

Carbon Sequestration Leadership Forum

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Report from Technical Group

Trygve U. Riis

Chairman

CSLF Technical Group

08 October 2010

Warsaw, Poland

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Report from Technical Group

In Brief

- Summary of Pau, France meeting of Technical Group (March 2010)
- New Task Force to Assess Progress on Technical Issues Affecting CCS
- Other Technical Group Activities

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Report from Technical Group

In Brief

- Extension of CSLF Charter (*Agenda Item 7*)
- Update of CSLF Technology Roadmap (*Agenda Item 8*)
- New Projects Nominated for CSLF Recognition (*Agenda Item 9*)

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Report from Technical Group

**CSLF Technical Group Meeting in Pau, France
15-17 March 2010**



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Report from Technical Group

CSLF Technical Group Meeting in Pau, France

15-17 March 2010

- Initiated update of CSLF Technology Roadmap
- Formed new Task Force for Assessing Progress in Closing Technology-related Gaps
- Developed strategy for engaging CSLF-recognized projects



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Report from Technical Group

CSLF Technical Group Meeting in Pau, France

15-17 March 2010

- Endorsed Gorgon CO₂ Injection Project
- Initiated planning for CSLF Projects Workshop
- Visited CSLF-recognized Lacq CCS Project



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Report from Technical Group

New Task Force to Assess Progress on
Technical Issues Affecting CCS (*chaired by
Australia*)

- Objective: Assess progress on technology gaps and issues that affect the deployment of CCS
- Initial Task: Produce revised Technology Gaps Checklist

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Report from Technical Group

New Task Force to Assess Progress on Technical Issues Affecting CCS

- **Four Working Groups:**
 - *Capture (chaired by United States)*
 - *Transport and Infrastructure (chaired by Netherlands)*
 - *Storage (chaired by Canada)*
 - *Integration (chaired by Global CCS Institute)*

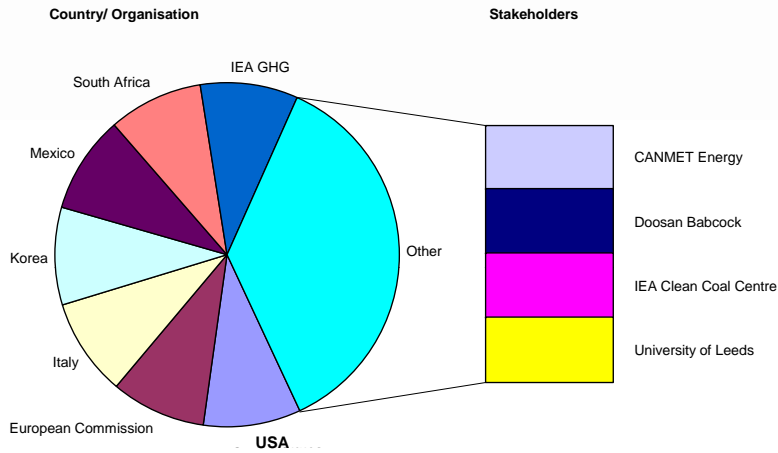
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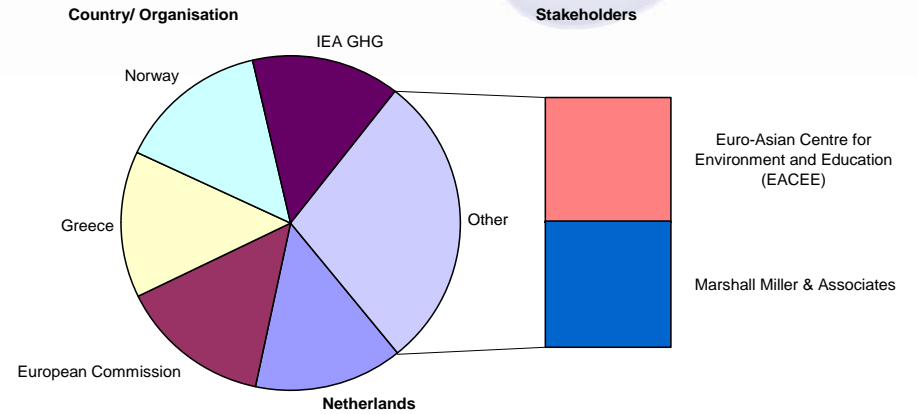


