



Technical Group Meeting Summary and Outcomes Virtual Meeting, Hosted by Norway Delegation

Wednesday, 08 December 2021

KEY OUTCOMES

1. The Projects Interaction and Review Team (PIRT) will proceed with next steps as follows:
 - a. Implement a revised applications process
 - b. Co-locate PIRT meetings with CSLF meetings
 - c. Apply a new project review form and review criteria
 - d. Review the existing list of projects – recommendations for projects to approach
 - e. Identify and propose projects
 - f. Establish an exit interview strategy; gain insight into learnings
 - g. Revisit the website; include successes and maps showing project locations
 - h. Find additional ways to share knowledge through CSLF projects
 - i. Transition responsibilities with staff departure (Richard Lynch)
2. PIRT will entertain proposals for CSLF recognition of additional projects. This review will be slated to coincide with the next in-person Technical Group meeting.
3. New PIRT members include the CO₂GeoNet Association (Ceri Vincent), Canada (Eddy Chui), Norway (Eva Halland and Lars Ingolf Eide), and Australia (Max Watson). Additional volunteers are welcome and should contact the PIRT chairs.
4. The Technical Group's Action Plan will ensure targeted and value-added actions and align with the focus areas: industrial carbon capture, carbon utilization, negative emission technologies, and saline storage with monitoring and verification activities.
5. The Technical Group meeting structure will be adjusted to promote more interactive discussion.
6. Regional interactions are expected to become increasingly important. The Technical Group will coordinate with the CEM CCUS Initiative to try to find ways to assist representatives from non-CSLF member countries with emerging economies to become more involved with the Technical Group and its activities. One option is to hold Technical Group meetings in non-member countries to increase the host country's interest and participation in CCUS and CSLF.
7. The Technical Group will organize two technical workshops in 2022 on the focal areas of CO₂ removal (CDR) and the Central/Eastern Europe region. The CDR workshop could be held in conjunction with the next in-person Technical Group meeting. Ad hoc groups will be formed for organizing each workshop. Volunteers should contact Norway (Lars Ingolf Eide).
 - a. CDR: Australia (Eric Tenthorey), Norway (Lars Ingolf Eide), CEM CCUS (Juho Lipponen), Mission Innovation (Mark Ackiewicz), IEAGHG (James Craig)
 - b. Regional: European Commission (Wolfgang Schneider), France (Isabelle Czernichowski-Lauriol)
8. Norway has been re-elected as the Technical Group Chair. Australia, Canada, and Japan have been re-elected as Vice Chairs.

ATTENDEES

Chair Åse Slagtern (Norway)

Delegates

Australia: Eric Tenthorey (Vice Chair), Max Watson
Canada: Eddy Chui (Vice Chair)
China: Mingwei Shi
European Commission: Wolfgang Schneider
France: Isabelle Czernichowski-Lauriol
Germany: Hannes Stadler
Italy: Paolo Deiana, Sergio Persoglia
Japan: Ryozo Tanaka (Vice Chair), Hiroto Yoshikawa
Netherlands: Paul Ramsak
Norway: Lars Ingolf Eide, Espen Bernhard Kjærgård
Romania: Sorin Anghel
Russia: Georgy Ryabov
Saudi Arabia: Hamoud AlOtaibi
South Africa: Noel Kamrajh
United States: Mark Ackiewicz, Sallie Greenberg

Representatives of Allied Organizations

CO₂GeoNet Association: Ceri Vincent
Global CCS Institute: Bruno Gerrits
IEAGHG: James Craig

CSLF Secretariat

Richard Lynch, Kathryn Paulsgrove, Stephanie Hutson, J.P. Dutton, Shane Teramana

Invited Speakers

France: Juho Lipponen (CEM CCUS)
Norway: Sverre Quale (ECCSEL)
United Kingdom: Owain Tucker (Shell)
United States: Sean Brennan (US Geological Survey)
Peter Warwick (US Geological Survey)

Observers

Canada: Mike Monea
Japan: Hiroki Goto, Takashi Kawabata, Yoshihiro Sawada, Jiro Tanaka
Netherlands: Harry Schreurs
Nigeria: Victor Richard Osu
Norway: Eva Halland, Michel Bohnenblust
Russia: Anastasia Lebedeva
Saudi Arabia: Mohammad Khadhravi, Abdulaziz Qasim
United Kingdom: Helen Taylor-Curran, James Craig, Tim Dixon
United States: Katherine D. Romanak (University of Texas)

PROCEEDINGS AND SUMMARY

1. Welcome and Meeting Protocols, Åse Slagtern, Chair of the Technical Group

The Technical Group should facilitate development and advancement of CCS technologies and the possibility of storing CO₂. Participants are invited to share their CCS activities and experiences.

