between students and/or professionals on CSLF-related topics. Mr. Wildgust reported that development of the website has been delayed due to the recent redesign of the IEA GHG website (which will be the host), but progress is expected soon.

Ensuing discussion centered on how to create academia programs on CCS in places where they do not currently exist. Tony Surrige stated his interest in having this kind of program widely available in South Africa, and asked that the Task Force consider chronicling how a country can build up academic programs in CCS from essentially zero. Trygve Riis mentioned that it would probably be necessary to have a certain level of activity in CCS before a country can start an education program in that area. Norway, for instance, now has two centers of excellence for CCS which will be collaborating on educational opportunities. Clinton Foster stated that the Australian government helped establish cooperative research centers where cooperation in areas such as CCS is encouraged between the universities and other organizations that are members. CO2CRC, headed by Australia's CSLF Technical Group delegate Peter Cook, is one such example and includes approximately 100 researchers. This type of activity leads to academic programs. Mr. Wildgust reported that the Task Force is very interested in finding ways to promote and encourage CCS academic programs, and that the current worldwide review, once concluded, will be the starting point on moving forward to bring these kinds of programs to places where they do not yet exist. Sergio Persoglia of Italy and Harry Schreurs of the Netherlands expressed their support for the Task Force's activities and were added as members of the Task Force.

12. Update from the Global CCS Institute

Bill Koppe of the Global CCS Institute gave a presentation about the Institute and its activities. The Institute was created by the Australian Government following the 2008 G8 meeting in Japan. As a result of recommendations by the CSLF and IEA, the G8 Ministers committed to support 20 large-scale CCS demonstration projects. Australian Prime Minister Kevin Rudd, who was present at the meeting, returned to Australia convinced that it was in Australia's interests to help promote this set of recommendations. In that regard, the Institute's key and main objectives center on the facilitation of at least 20 large-scale CCS projects, but it is also committed to following through on main enabling actions concerning public awareness, commercial gaps, and other important issues related to CCS.

Mr. Koppe stated that the Global CCS Institute has a broader focus than just utility CCS applications. He mentioned that some of the easier options, initially, will actually be industrial applications such as natural gas processing. The Institute also wishes to include steel and cement manufacturing applications in its portfolio and has an interest in biofuels applications as well.

The Institute currently earmarks about A\$50 million per year of its resources toward direct project support. In December there was a worldwide call for project proposals; assessment is now in progress on the proposals that were received, and results will be announced at the Institute's next members meeting, in Pittsburgh in May. There will be additional proposal solicitation rounds as time goes on.

Mr. Koppe stated that the Institute is committed to collaboration with other organizations such as the CSLF. It, along with the CSLF and IEA, has co-sponsored a workshop on "Bridging the Commercial Gap for CCS Demonstration Projects". The report from that workshop, as well as an Institute-sponsored report on "Strategic Analysis of the Global Status of CCS", is being used as input for a report to the G8.

Ensuing discussion touched on the collaborative aspects of the Institute's activities and what kinds of projects are eligible for support under the current solicitation. Mr. Koppe stated that the Institute's definition of "large-scale project" was approximately one million tonnes of CO₂ injected annually but that proposals for smaller projects would be considered if there is a clear pathway toward support of larger-scale CCS development. The Institute is actively involved in collaborations with other organizations. In general, when it develops networking arrangements for its members and their CCS projects, it plans to do so in association or alignment with existing networks such as those established by the IEA GHG.

13. Update from the IEA Greenhouse Gas R&D Programme

Neil Wildgust gave a presentation of IEA GHG activities. The CSLF Technical Group, since 2008, has a mutual representation agreement with the IEA GHG. In that regard, the Technical Group can be represented at IEA GHG Executive Committee (ExCo) meetings and the IEA GHG is invited to attend and participate in Technical Group meetings. IEA GHG activities include management of several research networks, which bring together key groups of international experts to share knowledge and experience on CCS, identify and address knowledge gaps, and act as informed bodies for regulators and other stakeholders. Networks currently exist for many topics, including risk management, modeling, post-combustion CO₂ capture, oxyfiring, wellbore integrity, and social

research. In addition, IEA GHG sponsors the biennial Greenhouse Gas Technologies Conference and supports research studies on various aspects of CCS.

