



## TECHNICAL GROUP

### Action Plan Status Report

#### Background

At the September 2011 CSLF Ministerial Meeting in Beijing, the Technical Group approved a new multi-year Action Plan to identify priorities and provide a structure and framework for conducting Technical Group efforts through 2016. Twelve individual actions were identified; task forces were formed to address four of these twelve actions, and several other actions were deferred. At the November 2013 Technical Group meeting in Washington, a working group was formed to review any existing documents and other materials relevant to the unaddressed Actions Plan items and recommend which of these unaddressed actions are worth pursuing. Additionally, three of the existing task forces completed their activities and a new action on “Review of CO<sub>2</sub> Storage Efficiency in Deep Saline Aquifers” was approved with a new task force formed.

This paper is an update, prepared by the CSLF Secretariat, on the status of the Technical Group’s Action Plan.

#### Action Requested

The Technical Group is requested to review the Action Plan status report.



## CSLF Technical Group Action Plan Status (as of February 2014)

### COMPLETED ACTIONS

#### Technology Gaps Closure

**Action:** The Technical Group will identify and monitor key CCS technology gaps and related issues and recommend any R&D and demonstration activities that address these gaps and issues.

**Outcome:** Identification of all key technology gaps/issues and determination of the effectiveness of ongoing CCS RD&D for addressing these gaps/issues.

**Status:** Final Report has been issued. Key findings are:

- At a high level there are no major technology gaps. CCS technologies are ready and available, and are being deployed today.
- There are many contending capture technologies, in both current technologies and 2<sup>nd</sup> & 3<sup>rd</sup> generation technologies.
- Next generation technologies are vital for substantial cost reduction.
- However, there is no strong market pull for new technologies at the moment.
- There is a need to continue work towards low cost, high resolution MMV, particularly in the offshore environment.
- The lack of exploration for CO<sub>2</sub> storage sites is a significant barrier to rapid deployment of CCS and, thus, learning by doing.

#### Technical Challenges for Conversion of CO<sub>2</sub>-EOR to CCS

**Action:** The Technical Group will determine technical and economic aspects that can affect moving from enhanced oil recovery (EOR) to carbon storage.

**Outcome:** Identification of permitting, monitoring, and reporting requirements for CO<sub>2</sub> EOR applications that apply for CO<sub>2</sub> credits.

**Status:** Final Report has been issued. Task force key findings are:

- There is sufficient operational and regulatory experience for this technology to be considered as being mature, with an associated CO<sub>2</sub> storage rate of the purchased CO<sub>2</sub> greater than 90%.
- The main reason CO<sub>2</sub>-EOR is not applied on a large scale outside west Texas in the United States is the unavailability of high-purity CO<sub>2</sub> in the amounts and at the cost needed for this technology to be deployed on a large scale.

- The absence of infrastructure to both capture the CO<sub>2</sub> and transport it from CO<sub>2</sub> sources to oil fields suitable for CO<sub>2</sub>-EOR is also a key reason for the lack of large scale deployment of CO<sub>2</sub>-EOR.
- There are a number of commonalities between CO<sub>2</sub>-EOR and pure CO<sub>2</sub> storage operations, both at the operational and regulatory levels, which create a good basis for transitioning from CO<sub>2</sub>-EOR to CO<sub>2</sub> storage in oil fields.
- There are no specific technological barriers or challenges per se in transitioning and converting a pure CO<sub>2</sub>-EOR operation into a CO<sub>2</sub> storage operation. The main differences between the two types of operations stem from legal, regulatory and economic differences between the two.
- A challenge for CO<sub>2</sub>-EOR operations which may, in the future, convert to CO<sub>2</sub> storage operations is the lack of baseline data for monitoring, and generally monitoring requirements for CCS which are broader and more encompassing than for CO<sub>2</sub>-EOR.

### **CO<sub>2</sub> Utilization Options**

**Action:** The Technical Group will investigate CO<sub>2</sub> utilization options.

**Outcome:** Identification of most economically attractive CO<sub>2</sub> utilization options.

**Status:** Final report has been issued. Task force key findings are:

- A number of CO<sub>2</sub> utilization options are available which can serve as a mechanism for deployment and commercialization of CCS.
- EOR is the most near-term CO<sub>2</sub> utilization option. Non-EOR CO<sub>2</sub> utilization options are at varying degrees of commercial readiness and technical maturity.
- For mature non-EOR CO<sub>2</sub> utilization options, efforts should be on demonstration projects and on the use of non-traditional feedstocks or polygeneration concepts.
- Efforts that are focused on hydrocarbon recovery other than EOR should focus on field tests.
- Efforts that are in early R&D or pilot-scale stages should focus on addressing key techno-economic challenges, independent tests to verify the performance, and support of small and/or pilot-scale tests of first generation technologies and designs.
- More detailed technical, economic, and environmental analyses should be conducted on these options.

## ONGOING ACTIONS

### **Best-Practice Knowledge Sharing**

- Action:** The Technical Group will facilitate the sharing of knowledge, information, and lessons learned from CSLF-recognized projects and other CCS RD&D.
- Outcome:** Development of interactive references for assisting next-generation commercial CCS projects, which will include links with other CCS entities.
- Status:** Activity has been assigned to Projects Interaction and Review Team (*led by Australia*). Also, Technical Group is holding annual technology workshops featuring representatives of CSLF-recognized projects.