South Africa's Dr. Tony Surridge passed away earlier this year, and his accomplishments are noted in the CSLF community. As the longest-tenured member of the CSLF Technical Group, Dr. Surridge was instrumental in work on the CO₂ Storage Atlas as well as the CO₂ injection pilot in South Africa.

A total of 59 participants from 17 countries registered for the meeting, including the European Union and Nigeria. The Technical Group's three allied organizations—the CO₂GeoNet Association, the Global CCS Institute (GCCSI), and the IEA Greenhouse Gas R&D Programme (IEAGHG)—will provide presentations and updates.

Slides from all presentations are available on the [meeting website](#).

2. Participation of Delegates

Fifteen of the twenty-six CSLF Members are represented at this meeting by official delegates, and one additional Member is represented with observers. Stakeholder observers from nine countries are present, as are representatives from the three allied organizations.

3. Presentation from Owain Tucker, Shell on the Oil and Gas Climate Initiative (OGCI) Storage Atlas

Sequestration is the injection of CO₂ into geological strata with the aim of permanently isolating the CO₂ from the atmosphere. Storage is the facilitator of the process, enabling facilities to unlock benefits of industrial processes and negative-emission technologies. Income is normally linked to the production of clean products or the absence of emissions penalties, and the provider of storage must be able to provide commercial guarantees to the emitter. Emitters will not invest in unreliable storage projects.

OGCI can encourage storage. The hydrocarbon industry has a major role in the success of global CO₂ storage. There is an abundance of wells to drill, in addition to major work remaining and gaps. CO₂ storage is the ability to accommodate and retain CO₂ in the subsurface. Exploring for pressure space that can accommodate CO₂. The subsurface is like a road full of cars; to fit more cars, you must compress cars together.

The UK storage resource is difficult to determine because every atlas uses a different methodology. Estimates vary—some atlases provide a single number, and others give ranges, while all are incompatible and use the word “capacity”. The UK created a storage atlas that cites 78 Gt capacity in UK, but more details are needed.

The reality of storage capacity is unclear. It is difficult to compare regional evaluations with “bankable storage”. Regional evaluations use volumetric techniques that are very high-level and are not linked to a single project. Project evaluations take hundreds of hours of work,

seismic surveys, and exploration/appraisal wells. The following is the timeline for CO₂ storage:

- Theoretical storage (now) – estimated from existing maps and well data
- Discovered storage (2 yrs) – immature, injection rates and container limits untested
- Discovered storage (5 yrs) – injection rates and container limits tested
- Bankable storage (7 yrs) – technically and commercially ready to invest
- Operational (10 yrs) – CO₂ injected

A classification system is needed to consistently classify—not estimate—storage resources. The system would underpin investment and policy decisions, track project spend, and communicate between customers and storage. The system could be project-based or injection-mechanism based.

The CO₂ Storage Resource Management System ([SRMS](#)) is project-based, built on the Petroleum Resources Management System (PRMS). Classification involved assigning the stage of project maturity. Major classification thresholds include discovery and commercial maturity. SRMS uses P10, P50, P90 volumes and constraints. The resource range is expected to decrease with maturity.

In 2019, the OGCI started the CO₂ Storage Catalogue, which is scheduled to run for six years. The objectives of the project are to share information on resource maturity, provide open resources online, and provide transparency to the CCS community, regulators, project financiers, and the public. The project encourages adoption of SRMS and is classifying all published CO₂ storage assessments through SRMS. The vision is that more governments will want their storage resources added to the catalogue, and that resource estimates will be conducted in an SRMS-compliant manner and become an international standard. The catalogue would become self-sustaining and would promote project-based resource assessment to Atlas generators.

