

Carbon Sequestration leadership forum

CSLF-P-2009-31
11 September 2009

www.cslforum.org



POLICY GROUP

Documents for Ministerial Conference

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DOCUMENTS FOR MINISTERIAL CONFERENCE

Note by the Secretariat

Background

Three papers pertaining to the CSLF Ministerial Conference are presented in this document:

- Overview for the Ministers (developed by the CSLF Secretariat)
- What Has the CSLF Accomplished? (developed by the CSLF Secretariat)
- What Are the Challenges Ahead? (developed by the CSLF Ministerial Steering Board)

Action Requested

The Policy Group is requested to review and approve the “Overview for the Ministers”, “What Has the CSLF Accomplished?”, and “What Are the Challenges Ahead?” papers.



OVERVIEW FOR THE MINISTERS

October 2009

Given continued global reliance on fossil fuels, Carbon Capture and Storage (CCS) is essential to climate change mitigation – the emissions reductions needed to stabilize greenhouse gas concentrations cannot be achieved without CCS. For CCS to make a difference in climate change mitigation, however, early actions are needed to accelerate the commercialization of CCS on a global scale.

CSLF: Meeting the Global Challenges of CCS

The Carbon Sequestration Leadership Forum (CSLF) provides the coordination and focus needed for timely and effective international collaboration on CCS. The CSLF, whose Members represent over three quarters of the world's greenhouse gas emissions, was inaugurated in 2003. It is now more than half way through its chartered mandate to 2013. Its central focus remains promoting international collaboration and government-industry partnerships on CCS.

Since its inception, the CSLF has made significant progress in fostering a global consensus on the necessity for CCS and on the steps needed to make it a reality. The CSLF advanced international collaboration on CCS technology and aided Members in creating the institutional framework necessary to implement it. Two attached summary papers describe the achievements of the CSLF and how the CSLF will help to meet the future challenges of achieving widespread global deployment of CCS.

Looking the Future: The CSLF Strategic Plan and Technology Roadmap

The CSLF early on established a strategic plan and roadmap to help focus global efforts to develop CCS technology and the institutional framework it requires. Much progress has been made on CCS since the CSLF's inception, catalyzed to a large degree by the efforts of the CSLF and its Members.

Needs for greenhouse gas abatement highlight the necessity of accelerating broad commercialization of CCS in industrialized, developing and transitional economies. Recognition of these needs, coupled with rapid progress on CCS, led to the development of an updated CSLF Strategic Plan and a new CSLF Technology Roadmap. Together, these two documents lay the foundation for accelerating CCS commercialization and the future activities of the CSLF to build on that foundation.

Capacity Building

The CSLF pioneered CCS capacity building on CCS technology and on policy, legal and socio-economic issues for emerging economies. Recognizing, however, that CCS is new and the capacity to widely implement it is not yet adequate in either emerging or industrialized economies, the CSLF has developed a new capacity building program. This new program will assist all its Members to develop the information, tools, skills, expertise and institutions required to implement CCS demonstrations and then move rapidly into commercial operation. Greater levels of funding are needed, however, to support the program. The CSLF Program Plan for Capacity Building is attached.



WHAT HAS THE CSLF ACCOMPLISHED?

The mission of the Carbon Sequestration Leadership Forum (CSLF), as stated in its Charter, has three objectives:

- Facilitate the development of cost-effective technologies for the separation and capture of carbon dioxide for its transport and long-term safe storage;
- Make these technologies broadly available internationally; and
- Identify and address wider issues relating to carbon capture and storage, including promoting the appropriate technical, political and regulatory environments for the development of such technology.

The CSLF has made significant progress in achieving these objectives. When the CSLF was founded in 2003, Carbon Capture and Storage (CCS) was virtually unknown beyond a few technical specialists and policy analysts. Moreover, it was not clear what would be required to make CCS a commercial reality, or even if commercial deployment was feasible. Today, six years later, much technical progress has been made; CCS is widely recognized as an indispensable method for mitigating climate change; and many countries are well on the way to developing the capacity needed for deployment. Much of this progress was spearheaded by the CSLF.