### **Reviewing Best Practices and Standards for Geologic Storage and Monitoring of CO<sub>2</sub>**

- Action:** The Technical Group will identify and review standards for CO<sub>2</sub> storage and monitoring.
- Outcome:** Identification of best practices and standards for storage and monitoring of injected CO<sub>2</sub>. The application of such standards should inform CO<sub>2</sub> crediting mechanisms.
- Status:** Task force (*led by Norway*) has been active since June 2012. Reports for Years 2012 and 2013 have been issued.
- As of 2014 the task force will be moving onto Phase 2 activities, which will have a focus of outlining/designing a web-based solution that can be used for future annual updates. Resources permitting, the task force will also identify the applicability and shortcomings of various Best Practice Manuals and communicate these results to the ISO/TC 265 for use in future development of CCS standards in this area.

### **Review of CO<sub>2</sub> Storage Efficiency in Deep Saline Aquifers**

- Action:** The Technical Group will recommend the proper storage efficiency coefficients to be used when estimating CO<sub>2</sub> storage capacity, based on the scale of the assessment, geological characteristics and other parameters of the storage operation.
- Outcome:** Identification of guidelines for use of appropriate CO<sub>2</sub> storage efficiency coefficients that can be used by governments and industry in the assessment of CO<sub>2</sub> storage resource and in site selection for CO<sub>2</sub> storage.
- Status:** The CSLF Task Force for Review and Identification of Standards for CO<sub>2</sub> Storage Capacity Estimation published reports in 2005, 2007, and 2008 before concluding its work. New task force (*led by Canada*) has been active since November 2013 and will build on results from the previous task force and published literature since then.

## **PROPOSED ACTIONS**

### **Technical Barriers and R&D Opportunities for Offshore, Sub-Seabed Geologic Storage of CO<sub>2</sub>**

- Action:** The Technical Group will provide an assessment of the status of global offshore CO<sub>2</sub> storage potential (including potential for offshore EOR).
- Outcome:** Identification of technical barriers/challenges and potential opportunities for global collaboration on offshore, sub-seabed geologic storage of CO<sub>2</sub>.
- Status:** Proposed new task force (*to be led by United States*). Background paper has been drafted.

### **Energy Penalty Reduction**

- Action:** The Technical Group will identify technological progress and any new research needs for reducing the energy penalty for CCS, both for traditional CO<sub>2</sub> capture processes and new breakthrough technologies.
- Outcome:** Identification of opportunities for process improvements and increased efficiency from experiences of “early mover” projects.
- Status:** United Kingdom was asked to be lead and to report to the Technical Group on feasibility for activity in this area. Projected new task force would build on results from the United Kingdom’s Cost Reduction Task Force.

### **CCS with Industrial Emissions Sources**

- Action:** The Technical Group will document the progress and application of CCS for industrial emissions sources and will identify demonstration opportunities for CSLF Members.
- Outcome:** Identification of opportunities for CCS with industrial sources. Identification and attempted resolution of technology-related issues (including integration) unique to this type of application.
- Status:** South Africa was asked to be lead (with support from the United States and the IEA GHG) and to report to the Technical Group on feasibility for activity in this area. Projected new task force would build on the Clean Energy Ministerial / IEA report that has been issued.

### **CO<sub>2</sub> Compression and Transport**

- Action:** The Technical Group will review technologies and assess pipeline standards for CO<sub>2</sub> transport, in particular in relation to impurities in the CO<sub>2</sub> stream. Issues such as thermodynamics, fluid dynamics, and materials of construction, will be considered. Alternatives to pipelines, such as ship transport, will also be assessed.
- Outcome:** Identification of optimum technical CO<sub>2</sub> transport strategies, both for pipeline and non-pipeline alternatives. Assessment of purity issues as they apply to CO<sub>2</sub> transport. Identification of optimal compression options and alternatives.
- Status:** Japan was asked to be lead and to report to the Technical Group on feasibility for activity in this area.

## **Competition of CCS with Other Resources**

- Action:** The Technical Group will examine criteria for assessing competing development priorities between CCS (particularly CO<sub>2</sub> storage) and other economic resources.
- Outcome:** Identification of criteria for determining relative economic viability of CO<sub>2</sub> storage sites.
- Status:** France was asked to be lead and to report to the Technical Group on feasibility for activity in this area.

## **Life Cycle Assessment and Environmental Footprint of CCS**

- Action:** The Technical Group will identify and review methodologies for Life Cycle Assessment (LCA) for CCS, including life cycle inventory analysis, life cycle impact assessment, and interpretation of results.
- Outcome:** Identification of criteria for determining the full range of environmental effects for CCS technologies.
- Status:** Norway was asked to be lead (with support from the United States and the IEA GHG) and to report to the Technical Group on feasibility for activity in this area.

## **Carbon-neutral and Carbon-negative CCS**

- Action:** The Technical Group will investigate technical challenges in use of CCS with power plants that utilize biomass (either pure or co-fired), to determine a pathway toward carbon-neutral or carbon-negative functionality.
- Outcomes:** Identification of issues and challenges for use of CCS with biomass-fueled power plants.
- Status:** United Kingdom was asked to be lead (with possible support from the Netherlands and the IEA GHG) and to report to the Technical Group on feasibility for activity in this area.