Carbon Sequestration Leadership Forum
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DRAFT

MEETING SUMMARY

Projects Interaction and Review Team (PIRT) Meeting
Abu Dhabi, United Arab Emirates
30 April 2017

Prepared by the CSLF Secretariat

LIST OF ATTENDEES

PIRT Active Members

Australia:	Andrew Barrett (Chair), Max Watson
Canada:	Eddy Chui, Mike Monea
China:	Ping Zhong, Yi-Ming Wei
France:	Didier Bonijoly
Japan:	Ryozo Tanaka
Netherlands:	Harry Schreurs
Norway:	Lars Ingolf Eide, Åse Slagtern (Technical Group Chair)
Saudi Arabia:	Ammar AlShehri
South Africa:	Tony Surridge, Landi Themba
United Arab Emirates:	Meshayel Omran AlAli, Fatma AlFalasi, Reshma Francy
United Kingdom:	Brian Allison
United States:	John Litynski
IEAGHG:	John Gale

Other CSLF Delegates

Australia:	Sarah Chapman
Korea:	Chong Kul Ryu, Chang-Keun Yi

CSLF Secretariat Richard Lynch, Stephanie Duran

Invited Speakers

Dipak Sakaria, Abu Dhabi Carbon Capture Company, United Arab Emirates
Grant Bromhal, National Energy Technology Laboratory, United States

Observers

Canada:	Simon O'Brien
India:	Shishir Tamotia
Japan:	Jiro Tanaka
Kuwait:	Harish Reddy
United Arab Emirates:	Taghreed AlKathiri
United States:	Sallie Greenberg, Frank Morton

1. **Welcome**

   PIRT Chairman Andrew Barrett welcomed participants to the 27th meeting of the PIRT. Mr. Barrett stated that the two major items to be taken up at this meeting were review of three projects nominated for CSLF recognition and a report and an update on ongoing PIRT activities to engage CSLF recognized projects. Besides these, there would also be a review of the status of the 2017 CSLF Technology Roadmap (TRM) and a discussion on possible future activities for the CSLF Technical Group.

2. **Introduction of Meeting Attendees**

   PIRT meeting attendees introduced themselves. In all, thirteen CSLF delegations were represented at the meeting.

3. **Adoption of Agenda**

   The draft agenda for the meeting, which had been prepared by the CSLF Secretariat, was adopted without change.

4. **Approval of Meeting Summary from Tokyo PIRT Meeting**

   The Meeting Summary from the October 2016 PIRT meeting in Tokyo was approved as final with no changes.

5. **Report from CSLF Secretariat**

   Richard Lynch provided a two-part report from the Secretariat, which covered the status of CSLF-recognized projects and outcomes from the October 2016 PIRT meeting in Tokyo.

   Concerning the portfolio of CSLF-recognized projects, Mr. Lynch stated that as of October 2016 there were 34 active projects and 17 completed projects spread out over five continents, though this would change based on outcomes from the current meeting. For the current meeting, three new projects had been proposed for CSLF recognition.

   Mr. Lynch reported that there were four outcomes from the Tokyo meeting:

   - The PIRT recommended approval by the Technical Group for both the Tomakomai CCS Demonstration Project and the NET Power 50 MW_{th} Allam Cycle Demonstration Project.
   - The PIRT approved a small revision to the CSLF Project Submission Form and will use the completed Form from the Tomakomai CCS Demonstration Project as a model for future project sponsors to use as an example of the kinds of project information being requested.
   - The PIRT implemented a project engagement strategy:
     - CSLF-recognized projects will be contacted for updates on their progress and accomplishments during years when there are CSLF Ministerial Meetings (i.e., every two years).
     - The CSLF Secretariat will oversee this activity.
     - Information received from projects will be utilized for future TRM updates and to prepare a summary document as an input to CSLF Ministerial Meetings.
   - The 2017 TRM update is underway and on schedule for roll-out in time for the 2017 CSLF Ministerial Meeting. The structure of the new TRM will be slightly

different than the 2013 TRM and will include information about recent developments in CCS, including COP21 outcomes, and new areas of interest such as CCS with industrial sources and bio-energy with CCS.