Mr. Wildgust stated that the IEA GHG, in a typical year, publishes between 10 and 20 reports and studies. Ideas for these studies result from proposals by ExCo members and the CSLF Technical Group delegates. One page summaries of all proposals are sent out to ExCo members for voting, which results in a preferential ordering of the proposals. At semi-annual ExCo meetings, these are then evaluated by ExCo members to determine which ones will be accepted. Once approved, a study will usually take about six months to complete, after which there is a peer review. An overview of the study is then prepared for presentation at the next ExCo meeting. After approval by the ExCo, a report on the study is published and made available to IEA GHG members.

A study originally proposed by the CSLF Technical Group, “Development of Storage Coefficients for CO₂ Storage in Deep Saline Formations”, has now been published as IEA GHG Report 2009/13. The main aims of the study were to review storage resource estimation methodologies and associated resource classification schemes, compile a database of key parameters from injection projects and associated modeling studies, and develop a series of storage coefficients that can be applied to regional resource surveys. Due to the relatively small amount of “real world” project data available, results were obtained from approximately 200 modeling simulations, utilizing a database of likely deep saline formation characteristics developed from hydrocarbon field databases and literature searches. Results showed the influence of various factors such as geological formations and injection rates on storage efficiency and these can be used to assist in regional storage resource estimation.

Mr. Wildgust stated that the IEA GHG would welcome additional suggestions for studies from the Technical Group, but due to the six month cycle of ExCo meetings, any ideas for studies to be considered at the next voting round must be submitted before the end of May.

During the ensuing discussion, Mr. Wildgust mentioned that IEA GHG reports are currently available without cost from the IEA GHG website only to its members, but the IEA GHG is willing to provide these reports free of charge to anyone who resides or works in a member country, or who works for one of IEA GHG’s sponsor organizations. As there are several CSLF member countries that are not IEA GHG members, there was consensus that the CSLF Secretariat should coordinate with IEA GHG about distribution of IEA GHG studies and reports to those CSLF delegates.

Additional discussion centered on possible future IEA GHG studies based on suggestions by the CSLF Technical Group. Stefan Bachu of Canada proposed that the IEA GHG commission two different studies on CO₂ storage in unconventional geological media, one for basalts and one for shales. There is currently a great deal of uncertainty if these media are suitable for CO₂ storage, and two studies are needed because of their different mechanisms for storage. Basalts have relatively quick geochemical reactions that change the CO₂ into a mineral, while CO₂ adsorbs on organic material in the shales. These two circumstances require different types of expertise and would therefore require separate assessments. Also, and particularly in North America, oil and gas is being produced from shale formations where fracturing of the shale is part of the extraction process. As this shale is very often the cap rock that keeps CO₂ in place after it is injected into underlying aquifers, this fracturing could possibly affect the overall integrity of the underlying storage reservoir. In that regard, Dr. Bachu suggested that the proposed study on shales could also address this point. There was consensus that Dr. Bachu work with Mr. Wildgust as necessary to develop and submit proposals for these two studies to the IEA

GHG by the end of May, so that they can be considered at the next IEA GHG ExCo meeting.

Tuesday, 16 March 2010

14. Reconvene Meeting

Chairman Riis called the meeting to order and thanked GeoGreen and ArcelorMittal for hosting the enjoyable dinner that concluded the previous day's activities.

15. Report from Projects Interaction and Review Team

The PIRT Chair, Clinton Foster of Australia, gave a presentation that summarized the PIRT's history, and its activities and actions from the PIRT meetings of 1-3 February in Canberra and 15 March in Pau. The PIRT was originally formed in 2006 with a mandate to encourage and assess candidate projects for inclusion in CSLF project portfolio. The role of the PIRT has since expanded to identify critical technology gaps and work with stakeholders to try to fill those gaps through collaborative initiatives, and to encourage countries to develop national CCS roadmaps and work on their implementation. There have been twelve PIRT meetings, including the ones in Canberra and Pau.