Developing the catalogue further requires more information to be available. Many reports are too high-level, and therefore the resources cannot be categorized in the SRMS.

OGCI would welcome a workshop to discuss further.

Discussion

The amount of work being done on storage capacity in a country before the country is itself engaged is comparable with technology transfer efforts. The next step is providing training materials/commercial training on how to classify storage resources.

4. Presentation from Dr. Peter Warwick and Dr. Sean Brennan from the United States Geological Survey (USGS) on Global CO₂ Storage Resources Assessments

Geographical coverage of the status of storage resource assessments spans the globe. Some developing countries are interested in potentially using CO₂ storage resources to meet their climate goals. Several multilateral organizations and international initiatives related to global geologic CO₂ storage resources are in place.

The SRMS is the resource classification system of the Society of Petroleum Engineers. USGS is focusing on undiscovered resources. The USGS storage assessment unit (SAU) developed a CO₂ storage model to examine potential storage resources. The model has worked in the USA and can be easily applied to the rest of the world. USGS is looking to partner with organizations to better define the application of the model.

USGS believes this can be realized in three phases:

- Phase 1: Prioritization and Data Collection, which includes:
 - Prioritizing countries or regions that could benefit from CO₂ storage resource estimates and subsurface characterization.
 - Determining the availability of relevant geologic data and identifying data gaps in those countries or regions.
 - Proceeding to collect data.
- Phase 2: The Assessment of the U.S. Geological Survey, which will facilitate focused CO₂ storage resource assessments by one of the following:
 - Doing the assessment with assistance from local geological staff.
 - Working directly with the local geological staff to do the assessment.
 - Advising the local geological staff as they do the assessment.

Training and assessment capacity-building is integral to the effort.

- Phase 3: Reporting, which is expected to provide the following results:
 - Publicly available reports of regional-, country-, or basin-specific geologic CO₂ storage resources.
 - Publication of accumulated non-proprietary data and derivative products of aggregated proprietary data.

USGS is looking for partners to help countries do assessments and aims to have one uniform method for doing assessments.

Discussion

Countries need to express their interest before work commences. The USGS wants to work with the countries, and USGS anticipates that potential partners will be interested and wish to be involved.

Several participants expressed interest in contributing, including representatives from the University of Texas, CEM CCUS, and IEAGHG.

5. Presentation by Sverre Quale, ECCSEL on European CCUS Research Infrastructure

ECCSEL currently consists of 5 member countries (Norway, Netherlands, Italy, France, and UK) and 11 member organizations, with an overall mission of infrastructure for CCUS. The organization coordinates access to 80+ CCUS research facilities, CO₂ capture, transport, use, and storage, and coordinates development of CCUS research infrastructure and services to meet CCUS deployment needs. ECCSEL is involved in a number of EU projects/proposals

with expected European Green Deal impacts/contributions. The organization has been focused on energy and increasingly involved in industry.

ECCSEL is aligned with other international initiatives, including:

- UN sustainable development goals (SDGs) – Contributed to solutions that substantially reduced CO₂ emissions from industry and power generation.
- SET-Plan – Developed CO₂ storage technologies to 2030 and beyond.
- Mission Innovation – Aligned with implementation of Innovation Challenge IC3 to enable development and testing of new and novel technologies.

Industry perspectives and ECCSEL priorities include a 2021 industry workshop series for key industry sectors; an updated ECCSEL service model for industry/SME engagement for knowledge-sharing, capacity-building, and joint research; identified research priorities for CO₂ capture and utilization; revised research priorities for CO₂ transport and storage; and design concepts for a new, large, multinational facility.

The first call for funded trans-national access is open through June 2022. The aim is to extend ECCSEL services to industry and perform collaborative research, knowledge-sharing, and capacity-building for CO₂ capture, transport, use, and storage. The second call for funded trans-national access is expected in spring 2022 and will address identified research priorities that overcome barriers to broad CCUS rollout in Europe. New members, observers, and collaboration partners (MoUs) are welcome.