Overarching Achievements

Several CSLF accomplishments have had significant impact in achieving each of the three objectives of the CSLF. Of greatest importance have been:

- ✓ Creating an ongoing global forum for experts and diverse stakeholders in all fields relevant to CCS to work together to address the major challenges facing development and commercial deployment of CCS;
- ✓ Helping to raise global awareness of CCS and inform the global dialogue on the use of CCS to reduce greenhouse gas emissions;
- ✓ Facilitating international collaboration on twenty diverse CCS projects, a mechanism for the worldwide sharing of information generated from projects that will facilitate the development of cost-effective CCS technologies, and a model for further international collaboration; and
- ✓ In response to a request from the G8 and working with the International Energy Agency (IEA), convening experts from around the world to develop the recommendations¹ that now form the basis for global activities to make CCS commercial and broadly available internationally by 2020.

¹ http://www.cslforum.org/meetings/workshops/iea_calgary2007.html.

The CSLF is a voluntary organization and has no budget, permanent staff or funding authority. Yet, it has had a significant impact as an international platform for governments, industry and other stakeholders to collaborate on CCS. The CSLF has also set the precedent for more recent funded international collaborative activities such as the Global Carbon Capture and Storage Institute, with which the CSLF actively collaborates.

The two major bodies within the CSLF, the Technical Group and the Policy Group, work together to achieve the CSLF objective of making CCS broadly available internationally. Each has each made significant progress to achieve the CSLF objective in its area of responsibility. The Secretariat, managed by the US Department of Energy, provides the administrative support to the CSLF.

CSLF activities are guided by the CSLF Strategic Plan. Members agreed on the initial CSLF Strategic Plan in 2004, which was updated in 2009.² Among other things, the CSLF Strategic Plan incorporates a comprehensive Technology Roadmap developed in 2004 and updated in 2009. The CSLF Strategic Plan represents the consensus of the Members on collaborative international activities to facilitate the development of CCS technologies, make these technologies broadly available internationally, and address wider issues relating to CCS.

Technical Group Accomplishments

The Technical Group strives to achieve the CSLF objective of facilitating “the development of cost-effective technologies for the separation and capture of carbon dioxide for its transport and long-term safe storage.” In order to achieve that, Technical Group activities bring together experts from around the world to evaluate technology development requirements and to create useful global standards. Evaluations of technology development needs inform the research, development and demonstration activities of Members. Nonbinding international standards provide guidance for project development and regulatory requirements in Member jurisdictions.

Specific achievements of the Technical Group are listed below:

1. The Technical Group developed a CSLF Technology Roadmap to identify and evaluate requirements for Research and Development (R&D). The CSLF Technology Roadmap reflects a consensus of leading international experts on the technical developments necessary to develop and deploy all aspects of CCS. The Roadmap provides input to Member R&D activities and to international collaboration. Considerable technical progress is reflected in the updated 2009 CSLF Technology Roadmap.³
2. Experts from the Technical Group developed international standards for storage capacity estimates.⁴ This is a critical breakthrough. Projects cannot be permitted or financed unless there is assurance that the storage capacity exists and consistent standards are needed to measure that capacity. The CSLF standards provide a consistent basis for estimating, comparing and valuing geologic storage capacity for CO₂. The CSLF reports on storage capacity standards are widely cited as authoritative in measuring storage capacity.

² http://www.cslforum.org/publications/index.html?cid=nav_publications.

³ http://www.cslforum.org/publications/documents/CSLF_Tech_Roadmap_081809.

⁴ http://www.cslforum.org/publications/index.html?cid=nav_publications.