6. 2017 TRM Update

The TRM editor, Lars Ingolf Eide, stated that the TRM Working Group created in 2015 has been actively working on drafting the new TRM. The Working Group has been chaired by Australia with representation from Norway, Canada, South Africa, the United Kingdom, the United States, the IEAGHG, and the CSLF Secretariat. In addition, there have been contributions from several international experts on CCS. The overall approach was to refreshing the structure and content of the 2013 TRM as needed, in order to keep the overall level of effort to a manageable level.

Mr. Eide briefly described the main changes from the 2013 TRM:

- New time horizons were being used for medium- and long-term recommendations and targets (2025 and 2035 respectively, instead of the previous TRM's target dates of 2030 and 2050).
- The "Background" chapter was revised to reflect COP21 targets, and quantitative targets which meet the IEA 2 ºC scenario were used for CO_2 sequestration.
- A new section was included on non-technical measures such as regulations, and there is expanded discussion on CCS, CCU, and CCUS.
- The chapter on "Assessment of Present Situation" was shortened and merged into the "Technology Needs" chapter.
- There is less detail concerning specific technology types and fundamentals, and more emphasis on industrial and biomass CCS.
- There is a new separate section on sectors other than power, industry and biomass (though hydrogen production with CCS is the only topic so far).
- There is more emphasis on development of a "clusters and hubs" approach toward CCS, and also on ship transport of CO_2.
- Recent CO_2 storage projects and activities have been referenced, and description has been updated and expended about various aspects of CO_2 utilization.
- There are identified actions to meet technology needs throughout the CCS chain.

Mr. Eide stated that the main findings of the 2017 TRM are that CCUS works in power and industrial settings, but implementation of CCUS is well behind the trajectory of reaching the stated COP21 "less than 2 ºC temperature rise" goal. Additionally, CCUS is not possible without the right policy settings and the appropriate financial framework. There are several important recommendations made by the TRM:

- Based on the IEA 2 ºC scenario, governments and industry should work together to contribute to the COP21 targets by implementing sufficient large-scale projects in the power and industry sectors to:
  - Permanently store 0.5 gigatonnes (Gt) of CO_2 per year by 2025 (or have permanently captured and stored 2 $GtCO_2$); and
  - Permanently store 2.7 $GtCO_2$ per year by 2035 (or have permanently captured and stored 20 $GtCO_2$).

- Governments and industry should work together to:
  - Develop supportive policy incentives and support for CCS on similar terms as other low-carbon technologies;
  - Develop markets and business models for CCUS support;
  - Accelerate legal and regulatory frameworks for CCS; and
  - Develop strategic transportation and storage infrastructures using a cluster-and-hub approach, in particular for industrial CCUS, including early identification and characterization of potential CO_2 storage sites.
- Improve CCUS public outreach and education, supporting educators as well as community proponents of CCUS projects.
- Facilitate exchange of data from operating large-scale CCUS projects.
- Support RD&D for novel and emerging technologies along the entire CCUS chain, in order to drive down costs.
- Map opportunities, conduct technology readiness assessments, and resolve main barriers for the implementation of CCUS.

Mr. Eide concluded his presentations by briefly describing next steps. The mostly-final draft of the 2017 TRM has been sent to all CSLF delegations, with a firm deadline of July 1st for receiving comments. A finalized version will be completed and sent to the CSLF Secretariat by September 15th and a publication-ready version will then be prepared for publication and inclusion in Ministerial Meeting briefing documents.

