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CSLF Technology Roadmap (TRM) 2017

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&

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Outline of presentation

- Acknowledgements
- Process
- Major changes from TRM 2013
- Findings and recommendations
- Next steps
- Points for discussion

Acknowledgements

- TRM responsible: CSLF Project Interaction and Review Team (PIRT)
- TRM was prepared by an editorial committee with the following members:
  - Andrew Barrett, Australia (Chair)
  - Brian Allison, UK
  - Eddy Chui, Canada
  - Tony Surridge, South Africa
  - John Litynski, USA
  - Tim Dixon, IEAGHG
  - Lars Ingolf Eide, Norway (editor)

The CSLF Secretariat (Richard Lynch) and the
CSLF TG Chair Åse Slagtern (Norway) have also taken active part in the discussions

A number of international experts have commented on and made contributions to the TRM

The Update Process

(Section to be deleted from the final TRM version)

The approach for the update was:

- The CSLF Technical Group (TG) chair, co-chairs, task force leaders and Secretariat identified where changes from the TRM 2013 were needed
- The editorial group divided the work:
  - Capture – Norway
  - Transport and infrastructure – Norway
  - Storage – Australia
  - Monitoring – IEAGHG
  - Regulations - IEAGHG
  - Utilisation - USA
  - The first draft was sent to experts worldwide for comments and input

Main changes from TRM 2013

General

- New time horizon for medium- and long-term recommendations and targets,
  - 2025 and 2035 vs earlier 2030 and 2050
  - Kept 2020 to emphasise the need for immediate acceleration
- Revised background chapter to reflect COP21 targets
- Introduced quantitative targets that meet IEA 2 ^{o}C scenario
- Added section on non-technical measures, including regulations
- Expanded discussion on CCS, CCU and CCUS
- Chapter on “Assessment of present situation” moved into “Technology needs” and shortened (use of references)

Main changes from TRM 2013

Capture (3.1)

- Less detailed on technology types and fundamentals
- More emphasis on industrial and biomass CCS
- Separate section on sectors other than power, industry and biomass
  - Hydrogen production w/CCS only topic so far
- Identified actions to meet technology needs:
  - Learning from experience (capture works)
  - RD&D on novel, emerging, innovative or transformational technologies

Main changes from TRM 2013

Transport and infrastructure (3.2)

- Expanded on ship transport
- More emphasis on development of clusters and hubs
- Few, if any, technology show-stoppers
- Technology needs
  - Most gaps, risks and challenges of commercial and policy nature
  - Must move from project-by-project to system thinking

Main changes from TRM 2013

Storage (3.3)

- Storage works!
- Added recent reference projects and activities
- Additional actions to meet technology needs:
  - Expanded Monitoring, Offshore CO2-EOR, Storage integrity and Storage closure, including post-injection monitoring and liability
  - Methods and protocols: Changed from “development” to “demonstration”
  - Risk elements and needs are essentially still valid

Main changes from TRM 2013

Utilisation (3.4)

- Expanded and updated text, particularly on offshore CO_2-EOR, geothermal energy systems, water recovery, bio-plastics and animal feed
- More detailed differentiation between the options that lead to permanent storage and those that do not
- Barriers added: Lack of scalability and the economic challenges
- Additional technology needs:
  - Large scale processes for conversion of CO_2 directly to fuels or other products, e.g. based on electro or photo catalysts

Main Findings

- CCUS works in the power industry, the gas processing industry, refineries, industries using biomass as raw material, and the enhanced oil recovery industry
- Implementation of CCUS is well behind the trajectory to reach the stated goal from COP21 of being significantly below a 2°C temperature rise
- CCUS is not possible without the right policy settings and the appropriate financial framework

Main Recommendations (1)

- Governments and industry should work together to contribute to the COP21 targets by implementing sufficient large-scale projects in the power and industry sectors to
  - Permanently store 0.5 $GtCO_2$ /year by 2025 (or have permanently captured and stored 2 $GtCO_2$)
  - Permanently store 2.7 $GtCO_2$ /year by 2035 (or have permanently captured and stored 20 $GtCO_2$)

(Based on IEA 2 degree scenario)

Main Recommendations (2)

- Governments and industry should work together to:
  - Develop supportive policy incentives, including equity considerations, recognition and support for CCS on similar terms as other low-carbon technologies
  - Develop markets and business models for CCUS support
  - Accelerate legal and regulatory frameworks for CCS, also on a regional scale
  - Develop strategic transportation, storage infrastructures and clusters and hubs, in particular for industrial CCUS, including early identification and characterisation of potential storage sites

Main Recommendations (3)

- Improve CCUS public outreach and education, and supporting educators as well as community proponents of CCUS projects
- Facilitate exchange of data from operating large scale projects
- Support RD&D for novel and emerging technologies along the whole CCUS chain to drive down costs
- Map opportunities, conduct technology readiness assessments and resolve main barriers for the implementation of the CO_2 utilisation family of technologies including life-cycle assessments and CO_2 and energy balances

Next steps

- July 1, 2017: Deadline for comments from TG delegations (one set from each)
- September 15, 2017: Final draft to Secretariat
- November 1, 2017: Final TRM 2017 ready for publication

Points for discussion

- The use of CCS vs. CCU and CCUS and the role of utilisation
- Hydrogen production with CCS as separate section?
  - Include other applications?
- Introduction of quantitative targets – if we keep, do we have the right ones?
- Are the Recommendations the right ones?