6. Presentation by Juho Lipponen, CEM CCUS Initiative Coordinator

CEM CCUS membership includes 13 countries with links to other countries, industry, financial institutions, and organizations. The overall goal is to put policies in place to drive deployment of CCS. The CCUS Initiative Annual Meeting was held December 6–7, 2021, with record attendance: 80 attendees and 12 guest countries. The group chair is USA, and vice chairs are China, Saudi Arabia, and UK. The regional focus of the December meeting was Australia and Indonesia, with emphases on key climate policy targets, current government strategy for CCUS, deployment policies and programs in place, other government initiatives, and priorities going forward. Australia joined CEM CCUS in September 2021.

Asset classes for emissions are well established. A corresponding asset class is needed for the carbon production and storage accounting frame. Carbon storage units (CSUs) would provide stakeholders with a trustworthy record of permanent storage. CSUs would be issued under clearly defined protocols, either by independent inspectors or by accredited storers who would be audited regularly. CSUs could satisfy the needs of both compliance and voluntary markets.

CEM CCUS and OGCI have had a collaboration agreement since 2019. Possible collaborations include:

- A hubs accelerator to bring governments and finance sectors together in key regions, with particular emphasis on industrial sectors such as cement and blue hydrogen. The hubs would foster work on planning to create infrastructure networks in all relevant regions.

- Policy and finance dialogue on incentive policy to deploy CCUS, on market creation for low-carbon products, and on Paris Agreement Article 6 mechanisms.
- Direct air capture and storage (DACs) and bioenergy with carbon capture and storage (BECCS) to accelerate and facilitate engineered CO₂ removal.

GCCA Concrete Future presents an opportunity for collaboration with CEM countries helping implement CCUS in cement facilities. Areas of policy support could include public financing mechanisms, transport infrastructure and storage infrastructure, and support for R&D.

The next CEM CCUS meeting will be at the CEM-13 ministerial in Pittsburgh, Pennsylvania (USA), in September 2022. The following are four suggested themes: global CCUS fund, CO₂ storage resource assessments, DACs and BECCS, and industry collaboration to drive CCUS in cement.

7. Update on Mission Innovation CO₂ Removal Status by Mark Ackiewicz, Mission Innovation CDR Team

The Mission Innovation CDR Mission is co-led by USA (U.S. Department of Energy [DOE]), Saudi Arabia (Ministry of Energy), and Canada (Natural Resources Canada). The core member is Norway (Gassnova), and the support group includes Australia (national Commonwealth Scientific and Industrial Research Organization [CSIRO]), European Commission (Directorate-General for Research & Innovation), Japan (Ministry of Economy, Trade and Industry), and India (Ministry of Science and Technology [DBT and DST]).

The goal is to enable CDR technologies to achieve a net reduction of 100 million metric tons of CO₂ per year globally by 2030, with an emphasis on secure CO₂ storage and conversion into long-lived products. The scope includes 3 technological CDR approaches: DAC, biomass with carbon removal and storage (BiCRS), and enhanced mineralization.

Co-leads and core members of the Mission commit to demonstrating domestic leadership and investment in one or more of the CDR approaches prioritized for this Mission (i.e., DAC, BiCRS, enhanced mineralization, or lifecycle and technoeconomic analyses [LCAs and TEAs]), either by funding RD&D projects and activities over the next 5 years, with a suggested minimum investment of \$5 million/year, or by demonstrating prior investments in CDR RD&D (e.g., continued operation of dedicated test facilities) that can be leveraged to support Mission objectives. Co-leads and core members must also actively participate in the Mission by dedicating at least one staff member to facilitate Mission coordination within their respective countries; leading or co-leading at least one workstream or function within the Mission; inviting their research communities, private industry, academia, and other relevant stakeholders; developing collaborative projects with other Mission members; and developing a roadmap that identifies innovation gaps and an action plan for the Mission.

Supporting members of the Mission commit to contributing time and/or resources to the development of reports, workshops, and/or collaborative RD&D projects, as well as inviting stakeholders to participate in Mission activities.

Next steps for the CDR Mission include developing a roadmap and action plan. The Mission is looking for additional partners to jointly fund R&D for next-generation CDR technologies, jointly fund demonstration projects, share lessons learned from first-generation CDR projects and business models, and advance LCAs and TEAs for CDR technologies.

