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TECHNICAL GROUP

Summary of the Report by the CSLF Task Force on CO_2 Utilization Options

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. To that end, a task force (led by the United States) was formed to address the "CO_2 Utilization Options" Action in the Plan. The task force mandate was to identify/study the most economically promising CO_2 utilization options that have the potential to yield a meaningful, net reduction of CO_2 emissions, or facilitate the development and/or deployment of other CCS technologies. The final Phase 2 report of the task force has been issued. This paper is a summary of the findings of the task force's Phase 2 report.

Action Requested

The Technical Group is requested to review the summary of findings from the CO_2 Utilization Options Task Force.

Utilization Options of CO_2

Summary of the Phase 2 Report by the CSLF Task Force on Utilization Options of CO_2

The Phase 2 Report on CO_2 Utilization Options provides a more thorough discussion of the most attractive CO_2 utilization options based upon economic promise and CO_2 reduction potential. This report looks at the current and future economic viability, potential for co-production, and Research, Development and Demonstration (RD&D) needs of these options. The CO_2 Utilization Task Force members selected the following options for further investigation: enhanced gas recovery (CO_2-EGR), shale gas recovery, shale oil recovery, urea production, algal routes to fuels, utilization in greenhouses, aggregate and secondary construction material production, and CO_2-assisted geothermal systems. This work did not include Enhanced Oil Recovery, which is addressed by a separate CSLF Task Force.

As identified in the Phase 1 report, market potential for many of the utilization options is limited (i.e., small, and/or 'niche'), with some exceptions (e.g., enhanced oil recovery – not a subject of this report – or the conversion of CO_2 to fuels or chemicals). However, when taken cumulatively, the sum of these options can provide a number of technological mechanisms to utilize CO_2 in a manner that has potential to provide economic benefits for fossil fuel fired power plants or industrial processes. As such, they may well be a means of supporting the early deployment of carbon capture and storage (CCS) in certain circumstances and accelerating deployment.

One of the key observations from this report is that the potential uses of CO_2 are broad. CO_2 has the potential to be used in the extraction of other energy resources, as a working fluid, and as a chemical feedstock. These applications have some market potential, although the technology maturity varies widely. Some applications, such as urea production, already have an existing global market, while other less mature options, such as algae to fuels have the potential for significant markets and require additional RD&D to address technical challenges and to validate the utilization of CO_2 as an option, reduce the cost and improve the efficiency.

There are a wide range of CO_2 utilization options available, which can serve as an additional mechanism for deployment and commercialization of CCS by providing an economic return for the capture and utilization of CO_2. The results offer several recommendations that can assist with the continued development and deployment of non-EOR CO_2 utilization options in this context.

1. For commercially and technologically mature options such as urea production and utilization in greenhouses, efforts should be on demonstration projects. For urea production, the focus should be on the use of non-traditional feedstocks (such as coal) or 'polygeneration' concepts (such as those based on integrated gasification combined cycle (IGCC) concepts) which can help facilitate CCS deployment by diversifying the product mix and providing a mechanism for return on investment. For utilization in

greenhouses, new and integrated concepts that can couple surplus and demand for CO_2 as well as energy, thus optimizing the whole energy and economic system, would be valuable.

2. Efforts that are focused on hydrocarbon recovery, 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. R&D efforts on CO_2 as a fracturing fluid should focus on the development of viscosity enhancers that can improve efficiency and optimize the process. Issues such as wellbore construction, monitoring and simulations should leverage those tools and technologies that currently exist in industry or are under development through existing CCS R&D efforts.
3. For algal routes to fuels and aggregate/secondary construction materials (SCM) production, the primary focus should be on R&D activities that address the key techno-economic challenges previously identified for these particular utilization options. Independent tests to verify the performance (less energy requirements with CO_2 utilization to produce SCM and building materials) of these products compared to technical requirements and standards should be conducted. Support of small, pilot-scale tests of first generation technologies and designs could help provide initial data on engineering and process challenges of these options.
4. For CO_2-assisted geothermal systems, more R&D and studies are necessary to address the subsurface impacts of utilizing CO_2 in this application. Additionally, small pilot-scale tests could provide some initial data on actual operational impacts and key engineering challenges that need to be addressed.
5. Finally, more detailed technical, economic, and environmental analyses should be conducted to better quantify the potential impacts and economic potential of these 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. A holistic approach, not only taking a one-dimensional technocratic perspective, is important.