Carbon Sequestration Leadership Forum
www.cslforum.org

CSLF-P-2013-03
16 October 2013

POLICY GROUP

Key Messages and Recommendations from the CSLF Technical Group

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, and Task Forces were formed to address four of these twelve actions. This paper is a summary of key messages and recommendations from the following three Technical Group Task Forces:

- Technology Opportunities and Gaps Task Force
- Technical Challenges for Conversion of CO_2-EOR to CCS Task Force
- CO_2 Utilization Options Task Force

Action Requested

The Policy Group is requested to review the messages and recommendations from the Technical Group.

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Key Messages and Recommendations from the CSLF Technical Group

Prepared by the CSLF Technical Group Executive Committee

CCS Technology Opportunities and Gaps

- At a high level there are no major technology gaps or impediments to large-scale CCS deployment; the technology is available and can be effectively deployed.
- The focus of the technology development is now on driving down costs, improving operational and monitoring performance, and contributing to better regulatory frameworks for CCS.
- Current commercially available capture technologies will evolve by implementing more projects. This typical "learning by doing" phenomenon is common with many technologies and is already happening in CCS.
- For the next generation of capture technologies, that promise much lower costs than those currently available, more attention is needed. Investment in the early stages of development has been significant with a number of promising emerging technologies. However, with little or no market for CCS (e.g., CO_2 price or emissions reduction mandate), the market pull for this next crop of technologies is weak. Getting next-generation lower-cost technologies into large scale pilots and demonstration operations is important and requires governments to act to ensure that CO_2 capture at much lower costs is available for deployment by 2030 and beyond.
- Technologies for capturing CO_2 from natural gas combustion should be a priority, as low-cost shale gas will encourage more gas combustion driven both by market costs and by an increasing need to reduce CO_2 emissions.
- Pipeline transporting of CO_2 is a mature technology, but more experience is need in planning and designing large scale transport hubs managing a diverse supply of CO_2 with different impurity concentrations. Large scale transport of CO_2 by ship offers promise and needs to be demonstrated as scale.
- On storage, the significant body of knowledge from the oil and gas industry combined with what is now 10-15 years of R&D on the behaviour of CO_2 in deep rock formations underpins a strong consensus that safe CO_2 storage is possible today.
- The lead times from initiating exploration through to approvals and construction of storage sites will often be 10-15 years. The rate at which exploration is incentivised to start will have a profound impact on the degree to which CCS can contribute to reaching 2050 global CO_2 reduction targets. This will increase the ability to deploy CCS more rapidly and will in turn affect the rate of technology improvement. There is a strong recommendation to start or incentivize more exploration for storage.

- Monitoring, measurement verification (MMV) for stored CO_2 continues to progress well. Low cost, continuous, high-resolution subsurface monitoring is being refined and may be valuable in some situations. An important new front is developing MMV technologies and strategies for MMV for storage in offshore environments.
- It is recommended that Governments continue to look to support and incentivise international technology collaboration and researcher exchange to spark faster developments and the diffusion of new CCS technologies, particularly in the fields of capture and monitoring.

Converting CO_2-EOR Operations to CCS

- Enhanced Oil Recovery (EOR) is the most near-term utilization option that has broad commercial deployment opportunities.
- There is sufficient operational and regulatory experience for this technology to be considered as being mature, with an associated CO_2 storage rate of the purchased CO_2 greater than 90%.
- The main reason CO_2-EOR is not applied on a large scale outside west Texas in the United States is the unavailability of high-purity CO_2 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_2 and transport it from CO_2 sources to oil fields suitable for CO_2-EOR is also a key reason for the lack of large scale deployment of CO_2-EOR.
- There are a number of commonalities between CO_2-EOR and pure CO_2 storage operations, both at the operational and regulatory levels, which create a good basis for transitioning from CO_2-EOR to CO_2 storage in oil fields.
- There are no specific technological barriers or challenges *per se* in transitioning and converting a pure CO_2-EOR operation into a CO_2 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_2-EOR operations which may, in the future, convert to CO_2 storage operations is the lack of baseline data for monitoring.
- In order to facilitate the transition of a pure CO_2-EOR operation to CO_2 storage, operators and policy makers have to address a series of legal, regulatory and economic issues in the absence of which this transition can not take place. These should include:
    1. Clarification of the policy and regulatory framework for CO_2 storage in oil reservoirs, including incidental and transitioned storage CO_2-EOR operations.
    2. Clarification if CO_2-EOR operations transitioning to CO_2 storage operations should be tenured and permitted under mineral/oil & gas legislation or under CO_2 storage legislation.
    3. Clarification of any long-term liability for CO_2 storage in CO_2-EOR operations that have transitioned to CO_2 storage, notwithstanding the CO_2 stored during the previous phase of pure CO_2-EOR.

4. Clarification of the monitoring and well status requirements for oil and gas reservoirs, particularly for CO_2-EOR, including baseline conditions for CO_2 storage.
5. Addressing the issue of jurisdictional responsibility for pure CO_2 storage in oil and gas reservoirs, both in regard to national-subnational jurisdiction in federal countries, and to organizational jurisdiction (environment versus development ministries/departments).

CO_2 Utilization Options

- Besides utilization in CO_2-EOR operations, there is a wide range of CO_2 utilization options available which can serve as a mechanism for deployment and commercialization of carbon capture and storage (CCS) by providing an economic return for the capture and utilization of CO_2.
- Non-EOR CO_2 utilization options are at varying degrees of commercial readiness and technical maturity.
- For commercially and technologically mature options such as urea production and utilization in greenhouses, efforts should be on demonstration projects and on the use of non-traditional feedstocks (such as coal) or ‘polygeneration’ concepts (such as those based on integrated gasification combined cycle (IGCC) concepts). This can help facilitate CCS deployment by diversifying the product mix and providing a mechanism for return on investment.
- Efforts that are focused on hydrocarbon recovery other than EOR, such as CO_2 for enhanced gas recovery (via methane displacement) or CO_2 utilization as a fracturing fluid, should focus on field tests to validate existing technologies and capabilities, and to understand the dynamics of CO_2 interactions in the reservoir.
- Efforts that are in early R&D or pilot-scale stages, such as algal routes to fuels, aggregate/secondary construction materials (SCM) production, and enhanced geothermal systems, should focus on: addressing key techno-economic challenges; independent tests to verify the performance (e.g., less energy requirements with CO_2 utilization to produce SCM and building materials) of these products compared to technical requirements and standards; and support of small, pilot-scale tests of first generation technologies and designs that could help provide initial data on engineering and process challenges of these options.
- More detailed technical, economic, and environmental analyses should be conducted to better quantify the potential impacts and economic potential of CO_2 utilization technologies and to clarify how R&D could potentially expand the market for these utilization options (e.g., in enhanced gas recovery) and improve the economic and environmental performance of the system.