Discussion

Requirements for leads and members are set up separately for each mission. Missions have latitude when setting up their roadmaps and making determinations for roles and commitments. The purpose is to drive collaboration, focus on progress, and bring resources together to achieve common goals.

The next Mission Innovation Ministerial will be in Pittsburgh, Pennsylvania (USA), in September 2022.

8. Update on CSLF Projects Interaction and Review Team (PIRT) by Dr. Sallie Greenberg, Co-Chair of PIRT

The objectives of the PIRT are to facilitate the next set of projects by providing resources and connections with previous/current projects, leverage learnings from R&D and commercial projects, align projects with the CSLF knowledge-sharing platform, and act as a resource and facilitator for newly joined projects.

The PIRT submission form now includes new categories: Project Description and Relevance, Project Description (Technical), Novel Aspects of Project, and Criteria. There are forms for CSLF project submissions and a CSLF project elements checklist. There are many opportunities to recognize projects. A suggestion to improve PIRT recognition is to align CSLF-recognized projects to the CSLF Technology Roadmap.

The next steps for PIRT (which are carried forward from the last meeting) are as follows:

- Implement the revised applications process.
- Co-locate PIRT meetings with CSLF meetings.
- Apply the new project review form and review criteria.
- Review the existing list of projects – recommendations for projects to approach.
- Identify and propose projects.
- Establish an exit interview strategy; gain insight into learnings.
- Revisit the website; include maps showing project locations and successes.
- Find additional ways to share knowledge through CSLF projects.
- Transition responsibilities with staff departure (Richard Lynch).

The next PIRT project review will be in person, likely in spring 2022. Project nominations and review need to be around the beginning of the year, with enough time to be considered at the next CSLF meeting. Ms. Ceri Vincent, Ms. Eva Halland, Mr. Lars Ingolf Eide, Dr. Max Watson, and Mr. Eddy Chui will assist Dr. Greenberg in the next 6 months to identify potential projects.

Discussion

For projects to be recognized, they must show what their unique contribution is and how the project connects to the CSLF roadmap.

PIRT will aim for a physical meeting in spring, and the project nomination and review team will work on possible projects that can be presented at the next meeting.

In the past, CSLF has given out recognition awards to projects that have been successfully completed or reached demonstratable milestones. It has been the prerogative of the Secretariat to determine which projects receive awards, but this responsibility will likely fall to PIRT chairs in the future. This needs to be discussed further.

9. Update from the Technical Group Strategic Planning by Mark Ackiewicz and Eddy Chui

The purpose of the strategic planning effort was to plan and strategize where the CSLF Technical Group can be most impactful. There were three questions from the Fall 2020 meeting:

- How can the CSLF Technical Group contribute to broader CCUS discussions?
- What can the CSLF Technical Group do to facilitate advancement of CCUS by industry and governments?
- What new Technical Group activities would be useful? What and where are opportunities?

Based on a survey of CSLF members, technical topics of most interest are:

- Tier 1: Capture for industrial carbon utilization.
- Tier 2: Negative emissions technologies, offshore saline, onshore saline, storage M&V.
- Tier 3: Capture for power, offshore O&G, onshore O&G, storage modeling and simulation.

The main impediments to successful deployment of CCUS within individual countries include:

- Tier 1: No market/demand for CO₂.
- Tier 2: Lack of government support for demonstrations and R&D, lack of educational opportunities at universities and academic institutions, and “other” (lack of general technology awareness, lack of government willingness to deploy tech and its role in GHG mitigation).
- Tier 3: Lack of public acceptance, human resource capabilities, technical capabilities, no CO₂ emissions regulations, and no CO₂ storage regulatory framework.

The survey identified workshops, roadmaps, task forces and reports, and recognized projects as the most useful activities.

Suggestions on how to engage with CSLF member countries include holding joint workshops; collaborating on CSLF task force reports; jointly funding R&D; increasing interactive technical exchanges between CSLF member countries and their researchers and

policymakers, including updates on CCUS activities during Technical Group meetings; and engaging academic institutions in CSLF member countries to build targeted capacities.

The survey identified the following ways to accelerate CCUS development and deployment:

- Linking with storage infrastructure projects such as Longship in Norway.
- Leveraging research/lab infrastructure.
- CSLF transfer knowledge to Ministers; stronger influence on CEM CCUS.
- Using CSLF as a platform to share knowledge and experience.