3. An expert Task Force of the Technical Group identified and assessed gaps in Measurement Monitoring and Verification (MMV) of geologic storage. MMV is required in order to assure the security, safety and permanence of geologic storage. This assessment describes gaps in MMV technologies and practices as a guide to where further R&D is required.⁵
4. The Technical Group is undertaking an examination of risk assessment standards and procedures. Risk assessment is critical to design and regulatory approval of CCS projects. Activities are underway to assess prior work in this area, to determine critical issues for further development and to provide the basis for standards and procedures.
5. Technology gaps in capture and transport were identified by the Technical Group as a guide to further R&D. Considerable work is taking place throughout the world on capture and transport technologies. It is important that R&D planners and researchers understand where it all stands in order to most effectively and efficiently plan further projects and coordinate efforts. The Technical Group has prepared a report on gaps in CO₂ capture and transport to provide guidance in this area.⁶

Policy Group Accomplishments

Policy Group activities, aside from governance of the CSLF, focus on the CSLF objective of identifying and addressing the “wider issues relating to carbon capture and storage, including promoting the appropriate technical, political and regulatory environments for the development of such technology.” Activities address legal and regulatory frameworks, financing constraints, capacity building and public outreach. Specific accomplishments of the Policy Group are listed below:

1. The Policy Group has facilitated the development of approaches to financing CCS projects. The ability to commercially finance CCS projects is a major challenge for CCS, and this challenge is especially severe in developing countries. Financing was also highlighted in the recommendations to the G8. A workshop on financing involving key stakeholders, the financial industry and governments which was held in London, England (2004) identified the key issues related to financing. The CSLF Financial Issues Task Force in meetings in Delhi, India (2007 and 2008) and in Cape Town, South Africa (2008) focused attention on solving the financing challenges in developing countries. A new CSLF Financing Task Force with a subgroup on financing in developing countries is now working to develop approaches to close the financing gap. As part of this work, a workshop on bridging the financing gap was held in New York in September, 2009. A study with the Asian Development Bank to identify methods for financing CCS in developing countries is currently underway.

Financial incentives for both demonstration and commercial projects, including those (such as emission allowance prices) that provide value for reducing carbon dioxide emissions, will be necessary for financing CCS. Such incentives are now starting to be put in place in various countries. The CSLF has established a registry of financial incentives that can serve as the basis for evaluation of the design and effectiveness of incentives.⁷

⁵ http://www.cslforum.org/publications/documents/Final_Report_MMV_Task_Force.pdf.

⁶ http://www.cslforum.org/publications/documents/Final_Report_Task_Force_Identifying_Gaps_CO2_Capture_Transpo.pdf.

⁷ <http://cslforum.org/incentivesregistry/index.html>.

2. The Policy Group Task Force on Capacity Building in Emerging Economies conducted capacity building workshops for emerging economies and is expanding this activity. Capacity building is a critical need for all Members, and this need is particularly acute for emerging economy Members. Six workshops for emerging economies have been held so far in Brazil, Mexico, Saudi Arabia and the United States. These workshops led to the creation of academic courses and advanced CCS research projects in the host countries. Considerable expansion of this activity is planned and is the subject of another CSLF Ministerial Meeting Paper.
3. The Policy Group developed guidelines and has promoted information sharing on legal-regulatory frameworks. The legal and regulatory frameworks for CCS simply did not exist in most Member jurisdictions at the time the CSLF was formed. The Policy Group has addressed this issue since its inception. The CSLF held workshops on legal and regulatory issues in workshops in Brisbane, Australia (2003) and, with the IEA, in Paris, France (2006). The CSLF developed non-binding guidelines for legal and regulatory frameworks for CCS in 2004. Those guidelines were the first comprehensive assessment of the full range of legal and regulatory issues facing CCS. The guidelines provided input to the development of actual frameworks in Member countries. A number of CSLF Members (Australia, Canada, the European Commission, France, Germany, Japan, and Norway as well as some U.S. states) have now developed key elements of such frameworks and they are under development by other Members.
4. The Policy Group, on the recommendation of the Technical Group, has given recognition to 20 important CCS projects from around the world.⁸ This recognition provides the basis for international information sharing on some of the most important projects throughout the world covering all aspects of CCS. The projects report progress regularly to the CSLF and results are available to Members, stakeholders and others through the CSLF website. In return, the projects receive global visibility.
5. The Policy Group supports public outreach on CCS by Members. Public understanding and informed acceptance is critical to implementation of CCS. Members exchange information on their public outreach efforts through the CSLF and the CSLF website www.cslforum.org. This website, operated by the Secretariat, also provides a mechanism for the CSLF itself to provide information. The CSLF website now includes a daily news feed of media reports on CCS from around the world. Further collaborative efforts on public outreach are part of the 2009 CSLF Strategic Plan.
6. The CSLF has forged strong collaborative relationships with other international organizations to foster CCS. These organizations include the International Energy Agency, the Global Carbon Capture and Storage Institute and the Asian Development Bank. Discussions are currently underway on collaboration with the World Bank.