The aims of the Canberra meeting were to set the direction technically for the CSLF for the period 2010-2013, ensure consistency with the CSLF Strategic Plan while building upon the update of the CSLF Technology Roadmap, and create alignment where possible with other international and global actions of CCS (such as the IEA, the IEA GHG, and the Global CCS Institute). At that meeting, the PIRT took the following actions:

- Prioritized PIRT activities
- Revised and updated the PIRT Terms of Reference
- Updated the CSLF Project Submission Form
- Developed a new plan for analysis of CSLF-recognized projects in relation to gaps
- Developed a new plan for engaging CSLF-recognized projects and attracting new projects
- Recommended extension of CSLF Charter beyond 2013
- Developed a schedule for updating the CSLF Technology Roadmap
- Reviewed current collaborations and opportunities for new collaboration
- Transferred PIRT chairmanship from the United Kingdom to Australia

Dr. Foster mentioned that most of the above actions were taken in response to the request by the Technical Group at its October 2009 meeting in London that the PIRT should reexamine its mission and develop an action plan. In regards to the last action, Dr. Foster offered his thanks to the previous PIRT Chair, Nick Otter of the United Kingdom, who guided the PIRT for the previous three years and led the effort that resulted in a major update to the CSLF Technology Roadmap in 2009. (Note: The PIRT action on reviewing current collaborations and opportunities for new collaboration is described in the "Update from the IEA GHG" item, above. It is also included in the "Update on European Framework Activities and Opportunities for the CSLF" item, below. The PIRT action on prioritizing PIRT activities is included in the "Development of Technical Group Action Plan" item, below.)

Dr. Foster stated that the PIRT Terms of Reference was updated from the original 2006 version, which had been written prior to the PIRT's actual formation. The CSLF Project Submission Form was revised in many areas, the most significant being elimination of the requirement to describe how the proposed project is different from other CSLF-

recognized projects, elimination of the requirement for more than one project representative to sign the Form, elimination of the requirement that the proposed project should meet its major milestones prior to the expiration of the CSLF Charter in 2013, and addition of a checklist for project representatives to select the technology gaps that will be addressed. After brief discussion, there was consensus by the Technical Group to approve the updates of both the PIRT Terms of Reference and the CSLF Project Submission Form. The CSLF Secretariat was requested to post these documents to the CSLF website.

Concerning technology gaps, Dr. Foster stated that perhaps the most important action of the PIRT at the Canberra meeting was the development of a comprehensive plan for analyzing projects in relation to gaps, both for projects that have already been recognized by the CSLF and for projects that could be proposed for recognition. A preliminary version of a technology gaps analysis matrix “report card” on CSLF-recognized projects has been prepared by Geoscience Australia for the PIRT to help identify which technology gaps these projects address. This matrix will assist the PIRT in identifying projects that would address the remaining gaps, but first the entries for all CSLF-recognized projects need to be individually verified by the project managers. There was agreement that the CSLF Secretariat should prepare and send out, to each recognized project for verification, an individual gap analysis worksheet based on this preliminary matrix. Additionally, there is a need to assess each project in terms of its readiness level, using methodology similar to that developed by NASA. In this case, four readiness levels should be used: laboratory / bench scale, sub-scale pilot, full-scale demonstration, and first-of-a-kind commercial. Enabling Technologies and Applied Research should also be identified. After brief discussion, there was consensus that Norway would take the lead, with the assistance of the United States and the Global CCS Institute, in developing a technology readiness assessment for each of the 30 CSLF-recognized projects.

Another recommendation by the PIRT, concerning gaps, was that a new Task Force on Assessing the Progress of Closing the Gaps be formed. It would be chaired by the Technical Group Vice Chair from Australia, and would incorporate four working groups: Capture, Transport and Infrastructure, Storage, and Integration. Each working group would analyze all CSLF-recognized projects in relation to its assigned gap. After brief discussion there was consensus to create this new Task Force.

- The working group on Capture will be led by the United States and will also include Italy, Korea, and South Africa.
- The working group on Transport and Infrastructure will be led by Netherlands and will also include Norway.
- The working group on Storage will be led by Canada and will also include China, France, Italy, Japan, and the United States.
- The working group on Integration will be led by the Global CCS Institute.