Membership experience can be enhanced by proactively pushing for projects, increasing dialogue among members during Technical Group meetings, and more engagement with stakeholders.

An action plan was recommended that included the topics discussed below.

Focus Areas:

- Industrial carbon capture, carbon utilization, negative emission technologies, saline storage with monitoring, and verification activities.
- Ensure targeted and value-added actions.

Identified Needs:

- Provide technical input and strengthen alignment with policy-oriented groups to address impediments such as market development, government support, regulatory framework, public acceptance, and R&D funding.

CSLF Meeting Structure:

- Modify meeting structure to promote more dialogue among members to foster collaboration instead of just presentations.
- Identify areas to bring in experts, use panel/roundtable discussions.
- Goal is to have more participation and interaction amongst members.

Task Forces:

- New reports that focus on under-represented technical areas.
- Focus on in-depth technical discussions via workshops.
- Identify regional needs, and enhance local-level engagement.
- Build R&D collaborations amongst members, together with allied organizations.
- Goal is to facilitate efficient knowledge transfer/exchange and accelerate CCUS implementation.

Discussion

Availability of capacity-building funds for developing countries such as Nigeria and Ghana should be examined. The old CSLF capacity-building fund was dismantled in 2019 by the donor countries, and funds were transferred to the CEM CCUS Initiative, which essentially serves the same purpose for sensible requests. Emerging economies are encouraged to participate in CEM CCUS activities. A set of principles is available if funds are requested. Funds can be used for emerging economies to attend meetings and activities.

Consider arranging meetings in these emerging countries so they can have more participation (as opposed to just one person from the country attending a remote meeting). A potential first step is sending an expert/champion into the interested country to meet the CCS community first, and then setting up a meeting in the country. This is an item for follow-up, including further discussion at the CEM Ministerial in September.

10. Possible workshops organized by CSLF Technical Group by Lars Ingolf Eide

A maximum of two workshops in 2022 should be prioritized. In addition to others on the list, there are several themes new to CSLF that are mentioned in the strategic planning document:

1. Carbon dioxide removal (CDR). CDR is included in practically all integrated assessment models to achieve <1.5°C. While there are still uncertainties and debates, there was significant attention on CDR at COP26. The focus for CSLF would be on BECCS and DACSS.
2. Regional workshop on CCUS in Central and Eastern Europe (CEE), including Russia. The region includes five CSLF members (Poland, the Czech Republic, Serbia, Romania, and Russia). Activities are picking up in the region. For example, Poland has an EU PCI, and Romania and Turkey are members of ACT.
3. CSLF task forces and/or former workshops:
 - Transport and storage infrastructure projects
 - Progress and activities (Europe, USA, China, OGCI)
 - Opportunity to leverage expertise/projects and share lessons learned
 - Formally an ongoing task force with virtual workshop October 2020
 - Low-carbon hydrogen w/emphasis on fossil feedstock + CCUS
4. Other earlier or considered task forces without a report or workshop:
 - Non-EHR utilization (Phase 2), which was formally a task force
 - Mineralization (carbonation) of mine tailings and industrial wastes as an emissions reduction measure, excluding what may be covered under CDR

Discussion

The international workshop on offshore CO₂ storage was initiated with a whitepaper from CSLF. They are considering holding another international workshop in April in New Orleans.

H2020 funds two ongoing projects. The first project, STRATEGY CCUS, deals with socio-technico-economic evaluations for CCUS deployment in 8 industrial regions of Southern and Eastern Europe. The project will end in July 2022. Ideally, a final conference will be held before the project ends. The second project is PilotSTRATEGY, which will investigate geological CO₂ storage sites in Southern and Eastern Europe to support development of large-scale CO₂ capture and storage. For CO₂ removal, a new work program in Horizon Europe is being developed.