7. Review and Approval of Project Proposed for CSLF-Recognition: Al Reyadah CCUS Project

Dipak Sakaria, representing project sponsor Abu Dhabi Carbon Capture Company, gave a technically detailed presentation about the Al Reyadah project. This is an integrated commercial-scale project, located in Mussafah, Abu Dhabi, United Arab Emirates, which is capturing CO_2 from the flue gas of an Emirates Steel production facility, and injecting the CO_2 for enhanced oil recovery (EOR) in the Abu Dhabi National Oil Company's nearby oil fields. The main objectives are to reduce the carbon footprint of the United Arab Emirates, implement EOR in subsurface oil reservoirs, and free up natural gas which would have been used for oil field pressure maintenance. The Al Reyadah Project includes capture, transport and injection of up to 800,000 tonnes per year of CO_2 (processed at the required specifications and pressure) and is part of an overall master plan which could also create a CO_2 network and hub for managing future CO_2 supply and injection requirements in the United Arab Emirates.

Outcome: After a discussion which clarified some of the details about the project, there was unanimous consensus by the PIRT to recommend approval of the Al Reyadah CCUS Project by the Technical Group. Project nominators are the United Arab Emirates (lead), Australia, Canada, China, the Netherlands, Norway, Saudi Arabia, South Africa, the United Kingdom, and the United States.

8. Review and Approval of Project Proposed for CSLF-Recognition: Carbon Capture Simulation Initiative / Carbon Capture Simulation for Industry Impact (CCSI/CCSI^2)

Grant Bromhal, representing project sponsor the U.S. National Energy Technology Laboratory (NETL), gave a technically detailed presentation about CCSI/CCSI^2. This is a

computational research initiative, with activities ongoing at NETL, four other National Laboratories, and five universities across the United States, with collaboration from other organizations outside the United States including industry partners. The overall objective is to develop and utilize an integrated suite of computational tools (the CCSI Toolset) in order to support and accelerate the development, scale-up and commercialization of CO_2 capture technologies. The anticipated outcome is a significant reduction in the time that it takes to develop and scale-up new technologies in the energy sector. $CCSI^2$ will apply the CCSI toolset, in partnership with industry, in the scale-up of new and innovative CO_2 capture technologies. A major focus of $CCSI^2$ will be on model validation using the large-scale pilot test information from projects around the world to help predict design and operational performance at all scales including commercial demonstrations. These activities will help maximize the learning that occurs at each scale during technology development.

Outcome: After a discussion which clarified some of the details about the project, there was consensus by the PIRT to recommend approval CCSI/$CCSI^2$ by the Technical Group. Project nominators are the United States (lead), China, France, and Norway.

An additional outcome from discussion, in light of the "doesn't fit the mold" nature of the project, was that the PIRT Chair and the CSLF Secretariat were asked to review the CSLF and PIRT Terms of Reference documents to clarify project qualifications for CSLF recognition and to present recommendations at the next PIRT meeting.

9. Review and Approval of Project Proposed for CSLF-Recognition: National Risk Assessment Partnership (NRAP)

Grant Bromhal, representing project sponsor NETL, gave a technically detailed presentation about NRAP. This is a risk assessment initiative, with activities ongoing at NETL and four other National Laboratories across the United States, including collaboration with industry, regulatory organizations, and other types of stakeholders. The overall objective is development of defensible, science-based methodologies and tools for quantifying leakage and seismic risks for long-term CO_2 geologic storage. The anticipated outcome is removal of key barriers to the business case for CO_2 storage by providing the technical basis for quantifying long-term liability. To that end, NRAP has developed and released a series of computational tools (the NRAP toolset) that are being used by a diverse set of stakeholders around the world. The toolset is expected to help storage site operators design and apply monitoring and mitigation strategies, help regulators and their agents quantify risks and perform cost-benefit analyses for specific CCS projects, and provide a basis for financiers and regulators to invest in and approve CCS projects with greater confidence because costs long-term liability can be estimated more easily and with greater certainty.

Outcome: After a discussion which clarified some of the details about the project, there was consensus by the PIRT to recommend approval NRAP by the Technical Group. Project nominators are the United States (lead), Australia, China, and France.