The CSLF Secretariat was asked to contact CSLF delegations not present at this meeting and offer them the opportunity to participate in any or all of these working groups. Neil Wildgust was not able to immediately confirm which of these working groups the IEA GHG would want to join, and was asked to inform the Secretariat as soon as that decision is made. Peng Sizhen of China then commented that the CSLF Policy Group should also consider forming its own Task Force to assess progress in closing policy-related gaps such as regulatory issues. After brief discussion there was agreement that Chairman Riis would bring this recommendation forward to the Policy Group at its next meeting.

In regard to projects, Dr. Foster stated that engaging CSLF recognized projects and attracting new projects were key actions identified by the PIRT that should be undertaken by the Technical Group. There was agreement that in order to properly engage the projects, the Technical Group should first learn what the projects want and expect from CSLF recognition. Dr. Foster mentioned that the PIRT, at its Canberra meeting, had discussed this topic and had developed the following three questions that could be asked project representatives:

- What do you need to make the project succeed?
- What advantages do you see from greater CSLF project interaction?
- What else should the CSLF do?

Trygve Riis suggested that there should also be a fourth question:

- Would you be interested in participating in a conference / workshop on CSLF projects? And if so, what format is desirable for you?

After brief discussion, there was general agreement for all four questions to be put before each project representative by a Technical Group delegate from the country where the project is located. Information obtained from the project representatives would be sent to the Secretariat for summarization. There was also agreement Australia, the Global CCS Institute, and the Secretariat should work together to utilize this information for developing a plan to attract new projects for CSLF recognition.

Concerning the proposed workshop, there was general agreement that this was a good idea. Tim Bertels, representing CSLF stakeholder Shell International Exploration & Production Company of the Netherlands, gave a project representative viewpoint that such a workshop would be most useful if it concentrated on gaps instead of technologies, such that the projects could learn what specific gaps and technology areas are being addressed by others. Joseph Giove of the United States suggested that the workshop be open to representatives of projects not recognized by the CSLF, if those projects address technology gaps, as it could be a significant recruitment tool to attract more projects. There was consensus that if a positive response results from the fourth question, above, an ad hoc group consisting of Australia and the GCCSI, with support from the PIRT, Technical Group Executive Committee (consisting of the Chair, Vice Chairs, and Task Force Chairs), and Secretariat, will take the lead in developing a plan for the workshop.

There was one other recommendation from the PIRT concerning projects. Dr. Foster stated that the PIRT discussed ways of assessing outcomes from CSLF-recognized projects that have been completed, and that it would be helpful if the Secretariat would summarize each of these projects in a format similar to the IEA GHG online projects database. After brief discussion, there was consensus for the Secretariat to do this and make the summary available at the CSLF website.

Concerning the proposed extension of the CSLF Charter beyond its current expiry date of 2013, Dr. Foster stated that the PIRT believes this is necessary because many new projects are projected to commence after 2013 and it would be difficult to persuade project representatives to propose their projects for CSLF recognition if the CSLF is not in existence a few years from now. An additional reason for extending the Charter is that there are still many technical gaps and challenges to be addressed by the CSLF and that it will likely take longer than another three years to do so. There was general agreement in favor of this proposal. Tony Surridge suggested that since this would have to be taken up at the next Ministerial meeting, planning should start soon. Peng Sizhen concurred and added that the Technical and Policy Groups should work together for the planning of the

next Ministerial meeting, perhaps through a joint working group of some kind. There was agreement that Chairman Riis would bring forward the Technical Group's recommendation on extension of the Charter to the Policy Group at its next meeting.

The next set of recommendations from the PIRT concerned further updating of the CSLF Technology Roadmap. Dr. Foster stated that, at the Canberra meeting, the PIRT developed the following proposed schedule for the next update of the Roadmap:

- 01 June 2010: Update Technology Costs in Module 1
- 01 June 2010: Update Technology Gaps in Module 3
- 01 July 2010: Receive Updates from CSLF Delegates on National Programs and Projects in Module 2
- 31 July 2010: Assemble new Draft of Roadmap and Circulate to PIRT
- October 2010: Complete Roadmap Updating Process

There was consensus to accept this plan. The Global CCS Institute will handle the Module 1 technology cost revisions. Norway, with the assistance of the United States and the Global CCS Institute, will do the revisions to Module 3. The Secretariat will ask Technical Group delegates to provide updates to Sections 2.3-2.5 of Module 2. The Secretariat will assemble an updated draft of the Roadmap with this new information and provide the updated draft to the PIRT for review, after which a final draft will be prepared in time for the next CSLF annual meeting.