The CSLF Technical Group shall start the planning of two workshops in 2022: one on CDR and one on CCUS in Eastern and Southern Europe. The workshop on CDR will be organized

in close cooperation with the Mission Innovation Mission Implementation Plan on CDR. Australia (Eric Tenthorey) volunteered to lead the organizing group, which will have additional members from Mission Innovation (Mark Ackiewicz, USA), IEAGHG (Jasmin Kemper), CEM CCUS (Juho Lipponen), and Norway (Lars Ingolf Eide). The workshop shall be held in conjunction with the next physical meeting.

The organizing group for the workshop on CCUS in Eastern and Southern Europe will be led by Norway (Lars Ingolf Eide), with additional members/support from the European Commission (Wolfgang Schneider) and France (Isabelle Czernichowski-Lauriol).

11. Update from the CO₂GeoNet Association by Ceri Vincent, President

CO₂GeoNet is a pan-European research association that has the mission of supporting the safe and efficient deployment of CO₂ geological storage. The organization was created as a European Union FP6 Network of Excellence in 2004 and transformed into an Association under French law in 2008. The overall mission of the CO₂GeoNet Association is to be the independent scientific voice of Europe on CO₂ geologic storage in order to build trust in the technologies involved and to support wide-scale CCS implementation. Membership comprises 27 research institutes from 21 countries, and CO₂GeoNet uses the multidisciplinary expertise of its 300 members to advance the science supporting CCS. There are currently four categories of activities: research and networking, scientific advice and international collaboration, training and capacity building, and information and communication sharing.

“Histories – Hydrogen Storage in European Subsurface” focuses on depleted fields and aquifers, building on previous CO₂GeoNet member work. This group consists of 17 countries, covered by partners in-country, plus 5 additional neighboring countries. Candidates interested in an international master course on CO₂ geological storage are invited to apply by January 17, 2022.

Key messages from the EU pavilion event at COP26 included the following: CCS is essential to tackling climate change, CCUS has been going for years and is safe and working, there is abundant geological capacity, and CCUS is adapted carbon accounting.

The CO₂GeoNet Autumn Webinars from September 2021 included many key takeaways on the state of play on geological storage in EU.

Discussion

An updated report is available on the state of play of CO₂ geological storage in 32 European countries (http://www.co2geonet.com/media/73750/co2geonet_state-of-play-in-europe_2021.pdf).

12. Update from the IEAGHG by James Craig, Technical Programme Manager

The IEAGHG is organized under the auspices of the International Energy Agency (IEA) but is functionally and legally autonomous. The IEAGHG was founded in 1991 and focuses on CCS, with the objective of providing information on the role that technology can play in reducing greenhouse gas emissions from fossil fuel and biomass use in power and industrial

systems.

CSLF members suggest generating cooperative studies between the CSLF Technical Group/PIRT and IEAGHG, which would mutually benefit both organizations. CSLF proposed/related studies include the Hydrogen Production with CCS workshop, the 6 November 2020 in Paris, and the 4th International Workshop on Offshore CCS.

Flagship IEAGHG activities include 365 reports published on all aspects of CCS, International Expert Networks, GHGT conferences, PCCC conferences, and the Negative CO₂ Emissions conference. The GHGT-15 virtual conference 15–21 March 2021 consisted of 500 presentations and was attended by 956 delegates from 41 countries. International CCS Summer Schools include 636 alumni from 58 countries. The next CCS summer school is in Bandung, Indonesia, in 2022.

Expert networks and other events include the National Energy Technology Laboratory (NETL)–U.S. DOE Wellbore Integrity Workshop; ITB Indonesia; and NETL–U.S. DOE–CEM–IEAGHG CO₂ Global Storage Capacity workshop.

IEAGHG organized side events and activities at COP26. The IEAGHG webinar series includes virtual events on biorefineries and a CCS webinar; carbon capture and storage and SDGs; and COP26 outcomes. IEAGHG information papers highlighted the CSLF Technology Roadmap.

13. Update from the Global CCS Institute by Bruno Gerrits

The Global CCS Institute (GCCSI) is an independent, international think tank, backed by governments, business, and non-governmental organizations (NGOs). The head office is located in Melbourne, with satellite offices in several regions. Abu Dhabi is the newest office and is expected to be staffed in early 2022. The new CEO, Jarad Daniels, is based in Washington.

GCCSI is now working on the next five-year strategy, focusing on governments and the finance industry, since policy and finance are very important to scaling up CCS.

