



# **Measuring progress on Recommendations from 2017 CSLF Technology Roadmap Report from Ad Hoc Committee**

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**Champaign, Illinois, USA  
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# Background

## *Obligations from the TRM:*

- Monitor the progress of the Recommended Priority Actions.
- Report the findings at Ministerial meetings.
- Suggest adjustments and updates for the TRM.

***Venice April 2018:*** A small working group was formed to start work on monitoring  
Volunteers included Australia, Canada, the United Kingdom, the United States, Norway, the Technical Group Chair, and the CSLF Secretariat.



# The objective of monitoring

- Find and implement corrective actions where progress is slow

## Progress of *ad hoc* committee

- Questionnaire distributed
- Results presented in Melbourne
- Template developed for reporting on progress
- Members of *ad hoc* committee prepared background information
- Members of *ad hoc* committee agreed on progress status



# What was monitored

## Target

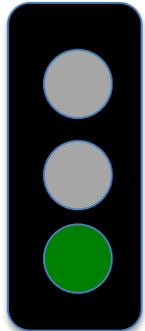


- Long-term isolation from the atmosphere of at least 400 megatonnes (Mt) CO<sub>2</sub> per year by 2025 (or have permanently captured and stored of 1,800 Mt CO<sub>2</sub>).
- Long-term isolation from the atmosphere of at least 2,400 Mt CO<sub>2</sub> per year by 2035 (or have permanently captured and stored of 16,000 Mt CO<sub>2</sub>).

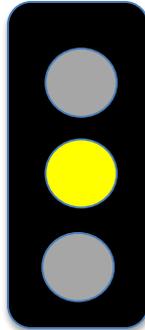
## Four priority recommendations

1. Facilitate CCS infrastructure development.
2. Leverage existing large-scale projects to promote knowledge-exchange opportunities.
3. Drive costs down along the whole CCS chain through RD&D (including more detailed technical recommendations in Annex B).
4. Facilitate innovative business models for CCS projects.

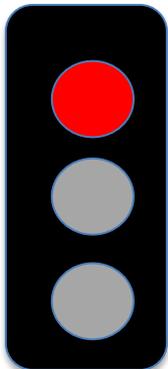
# Ratings



**Good, the progress contributes to reaching the Target**



**Room for improvement, progress registered but insufficient to reach target unless new actions are initiated**



**Poor progress, target will not be reached. Strong actions required**

# Result Target

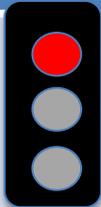


- Each recommendation is in itself not sufficient for the target to be reached. Thus the target may still be red even though none of the priority recommendations are.

	Rating	Comments
<b>Long-term isolation from the atmosphere of at least 400 megatonnes (Mt) CO<sub>2</sub> per year by 2025 (or have permanently captured and stored of 1,800 Mt CO<sub>2</sub>)</b>	A vertical traffic light icon with three circles. The top circle is red, the middle is grey, and the bottom is grey.	Need 10-fold increase in annual storage capacity next six years. Only one plant came online in 2018 (CNCP Jilin, China), increasing capacity by 1 Mt CO <sub>2</sub> /y to 38 Mt CO <sub>2</sub> /y. Projects in construction may add 7+ Mt CO <sub>2</sub> /y in 2019. Projects in advanced or early development will not add sufficient capacity by 2025, only 35 -40 Mt CO <sub>2</sub> /y.

# Results on Priority Recommendations



Recommendation	Rating	Comment
<b>1. Facilitate CCS infrastructure development.</b>		<p>Many good plans and studies but no infrastructure/network projects on line the last years; no project passed the Final Investment Decision (FID) gate in 2018</p>
<b>2. Leverage existing large-scale projects</b>		<p>Active leveraging through CSLF meetings, International Knowledge-Sharing Center , conferences, and reports. Not known which projects have used experience/knowledge from other projects.</p>
<b>3. Drive costs down along the whole CCS chain through RD&amp;D.</b>		<p>Much good research going on that progress CCUS technologies but no break-through technologies reported or identified that at TRL 6 or higher have convincing evidence of significant cost reductions</p>
<b>4. Facilitate innovative business models for CCS projects</b>		<p>Many good plans and studies but progress on development of bussiness models have not been implemented, except 45Q in the US, perhaps due to lack of policy and regulatory environment</p>

# Recommendations to Ministers



- **Foster a predictable business environment for development of large-scale CCUS projects.** Include policy and financial incentives, a practical regulatory environment, cost- or risk-sharing for early stage demonstration or commercial-scale projects, and stimulating cross-business and cross-border cooperation.
- **Facilitate (e.g., through co-funding) cross-industry projects** to ensure lowest total cost for the combined capture, transportation, utilization and/or storage infrastructure and networks.
- **Continue to promote RD&D investments in CCUS to drive down costs:**
  - Continue to fund early stage R&D and encourage transformative technologies as well as incremental advancement to progress technologies to the pilot-scale.
  - Support continued RD&D efforts that promote commercial deployment and business opportunities for more advanced carbon utilization, in particular for early-stage technologies. Lifecycle analyses should continue to ensure that technologies result in net greenhouse gas emissions reductions.
  - Continue to promote global RD&D collaboration that leverages knowledge, capabilities, facilities and funding that further drives down costs and increases the availability of CCUS as a greenhouse gas mitigation option around the world.
- **Continue to promote knowledge-sharing from large-scale projects.** This is important in framing continued RD&D and informing the development and refinement of business models for CCUS deployment.