16. Update on the United Nations Industrial Development Organization (UNIDO) Initiative on CCS Industrial Sector Roadmap

Bill Koppe gave a presentation on the UNIDO Global Technology Roadmap for CCS in Industry, which has been co-funded by the Global CCS Institute and Norway's Ministry of Petroleum and Energy. The purpose of this initiative is to advance the global uptake of low-carbon technologies in industry, particularly by involving developing countries and transition economies, and to help build the analytical foundation for identifying early opportunities for pilot and demonstration industrial sector CCS projects. Industrial sources currently account for about 40% of total energy-related CO₂ emissions, and the majority of industrial energy use and CO₂ emissions takes place in developing countries. CCS is one of the few low-carbon options for energy-intensive industries.

The three main expected outcomes from this activity are to provide relevant stakeholders with a vision of industrial CCS up to 2050, to strengthen the capacities of various stakeholders with regard to industrial CCS, and to inform policymakers and investors about the potential of CCS technology. The sectoral focus for this initiative will include cement, iron and steel, refineries, and industrial options involving biomass. UNIDO will first perform sectoral assessments and hold a series of workshops with selected stakeholders. These will take place during 2010, and the goal is to complete a draft of a CCS industrial sector roadmap by the end of 2010.

Mr. Koppe stated that the Global CCS Institute, as part of its sponsorship arrangements, will have actual involvement in the preparation of the UNIDO roadmap. The draft document, after it is prepared, will be made available to CSLF delegates for comment. Mr. Koppe suggested that since the CSLF Technology Roadmap is weighted toward power generation applications for CCS, there may be some content in the UNIDO industrial sector roadmap that can be used to broaden the scope of the CSLF Roadmap. Jostein Dahl Karlsen of Norway, representing the Ministry of Petroleum and Energy, concurred, and welcomed the potential partnership with the CSLF on this activity.

17. Introduction and Review of Gorgon CO₂ Injection Project

During the Report from the PIRT, there was agreement that this item would be put before the Technical Group separately from the rest of the PIRT presentation. The key outcome from the Pau PIRT meeting was review and approval of the Gorgon CO₂ Injection Project, which has been nominated for CSLF recognition by Australia, Canada, and the United States. Clinton Foster gave a presentation about the project and its features. This is a large-scale project that will store approximately 120 million tonnes of CO₂ in a water-bearing sandstone formation two kilometers below Barrow Island, off the northwest coast of Australia. The CO₂ stored by the project will be extracted from natural gas being produced from the nearby Gorgon Field and injected at approximately 3.5 to 4 million tonnes per year. There is an extensive integrated monitoring plan, and the objective of the project is to demonstrate the safe commercial-scale application of greenhouse gas storage technologies at a scale not previously attempted. The project has already progressed through its early development stages including site selection and appraisal, and is fully funded. Injection operations are expected to commence by the end of 2014.

After brief discussion, there was consensus by the Technical Group to recommend CSLF recognition for this project. Chairman Riis, with the assistance of the Secretariat, will bring this recommendation forward to the Policy Group at its next meeting.

18. Update on European Framework Activities and Opportunities for the CSLF

Chairman Riis gave a short presentation on European Union (EU) Research, Development and Demonstration Activities in Clean Coal and CCS that had been prepared by Jeroen Schuppers of the European Commission. The EU is currently in the middle of its 7th Framework Programme for Research and Technological Development (FP7). The energy component of FP7, administered jointly by the European Commission's Directorate-General for Research and the Directorate-General for Energy and Transport, includes both Clean Coal Technologies and CO₂ Capture and Storage Technologies for Zero Emission Power Generation as areas of interest. The EU has dedicated large amounts of money in support of these two areas of interest. A total of about €4 million has been committed for these two areas in FP7, to go with about €6 million that has been spent in the previous two Framework Programmes combined.