Taskforce and Working Group Members

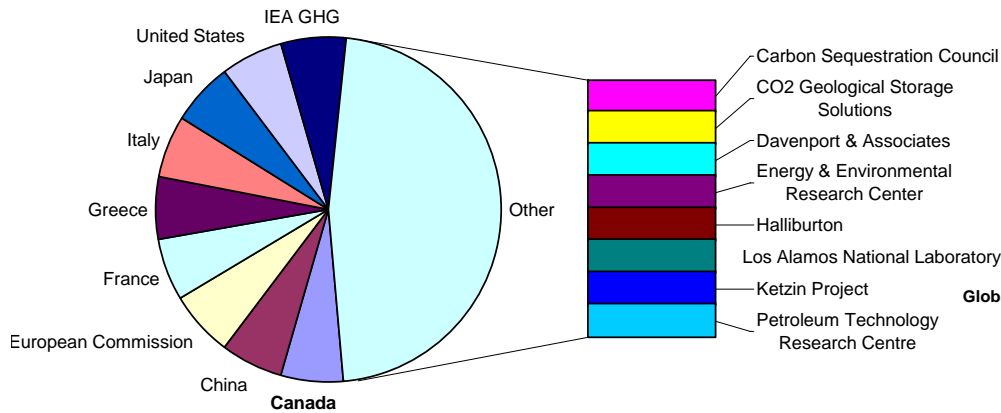
CAPTURE



TRANSPORT AND INFRASTRUCTURE

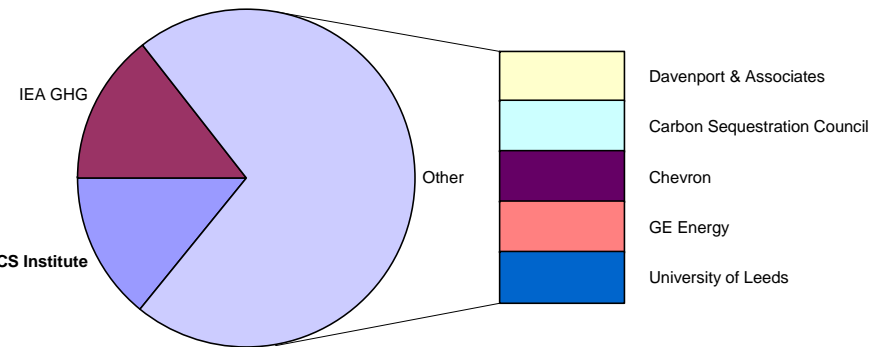


STORAGE AND MONITORING



Global CCS Institute

INTEGRATION



CSLF Meeting, Warsaw, Poland
6-8 October 2010

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The Technical Group recommends the Policy Group form a Task Force for Assessing Progress in Closing Policy-related Gaps such as Regulatory Issues.

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Report from Technical Group

Other Technical Group Activities:

- Risk Assessment Task Force starting Phase 2 activities.
- Planning is underway for 2011 Update to CSLF Technology Roadmap.
- CSLF Projects Workshop in Saudi Arabia in early 2011.
- Technical Group meeting in Alberta, Canada in May/June 2011.

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Report from Technical Group

Extension of CSLF Charter

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Report from Technical Group

The Technical Group **strongly** recommends the CSLF Charter be extended.

- Many critical projects are scheduled beyond 2013
- CCS entering a new phase – scale of projects is changing with a focus on large scale demonstrations
- Many technical gaps and challenges are still to be addressed by the CSLF