# Possible future work mode



- Small groups of TG delegate (task forces?), each responsible for following up and reporting on one of priority recommendations
- Approach should include:
  - Involving CSLF members Cooperation with allied organizations and others (GCCSI, IEAGHG, International CCS Knowledge Center, IEA, CO2GeoNet, Mission Innovation), recognized CSLF projects



## Possible future work mode

- Possible groups
  - Task Force on hubs and clusters follow up recommendations
  - Business models ???
  - Leveraging large scale???
  - RD&D???
- Reporting on status
  - Annually, or as required, to the CEM/ CSLF Ministerial Meetings
  - Results distributed to delegates at 1-2 months ahead of CSLF Technical Group spring meetings.
  - Delegates to give comments/supplements in writing ahead of meeting or orally at the meeting.

# Information Sharing

- Clean Energy Ministerial Solutions website dedicated to CCUS
- <https://cleanenergysolutions.org/topic/carbon-capture>
- Ask an Expert
- Reviewed Published CCUS Resources
- Attend a Webinar
  - Framework for CCUS in CEM
  - CCUS in Mexico for a Low Carbon Economy



Back up

Two examples

# Target

- **Increase in storage capacity last year:**
- ~ 1 Mt CO<sub>2</sub>/year
- **Number of projects that came on line last year:**
- One – 1.
- **Conclusion**
- Need 10-fold increase in annual storage capacity next six years. Only one plant came online in 2018 (CNCP Jilin, China), increasing capacity by 1 Mt CO<sub>2</sub>/y to 38 Mt CO<sub>2</sub>/y. Gorgon and ACTL are delayed but may add 6 Mt CO<sub>2</sub>/y in 2019. Only two other are in construction, both in China, total capacity 1+ Mt CO<sub>2</sub>/y. Even projects in advanced or early development will not add sufficient capacity by 2025, only 35 -40 Mt CO<sub>2</sub>/y.
- **Recommended actions to speed up:**
- Increased efforts to get projects into planning, incentives must be put in place. International cooperation required
- **Sources:**
- GCCSI
- The Global Status of CCS, 2017
- The Global Status of CCS, 2018
- **Reported by:**
- Lars Ingolf Eide
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# 2. Leverage existing large-scale projects to promote knowledge-exchange opportunities.

## Actions during reporting period to leverage knowledge and experience from large scale projects

- The CSLF Technical Group is active in leveraging knowledge and experience from large-scale projects. From the past 5 years alone, CSLF Technical Group meetings or workshops have included the following activities to leverage knowledge and experience from large-scale projects:
  - April 2019 TG Meeting: Presentations from Project Tundra, ADM; Additionally, CSLF members are invited to attend the MGSC Annual Meeting, which includes discussion of the ADM project, including other activities such as CarbonSAFE projects in the region.
  - October 2018 CSLF Meeting in Melbourne, Australia: Gorgon, CarbonNET, Southwest Hub. Policy meeting also included an update on the Hydrogen Energy Supply Chain Project between Australia and Japan.
  - April 2018 CSLF Meeting in Venice, Italy: Update on MHI's CDR process and commercial experience; Update on Fort Nelson Project; Norcem Carbon Capture Project
  - December 2017 meeting in Abu Dhabi, UAE: Update on ROAD Project, Uthmaniyah project, Emirates Steel Project
  - May 2017 CSLF meeting in Abu Dhabi, UAE: Emirates Steel Project, Uthmaniyah, ADM; Workshop in conjunction with that meeting: Emirates Steel, Shell Quest, Petra Nova, Boundary Dam; SABIC; Discussion of Full-scale CCUS activities in Norway.
  - October 2016 in Tokyo, Japan: More focused on large pilot/demo projects such as Tomokamai and NetPower
  - June 2016 meeting in London, UK: Policy Group – International Collaboration on Large-scale Saline injection; Bellona – CO2 Market Makers for Strategic EU Hubs and Clusters
  - November 2015 meeting in Riyadh, KSA: SABIC; Ministerial Meeting – Panel on large-scale CCUS projects: ADM, ROAD, Uthmaniyah, Occidental Petroleum's CO2-EOR business case.
  - June 2015 meeting in Regina, Saskatchewan: Workshop on Lessons Learned from Large-scale projects: Presentations were from ROAD, ADM, Kemper, Quest; PCOR Bell Creek Project; Equinor (Statoil at that time); Boundary Dam (SaskPower); Dakota Gasification
  - Highlight workshops from CSLF that had large-scale project engagement
- In addition to the CSLF, there are numerous other activities that focus on leveraging knowledge and experience from large-scale CCUS projects.
  - International Knowledge-Sharing Center (SaskPower/Canada). Their entire mission is to support new global CCS projects with business development, operations, and technological improvements to advance the deployment of CCS facilities around the world.
  - CLIMIT Summit: Includes significant number of presentations on Norwegian projects such as Sleipner, Snohvit, and the full-scale CCS projects. Also includes broader global participation, which touches upon large-scale projects.
  - IEAGHG/GHGT Conferences. The GHGT-14 conference in Melbourne, Australia included the following sessions: Session 1C: Large-scale Integrated Projects Experience; Session 2C: Regional Projects (this session included Boundary Dam and also a previous US project: AEP's Mountaineer Power Plant – Stratigraphic Test Well to Site Closure) Session 5C: Panel Discussion 3: From Projects to Infinity: Large-scale project experiences to be shared; Session 6C: Panel discussion 4: The status and potential of the Norwegian-EU CCS Project; There were also numerous other sessions that included results from large-scale projects, some very technical.

## Projects that have used the experience

## Conclusions

## Identified bottlenecks for knowledge exchange

## Corrective actions, if any, by CSLF to facilitate exchange of experiences between large-scale projects

## Sources

## Impact on TRM

## Reported by