In 2009, the EU adopted a climate package which provides for a reduction in greenhouse gas emissions based on the '3 x 20' objective: by 2020, reduce greenhouse gas emissions by 20%, increase energy efficiency by 20%, and raise the proportion of renewable energies by 20%. In order to achieve these ambitious goals, the EU has implemented the Strategic Energy Technology (SET) Plan. This Plan reinforces the need for international cooperation in meeting climate goals and is being led by industry. There is shared risk through a pool of public and private financing and the intent is to boost research and innovation while accelerating the deployment of new technologies.

One of the initiatives under the SET Plan is on CCS; the objective is to demonstrate CCS technologies at full-scale through a set of projects with different capture, transport and storage options, and with a relevant geographical spread to prepare the way for fully commercial implementation. The European Commission has committed €1 billion from its Energy Plan for Recovery (EEPR) for six CCS demonstration projects in six EU member states (Germany, Italy, Netherlands, Poland, Spain, and United Kingdom) which will be funded with up to €80 million each, with the exception of the Italian project (€100 million). These demonstration projects represent the focal point of the SET-Plan activities on CCS in the short term. These projects and others will be part of the EU's

new CCS Project Network, which will serve as an information hub for communication of results from the projects and will work to build public confidence in CCS and promote international cooperation with organizations such as the CSLF.

19. Development of Technical Group Action Plan

Through interactive discussion and based on the report from the PIRT earlier in the meeting, delegates developed a preliminary Technical Group Action Plan that included both near-term and longer-term actions:

Near Term Actions (next 6 months)	Lead Responsibility
Develop and submit to IEA GHG two proposals for studies of progress regarding the potential for CO ₂ storage in unconventional media (by May 31 st).	Canada
Provide updates for Module 1 of CSLF Technology Roadmap (by June 1 st).	Global CCS Institute
Provide updates for Module 3 of CSLF Roadmap (by June 1 st).	Norway
Form a new Task Force for Assessing Progress on Closing the Gaps (by June 30 th).	Australia
Provide updates for Module 2 of CSLF Technology Roadmap (by July 1 st).	Delegates
Assemble a new draft of Roadmap using the updates for Modules 1, 2 and 3; provide draft of updated Roadmap to PIRT (by July 31 st).	Secretariat
Complete Roadmap update (by October).	PIRT
Develop a plan for attracting new projects based on responses from questions asked to project representatives.	Australia
Prepare a technology readiness assessment for all CSLF-recognized projects.	Norway
Prepare an options paper that can be used to develop a plan for implementing a projects workshop.	Australia, Global CCS Institute

Longer Term Actions
Accomplish periodic assessments of gaps and upgrades of the CSLF Technology Roadmap.
Completion of activities by the new Task Force for Assessing Progress on Closing the Gaps.
Promote awareness of activities among the CSLF Members and stakeholders.
Engage projects through workshops, events, and networks.
Pursue opportunities for collaboration with other organizations.

20. Lessons Learned from CSLF-recognized CASTOR Project

Pierre Le Thiez of France gave a presentation on the now-completed CASTOR project, which had activities in three main areas: strategy for CO₂ reduction, post-combustion capture, and CO₂ storage performance and risk assessment studies. The overall goal of the project was to develop and validate innovative technologies needed to capture and store 10% of the CO₂ emitted in Europe.

Post-combustion CO₂ capture research was done at the CASTOR Pilot Plant, located at Esbjerg, Denmark. Major technical results from the Pilot Plant included development of new solvents for CO₂ capture, development of advanced CO₂ capture processes with lower power output losses, and process equipment improvements resulting in lower investment costs. Overall, this resulted in a dramatic decrease in the per-tonne cost of CO₂ avoided, from about 40-50 €/per tonne down to about 20-30 €/per tonne, depending on the type of fuel being consumed.