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Report from Technical Group

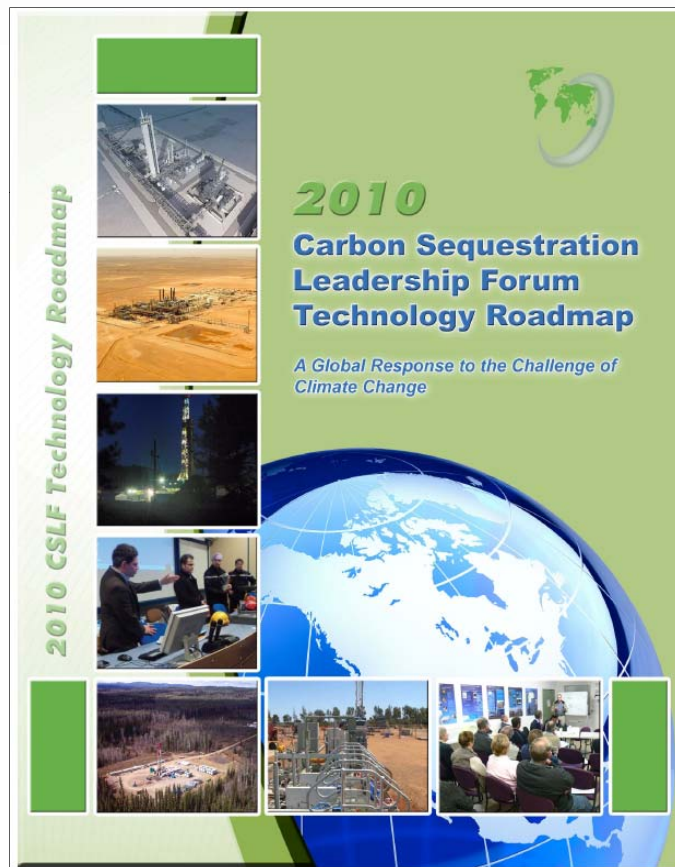
Update of CSLF Technology Roadmap

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Report from Technical Group



The Technical Group recommends the 2010 CSLF Technology Roadmap be approved.

- All modules have been significantly updated
- Includes recent global expansion of CCS activity

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Report from Technical Group

Update of CSLF Technology Roadmap

The focus of the 2010 CSLF Technology Roadmap is:

- Achieving commercial viability and deployment of CO₂ capture, transport, and storage technologies; reduction in the energy penalty and cost related to CO₂ capture;
- Developing an understanding of global storage potential, including matching CO₂ sources with potential storage sites and infrastructural needs;
- Addressing risk factors to increase confidence in the long-term effectiveness of CO₂ storage; and
- Building technical competence and confidence through sharing information and experience from multiple demonstrations.

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Report from Technical Group

Update of CSLF Technology Roadmap

The main changes from the 2009 Roadmap are:

- Stronger emphasis on CCS integration and demonstration of complete CCS value chains including CO₂ source and capture, transport, and storage of CO₂
- Stronger differentiation between demonstration and R&D
- Expanded and more detailed milestones for capture.



Report from Technical Group

Description of CSLF Technology Roadmap

- Module 0 – Introduction: Describes the purpose and structure of Roadmap.
- Module 1 – Current Status of CO₂ Capture and Storage Technology: Describes CO₂ Sources, Capture, Transport, Storage, and Uses
- Module 2 – Ongoing Activities in CO₂ Capture and Storage: Describes CSLF Activities, CCS Project Activities & Initiatives Worldwide, and R&D Components in CSLF Member Countries
- Module 3 – Gap Identification: Identifies Technology Gaps and Summarizes Key Technology Needs
- Module 4 – Technology Roadmap: Describes the Role of the CSLF and a Summary of Key Milestones to be Achieved in 2009-2013, 2014-2020, and Post-2020 Timeframes

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Key Milestones of Roadmap

Present

DEMONSTRATION AND INTEGRATION

- Initiate large-scale demonstration projects
- Engineer scale-up and integration
- Locate and characterize storage sites
- Build CCS projects database

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Key Milestones of Roadmap

Present

CAPTURE R&D

- Scale-up of existing technologies
- Develop guidelines for cost estimation
- Research and develop low-energy liquid solvents, adsorbents and membranes for the three categories of capture technology



Report from Technical Group

Key Milestones of Roadmap

Present

CAPTURE R&D (cont.)