Recommendation

Ministers are invited to note the progress that the CSLF has made in achieving its objective and endorse activities under the 2009 CSLF Strategic Plan to make further progress.

⁸ http://www.cslforum.org/projects/index.html?cid=nav_projects.



WHAT ARE THE CHALLENGES AHEAD?

1 Introduction

This paper takes the conclusions of “What has the CSLF Accomplished?” and explores where further action is needed. It also seeks to determine the key challenges looking forward to the commercialisation of CCS and puts forward suggestions of where the CSLF and its member countries working with private sector stakeholders and other international organisations can remove barriers and accelerate the development and deployment of this important climate change mitigation technology.

The CSLF Strategic Plan has been designed to address the way forward. In particular, it has identified eight themes:

- i) Accelerate R&D for this technology to realise its potential
- ii) Promote the deployment of demonstration projects**
- iii) Support the development of legal and regulatory frameworks
- iv) Identify the barriers to investment**
- v) Collaborate on capacity building, especially in developing countries**
- vi) Address public awareness
- vii) Collaborate with international organisations
- viii) Engage stakeholders

This paper focuses on themes ii), iv), and v) for the Ministerial discussion.

2 Promote the deployment of demonstration projects

2.1 *A greater and more global demonstration effort is required before 2020*

The IEA has estimated that in order to keep concentrations of greenhouse gases in the atmosphere below 450ppm will require as much as 220 GW of CCS (1.2 Gt of abatement) in power generation to be operational globally by 2030⁹, increasing to around 1139 GW by 2050¹⁰.

There are still both financial and technical barriers to the deployment of CCS in the developed and developing world. The different types of capture technologies are in various stages of maturity and the key challenge is to mature the technology, get the costs down, and establish incentives for dissemination and deployment. A global portfolio of early industrial scale demonstration projects is needed to mature the capture technologies and provide vital

⁹ Using IEA 450ppm CO₂e Scenario in 2030 for illustration purposes

¹⁰ Using IEA BLUE Scenario for 2050 for illustration purposes

in-country experience in operating the full chain of capture, transport and storage on industrial scale projects as recognized by the G8 commitment to launch at least 20 projects by 2010.

The IEA has made an initial assessment that there are currently *four* industrial-scale CCS projects globally that meet the criteria for the G8 projects, whilst recognising recent announcements of public funding for industrial-scale projects by Australia, Canada, the EU, the UK and the US should result in further projects coming on-stream in the near future.

However, the IEA has undertaken further analysis to determine the trajectory that is needed from 2010 through to 2050 globally. In the drafts of their CCS roadmap, to be published in October 2009, the IEA finds that investment needs for the next decade are on the order of 5 times the amount previously thought, with developing countries responsible for nearly half. This may sound ambitious, however the alternative could be even more challenging, since the IEA estimates that without CCS, the global cost of tackling climate change increases by 70 per cent.

The IEA finds that investment needs prior to 2020 are on the order of 5 times the amount previously thought, half of which will be needed in developing countries. This suggests that a greater and more global demonstration effort is needed.