Dr. Le Thiez stated that the objective of the CO₂ storage component of the CASTOR project was to develop and apply a methodology for the selection and the secure management of storage sites by improving assessment methods, defining acceptance criteria, and developing a strategy for safety-focused, cost-effective site monitoring. A secondary objective was to improve the “Best Practice Manual” for CO₂ storage that was started with the Norwegian Sleipner project by adding four more real-site cases. Work was undertaken in many areas pertaining to CO₂ storage, including geomodel building, analysis of fluid flow properties, reservoir simulation, geochemical / geomechanical experiments and simulations, well integrity analysis, monitoring of stored CO₂, and integrated risk assessment analysis. Results included complete assessments of the four industrial scale storages sites and development of criteria for storage site selection and management.

21. Update on CSLF-recognized Lacq Integrated CCS Project

Luc de Marliave, representing project sponsor Total of France, gave a presentation on the Lacq Integrated CCS Project. This is an intermediate-scale project that will test and demonstrate an entire integrated CCS process, from emissions source to underground storage in a depleted gas field. The project will capture and store approximately 60,000 tonnes per year of CO₂ for two years from an oxyfuel industrial boiler in the Lacq industrial complex in southwestern France. Dr. de Marliave stated that the focus of his presentation would be on stakeholder and public awareness issues, and that a more technical presentation about the project would be included during the site visit on March 17th.

To gauge public awareness of and interest in CCS, an opinion survey about CCS was conducted on a representative sample of French residents aged 15 years and above. Only about 6% of the respondents were able to provide a satisfactory definition of the technology, and of those, opinion was about equally divided between those who were in favor of the technology and those who were not. The public outreach plan was therefore based on knowledge than a generally uninformed populace would have to be enlightened about CCS in general and the Lacq Project in particular. In that regard, several public outreach events were held in Pau and the surrounding area, but one difficulty was that new stakeholders tended to emerge partway through the outreach process with new questions, and the process had to be restarted for them. An important conclusion from this process is that “mapping” of stakeholders must be done very carefully to ensure all key NGOs and other stakeholders are identified before any outreach plan is set in motion.

Dr. de Marliave mentioned that one other lesson learned from the public outreach process was that any decision-making procedure should be asymmetric – all participants to public dialog do not take part in the final decision but all participants in the decision making take part in the public dialog.

22. New Business

There was no new business.

23. Review of Consensus Reached, Action Items, and Next Steps

Consensus was reached on the following items.

- The Safety and Integrity Working Group has become incorporated into the Risk Assessment Task Force as a sub-group.
- Italy and Netherlands have become members of the CCS in the Academic Community Task Force.

Action items from the meeting are as follows:

Item	Lead	Action
<i>General</i>		
1	Technical Group Chair, Secretariat	Provide the Technical Group's recommendation to the Policy Group that the Gorgon CO ₂ Injection Project be recognized by the CSLF.
2	Technical Group Chair	Provide the Technical Group's recommendation to the Policy Group that the CSLF Charter be extended past its current expiry date of 2013.
3	Technical Group Chair	Provide Technical Group's recommendation to the Policy Group that the Policy Group should consider forming a new task force for assessing the progress in closing policy-related gaps such as regulatory issues.
4	Secretariat	Post the updated PIRT Terms of Reference to the CSLF website.
5	Secretariat	Coordinate with IEA GHG about distribution of IEA GHG technical reports to CSLF Members who are not also members of the IEA GHG.
6	Canada	Develop and submit to IEA GHG a proposal for a study of progress regarding the potential for CO ₂ storage in shales. The project scope should include an analysis of resource conflict (i.e., impact on damage of cap rock from shale gas production). <i>Target Date: 31 May 2010</i>
7	Canada	Develop and submit to IEA GHG a proposal for a study of progress regarding the potential for CO ₂ storage in basalts. <i>Target Date: 31 May 2010</i>