- Address identified turbine and boiler issues
- Achieve good understanding of environmental impacts of capture technologies, in particular amines
- Perform system studies of alternative solutions
- Harmonize cost estimation methods

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Key Milestones of Roadmap

Present

TRANSPORT R&D

- Determine allowable CO₂ impurities on CO₂ transport
- Establish models to optimize transport network of CO₂ between sources and potential risks



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Key Milestones of Roadmap

Present

STORAGE R&D

- Determine allowable impurities in the CO₂ for storage
- Establish methodologies for estimating storage capacity and develop national and global storage atlas
- Successfully complete pilot field tests for validation of injection and MMV



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Key Milestones of Roadmap

Present

STORAGE R&D (cont.)

- Well bore integrity and for risk assessment
- Initiate large-scale field tests for injection and MMV
- Establish industry best practices guidelines for reservoir selection, CO₂ injection, storage, and MMV
- Develop remediation measures

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Key Milestones of Roadmap

2013

DEMONSTRATION AND INTEGRATION

- Establish operational experience and lessons learned with CCS
- Demonstration integrated next generation technologies
- Conduct R&D based on lessons learned
- Ongoing technology diffusion

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Key Milestones of Roadmap

2013

CAPTURE R&D

- Demonstrate at large-scale existing capture systems
- Continued R&D on, and partly validation of concepts, including solvents, adsorbents, membranes in post- and pre-combustion and oxyfuel
- Chemical looping combustion for oxyfuel
- Chemical looping reforming, shift catalysts

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Key Milestones of Roadmap

2013

TRANSPORT R&D

- Establish technical standards for trans-boundary CO₂ transport
- Establish regional networks as examples of multiple source CO₂ transportation



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Key Milestones of Roadmap

2013

STORAGE R&D

- Refine global atlas of CO₂ storage capacity
- Successfully complete large-scale field tests for validation of injection and MMV
- Improve best practices for updating industry standards
- Commercialise MMV technologies
- Validate remediation measures

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Report from Technical Group

Key Milestones of Roadmap

2020

DEMONSTRATION AND INTEGRATION

- Achieve commercial readiness

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Key Milestones of Roadmap

2020

CAPTURE R&D

- Validation of capture technologies developed 2014–2020
- Scale-up and integration of technologies validated to commercial scale capture technologies
- R&D and validation of new and emerging technologies

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Report from Technical Group

Key Milestones of Roadmap

2020

TRANSPORT R&D

- Establish infrastructure emplacement for CO₂ transport

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Report from Technical Group

Key Milestones of Roadmap

2020

STORAGE R&D

- Implement commercial operation of storages sites

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Report from Technical Group

Projects Proposed for CSLF Recognition



Report from Technical Group

The Technical Group recommends the following five projects be recognized.

- CCS Bełchatów Project
- CO₂ Field Lab Project
- Gorgon CO₂ Injection Project
- Quest CCS Project
- SECARB Early Test at Cranfield Project

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CCS Bełchatów Project

Location: Bełchatów, Poland

Description: Demonstrate commercial-scale CO₂ capture, transport and storage at a utility power plant

Nominators: Poland, European Commission, and United States

Project Contact: PGE Górnictwo i Energetyka Konwencjonalna SA

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CO₂ Field Lab Project

Location: Svelvik, Norway

Description: Determine CO₂ migration and leakage characteristics for permeable geologic formations

Nominators: Norway, France, and United Kingdom

Project Contact: SINTEF

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Gorgon CO₂ Injection Project

Location: Barrow Island, WA, Australia

Description: Demonstrate commercial-scale CO₂ capture, transport and storage from a commercial natural gas field

Nominators: Australia, Canada, and United States

Project Contact: Chevron Australia Pty Ltd

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Quest CCS Project

Location: Fort Saskatchewan, AB, Canada

Description: Demonstrate commercial-scale CO₂ capture, transport and storage from an oil sands processing facility

Nominators: Canada, United Kingdom, and United States

Project Contact: Shell Canada Energy

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SECARB Early Test at Cranfield

Location: Cranfield, MS, United States

Description: Demonstrate commercial-scale CO₂ transport and storage in a deep saline reservoir

Nominators: United States and Canada

Project Contact: Southeast Regional Carbon Sequestration Partnership (SECARB)