10. Update on CSLF-recognized Projects Engagement Activities

Mr. Eide gave a presentation that reviewed an ongoing CSLF initiative, begun at the June 2016 meeting in London, toward better interacting with CSLF-recognized projects. To that end, a new project status reporting form was developed which requests the following information:

- Name of project
- Brief non-technical description
- Project status (Active? Ended? If ended, when and why? If still active, what are the important factors for its continued progress and why?)
- Overall timeline, emphasizing next six months
- Description of sharable information that has been produced
- Description of any interesting outcomes or gains in knowledge
- Project's main point-of-contact for CSLF

Mr. Eide stated that Technical Group delegates were asked to obtain this information, via the form, from all CSLF-recognized projects in their countries. In all, responses were received from 25 of the 35 active CSLF-recognized projects (as of the beginning of 2017) as well as two completed projects. There were several findings of general interest:

- Success factors for projects include secure funding, encouragement from owners, collaboration between stakeholders (e.g., industry, academia, and research organizations), and good communication with locals and other stakeholders.
- Factors leading to a project stopping include reaching specified targets or goals, and lack of sufficient funds to continue.

Mr. Eide also stated that the survey did not ask why a project sought CSLF recognition, or what benefits that project sponsors expect from CSLF recognition. After ensuing discussion, there was consensus that the survey form be amended to ask for this information. Project sponsors who were present at the meeting were queried as to the overall value of CSLF recognition and responses indicated that increased project visibility and opportunities to network with other project sponsors made it worth the effort to seek CSLF recognition. In particular, the opportunity to participate in CSLF workshops was seen to be a tangible benefit.

11. Open Discussion on Possible New Technical Group Activities

The CSLF Technical Group Chair, Åse Slagtern, made a short presentation that summarized existing Technical Group activities and possible new ones in advance of a more detailed discussion during the next day's full Technical Group Meeting. There are currently four active task forces besides the PIRT: Improved Pore Space Utilization (co-chaired by Australia and the United Kingdom), Bioenergy with CCS (chaired by the United States), Offshore CO_2-EOR (chaired by Norway), and Industrial CCS (chaired by France). Ms. Slagtern stated that there are at least ten possible future actions, identified by a Technical Group working group back in 2015, but there had not yet been any consensus to form task forces around these possible actions.

Ensuing discussion led to a few new ideas. Max Watson proposed that previous Technical Group task force final reports be revisited to see if updates are warranted. In that regard, Harry Schreurs suggested that the Technical Group take another look at non-EOR applications might be worthwhile, as there are activities of that nature underway in several CSLF member countries. Ms. Slagtern stated that at the next day's Technical Group meeting, she would recommend at a new working group be formed to review the findings of the 2015 working group and possibly suggest new actions.

12. General Discussion and New Business

There was no new business offered or further discussion on any topic.

13. Adjourn

Mr. Barrett thanked the attendees for their interactive participation, expressed his appreciation to the host United Arab Emirates Ministry of Energy, and adjourned the meeting.

Summary of Meeting Outcomes

- The PIRT has recommended approval by the Technical Group for the Al Reyadah CCUS Project, the Carbon Capture Simulation Initiative / Carbon Capture Simulation for Industry Impact, and the National Risk Assessment Partnership.
- The mostly-final draft of the 2017 TRM has been sent to all CSLF delegations, with a firm deadline of July 1st for receiving comments. A finalized version will be completed and sent to the CSLF Secretariat by September 15th and a publication-ready version will then be prepared for publication and inclusion in Ministerial Meeting briefing documents.
- The PIRT's projects engagement initiative has produced useful information, but the CSLF still needs to ramp up its efforts in this area.

Actions

- The PIRT Chair and the CSLF Secretariat will review the CSLF and PIRT Terms of Reference documents to clarify project qualifications for CSLF recognition and to present recommendations at the next PIRT meeting.
- The CSLF Secretariat will revise the Project Engagement survey form to include questions asking why the project sought CSLF recognition, or what benefits that project sponsors expect from CSLF recognition.