Item	Lead	Action
<i>Technology Gaps and Roadmap</i>		
8	Australia	Form new Task Force on Assessing the Progress of Closing the Gaps with four working groups: <ul style="list-style-type: none"> • <u>Capture</u>: United States (lead), Italy, Korea, South Africa • <u>Transport and Infrastructure</u>: Netherlands (lead), Norway • <u>Storage</u>: Canada (lead), China, France, Italy, Japan, United States • <u>Integration</u>: Global CCS Institute (lead) <p style="text-align: right;"><i>Target Date: 30 June 2010</i></p>
9	Secretariat	Contact CSLF delegations not present in Pau and offer them the opportunity to participate in any or all of the four working groups under the new Task Force.
10	IEA GHG	Inform Secretariat if it wishes to participate in any or all of the four working groups under the new Task Force.
11	Global CCS Institute	Update Module 1 (Current Status of CO ₂ Capture and Storage Technology) of CSLF Technology Roadmap with new cost information. <p style="text-align: right;"><i>Target Date: 01 June 2010</i></p>
12	Norway (lead), United States, Global CCS Institute	Update Module 3 (Gap Identification) of Roadmap. <p style="text-align: right;"><i>Target Date: 01 June 2010</i></p>
13	Delegates	Provide updated information to Secretariat for the following sections of Module 2 (Current Status of CO ₂ Capture and Storage) of the Roadmap: <ul style="list-style-type: none"> • Section 2.3: CCS Project Activities • Section 2.4: Demonstration and Research Activities • Section 2.5: R&D Components in Member Countries <p style="text-align: right;"><i>Target Date: 01 July 2010</i></p>
14	Secretariat	Assemble new draft of Roadmap using the updates for Modules 1, 2 and 3; provide draft of updated Roadmap to PIRT. <p style="text-align: right;"><i>Target Date: 31 July 2010</i></p>
15	Secretariat, PIRT	Complete Roadmap updating process. <p style="text-align: right;"><i>Target Date: October 2010</i></p>
<i>Projects</i>		
16	Secretariat	Post the updated CSLF Project Submission Form to the CSLF website.

Item	Lead	Action
17	Secretariat	Prepare and send out to each CSLF-recognized project for verification an individual gap analysis worksheet based on the preliminary gaps analysis matrix.
18	Norway (lead), United States, Global CCS Institute	<p>Prepare a technology readiness assessment for all CSLF-recognized projects using the following readiness levels:</p> <ul style="list-style-type: none"> • Laboratory / bench scale • Sub-scale pilot • Full-scale demonstration • First-of-a-kind commercial <p>Enabling Technologies and Applied Research should also be identified.</p>
19	Delegates	<p>Contact representatives of CSLF-recognized projects that are located in their countries to get answers for the following questions:</p> <ul style="list-style-type: none"> • What do you need to make the project succeed? • What advantages do you see from greater CSLF project interaction? • What else should the CSLF do? • Would you be interested in participating in a conference / workshop on CSLF projects? <ul style="list-style-type: none"> – If so, what format is desirable for you? <p>Provide any information obtained to Secretariat.</p>
20	Australia, Global CCS Institute, Secretariat	Develop plan for attracting new projects based on responses from questions asked to project representatives.
21	Australia, PIRT, Technical Group Executive Committee, Global CCS Institute, Secretariat	Develop plan for implementing a projects workshop based on consideration of the workshop options paper prepared by Australia and the Global CCS Institute, in addition to the responses from project representatives and gaps analysis.
22	Secretariat	Summarize all completed CSLF-recognized projects in a format similar to the IEA GHG online projects database, and make the summary available at the CSLF website.
<i>Risk Assessment</i>		
23	Delegates	<p>Provide comments on five “inFocus Carbon Capture and Storage” outreach documents to the Risk Assessment Task Force Chair.</p> <p style="text-align: right;"><i>Target Date: 02 April 2010</i></p>

Item	Lead	Action
24	Risk Assessment Task Force Chair	Provide any recommendations for editorial changes for the five “inFocus” outreach documents to the Policy Group’s Communications Task Force.
25	Risk Assessment Task Force Chair	Suggest to the Communications Task Force that an additional communication document should be considered to clarify the distinction between geologic storage and natural CO ₂ leakage scenarios, including Lake Nyos in Cameroon.

24. Closing Remarks/Adjourn

Chairman Riis thanked the meeting attendees for their hard work which resulted in a productive two days, expressed his appreciation to France for hosting the meeting, and adjourned the meeting.