Membership in the GCCSI has seen tremendous growth, which is reflective of worldwide investment and support of the industry. New members include organizations from Israel, Egypt, and UAE, and there have been inquiries from Russia and elsewhere.

Activities include an advocacy role at COP26, advancing macro-topics such as environmental, social and governance (ESG) assessments and CCS, the London Protocol, and EU Green Taxonomy. GCCSI is an impartial advisor, educator, advocate, and information source to supranational, national, state, and regional governments, policy makers, advocates, unions, NGOs, and other policy influencers. To pursue the mission to accelerate the deployment of CCS, GCCSI's consulting team creates free downloadable content for the general public. The GCCSI database houses 12 years' worth of research, from facility information to policy, legal, and regulatory information. The database is partially public, partially members-only.

GCCSI's flagship report is published annually. The *Global Status Report* has been downloaded 4,777 times since it was released in early October. The report from 2021 indicates growth in the CCS project pipeline in the last 4 years. There are 71 new CCS facilities added to its database of projects. There are 102 projects in planning, 4 in construction, and 27 operating. The wave of new projects, which started in 2017, has replenished the project pipeline and will deliver significant additional CCS capacity in the coming years. CCS projects are also increasingly diverse, covering a wide range of capture source industries. This is good news for the CCS industry, good news for emission-intense industries looking for carbon management solutions, and good news for climate action. It is still too early to be certain, but there are encouraging indicators that the investment environment for CCS is improving, and CCS may be entering a period of relatively rapid and sustained growth.

In regard to policy progress:

- USA is funding \$12 billion (as part of the bipartisan Infrastructure Investment and Jobs Act) for demonstrations and large-scale pilots, DAC, and transport infrastructure. An accompanying bill known as the Build Back Better Act is still being negotiated in Congress, but current markups provide enhanced 45Q provisions (including direct pay, changing the construction deadline to 2032, and raising tax credit value for DAC projects).
- In Canada, the province of Saskatchewan has announced support for CCS.
- In the UK, the Track 1 Cluster sequencing process has selected the HyNet and the Eastcoast Clusters to be taken forward into negotiations, with the Scottish Acorn cluster in reserve. The program has one billion pounds in funding.
- The EU Innovation fund announced €1.1 billion in funding for 7 large-scale projects, 4 of which are scaling up CCS (in France, Belgium, Sweden, and Finland— across a diverse range of industries). The second call for innovation projects in low-carbon technologies is currently open, with a budget of €1.5 billion.
- Dutch funding for CCS continues with SDE++. In the 2020 round, the government awarded €2.1 billion in subsidies to 6 CCS projects promising to reduce emissions by 2.34 Mtpa over 15 years. This could be reverse-engineered to a cost benchmark of about €75/t. The results of the current round have not been made public yet, as it closed only one month ago.
- In China, trading of the national carbon market started earlier in 2021. Carbon emissions from over 2,000 power companies covered are estimated to exceed more than 4 billion tonnes per year, making this the world's largest carbon market in terms of the amount of emissions covered.
- In Australia, policy support for CCS strengthens. AU\$250 million of funding is being provided for the CCS Hubs and Technologies Program. The AU Federal Government released a methodology that allows CCS projects to earn Australian Carbon Credit Units (ACCUs) under the Emissions Reduction Fund; the ACCUs can be sold.

14. Election of Technical Group Officers – Richard Lynch, Secretariat

According to the CSLF Terms of Reference, the election of officers must take place every three years. Currently, Norway is Chair, with Australia, China, and Japan as Co-Chairs. The

previous election was in Melbourne in 2018. There are no new nominations, and it was unanimously agreed that current officers be elected for another three-year term.

15. Closing Statements – Åse Slagtern, Technical Group Chair

Richard Lynch will be retiring and is thanked for all his efforts and commitment as Secretariat. Members express their thanks and appreciation to Richard for all his hard work and dedication over many years to the CSLF organization as the CSLF Secretariat.

The Chair hopes to have an in-person Technical Group meeting in Norway in Spring 2022. It will depend on the current status of the coronavirus pandemic. The Chair is appreciative of the Secretariat for its pre- and post-meeting support, and of the delegates and invited speakers for their active participation.