2.2 Countries must work together to achieve this level of demonstration

It is necessary to consider how countries can work together to achieve the required level of demonstration of the range of CCS technologies needed for deployment from 2020. Many countries, but particularly developing countries, lack public funding; institutional capacity; or access to knowledge and skills to develop an industrial scale CCS project. Given the importance of demonstrating CCS in all fossil fuel dependent countries where significant deployment of CCS is envisaged, co-development of this technology could help to remove barriers to deployment. CCS projects involving more than one government would help prepare the host country for the eventual deployment of CCS.

Countries willing to invest now in the global development of CCS should act together to co-develop CCS through delivering the necessary institutional arrangements and skills to build industrial-scale demonstration projects in emerging economy developing countries.

2.3 Knowledge sharing among industrial-scale CCS projects

Demonstration projects will provide a wealth of technical and commercial experience and knowledge where they are located, which could be exploited to assist with the design and financing of other large scale facilities around the world. This means projects implemented in different countries should be coordinated, with information and experiences widely and openly shared. Lessons learned on one project should be used on the others, helping to drive down costs and improve designs. Access to others' "learning by doing" will be immensely important for all countries.

The European Commission will run a "Knowledge Sharing Network", which is likely to be obligatory for those projects within Europe that receive EU funds. The European Commission intends for demonstration projects within the EU network to be monitored through site visits, with the reports shared widely via a purpose-built website. It will also

arrange for the sharing of knowledge from its programme globally, potentially through the Global Institute for Carbon Capture and Storage (GCCSI). As several CSLF members are currently in or about to enter negotiations with potential CCS project developers (Australia, Canada, the EC, the Netherlands, the UK and the US), it is important to ensure that knowledge sharing is recognised by public authorities and private entities undertaking these negotiations as an important aspect of any publicly funded project. The **Annex** includes an example of knowledge sharing principles based on the UK's demonstration competition requirement. CSLF members working together could help to avoid a "race to the bottom" on knowledge sharing, whilst respecting different jurisdictions and contractual relationships between governments and industry.

For large-scale demonstrations receiving a significant proportion of support from public funds, knowledge sharing principles should be agreed to ensure that access to the technology does not become a barrier to global deployment.

3 Identify the barriers to investment

3.1 *Global incentives are needed*

Without financial incentives CCS cannot presently be deployed on commercial scale energy projects – even in regions where existing carbon markets already recognise CCS (e.g. the EU Emissions Trading Scheme) – because CCS will not become economically viable in the short-term. This remains the greatest barrier to both the demonstration and commercialisation of CCS. Despite the numerous incentives available, as per the CSLF Incentive Registry, there are still gaps in funding in some countries that are preventing industrial-scale CCS projects from going ahead.

3.2 *Inclusion of CCS in international agreements*

It is important that CCS be incorporated in international agreements that may affect its implementation and which relate to climate change. For example, the OSPAR Convention (on marine protection) has been amended to allow for the safe and secure storage of carbon dioxide in geological formations under the seabed. However, the London Protocol, which was amended in 2006 to permit the safe geological storage of carbon dioxide, still prohibits the cross-border export of carbon dioxide for disposal into a sub-seabed formation. An amendment to the Protocol would enable cross-border CCS projects in parts of Northern Europe and South-East Asia to proceed.

Likewise, any international agreement on climate change should ensure that CCS can play its part in a comprehensive portfolio of mitigation action options available to UNFCCC Annex I and non-Annex I countries and supported through predictable finance and technology flow under national mitigation strategies. In order to enable this technology to reach its full potential, financial incentives are needed for both public and private investments in CCS technologies in developing countries. Several proposals are being considered under the UNFCCC, although not all supported by CSLF members, including:

- i) Inclusion of CCS in National Appropriate Mitigation Actions (NAMAs);
- ii) Inclusion of CCS in the CDM pre and/or other post 2012 agreement;
- iii) Establishment of a separate CO₂ project based mechanism;

- iv) Support, promote and/or advise on CCS capacity building activities, R&D and demonstration.

3.3 Assessment and assumption of risks must be clarified

One of the main barriers to commercial CCS that can be tackled now is the long-term liability for stored CO₂. Australia, the European Union, Norway and Japan have all responded to this issue by introducing regulatory frameworks for CO₂ storage that involve the government accepting the long-term responsibility for CO₂ storage sites. However, there remains a need to consider the wider business risks associated with the deployment of CCS. A project risk framework sees business risks shift over the project timeline of the design, construction, permitting and operation of an energy project. For analysis the risks over the project timeline are separated into three basic categories:

- i) system technology and operations;
- ii) regulatory and policy; and
- iii) market risks.

Project financing will be critically dependent on the assessment of these risks. At present, the individual technologies are well understood but integration remains an issue. The regulatory and policy risks fall into two parts: those relating to mitigation policies that will put a price on carbon; and those relating to the policies for safe transport and storage of CO₂. The establishment of a carbon price is only evident in the EU. Policies to regulate transport and storage are better developed but issues remain, such as the aforementioned assumption of long-term liability. Market risks will be a function of the CO₂ price and any revenues, for example from Enhanced Oil Recovery. Capital and operating costs of CCS projects are not well known; therefore, demonstration projects are required to provide real data. There is a need to develop a CCS project risk framework on which to base the investment decision to finance and build a plant, in order to inform policy makers and the financial community.

The commercialisation of CCS will require a clear understanding of the risks and rewards by the financial community, as well as governments developing appropriate treatment for risks such as the long-term liability for stored CO₂.

4 Collaborate on capacity building, especially in developing countries

There is an urgent need to ensure that all countries that will need to deploy CCS have the capacity to do so. This can be partially achieved through gaining practical experience from hosting an early industrial-scale project. There will also need to be a focused programme of institutional and industrial capacity building, tailored to the deployment needs of each country.

The focus on the CSLF since its inception has been to increase the CCS readiness of its members, from regular policy and technical group meetings and task forces on particular issues, through to specific in-country capacity building activities. It is clear that there are a number of issues that need to be considered in preparing for the deployment of CCS, including but not limited to:

- i) CO₂ storage mapping and capacity estimates;
- ii) Access rights and licensing for environmentally safe CO₂ transport/storage;

- iii) Building industrial and institutional capacity;
- iv) Capture readiness and high efficiency for new power plants; and
- v) Public Awareness.

The CSLF Capacity Building task force report concludes that a targeted, project-based approach to capacity building is needed in the next phase. Several such activities are already underway between CSLF members, for example the EU-China NZEC initiative and the South African CCS Centre of Excellence, which are building capacity in preparation for industrial-scale CCS demonstration. Building on members' existing bilateral efforts to increase CCS capacity through a coordinated programme will ensure best use is made of resources. The CSLF is well-placed to deliver a tailor-made capacity building programme to ensure that all countries that are likely to need to deploy CCS by 2020 will have sufficient institutional and industrial capacity to do so.

To assist in development of capacity building activities, CSLF members should endorse the principles in the CSLF Strategic Plan and agree to support the new CSLF Capacity Building Programme financially or in-kind.

5 Recommendations

This paper highlights a number of potential actions that could provide momentum towards achieving the aims of the CSLF Strategic Plan. **Ministers are invited to approve the CSLF Strategic plan and agree a Communiqué on their conclusions to accelerate the commercialisation of CCS.**

ANNEX

Example of principles for knowledge sharing in publicly-funded projects

(i) The provision of information needed to understand the performance of the technology

For example, operators would provide design, construction, programming, operational and storage data in a suitable format to be understood by different audiences (e.g. generators, engineers, policy makers, international knowledge sharing institutions and the public) and arrange for its distribution at no cost.

(ii) Measures to ensure the transfer of know-how

For example, operators would undertake a number of soft “know-how” transfer activities, including hosting inward secondments from other organisations and countries and participating in international knowledge sharing events.

(iii) Measures to share knowledge about new technical advancements

For example, operators would provide access to the IPR generated as part of the publicly funded activities to third parties on a fair, reasonable and non-discriminatory basis, whilst retaining ownership.