GLOBAL KNOWLEDGE SHARING FRAMEWORK

Phase 1: Project reporting framework

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Global knowledge sharing framework

As a part of regional efforts to accelerate deployment of commercial-scale CCS, various governments and supporting bodies are introducing knowledge sharing requirements as a condition for public funding support. Reliant on the principle of accelerating innovation by learning from experience, knowledge sharing will help achieve CCS deployment more efficiently and more rapidly.

To complement the knowledge sharing activities underway and increase the opportunities for collaboration, the Global CCS Institute convened and facilitated a Knowledge Sharing Working Group amongst the European Commission and six of the key governments delivering large-scale CCS demonstration programs. These include Alberta, Australia, Canada (Chair), Norway, the United Kingdom, and the United States of America.

Through an iterative process, the Working Group established a Knowledge Sharing Framework to assist organisations designing and implementing the knowledge sharing component of publicly funded large-scale CCS demonstration programs. The Framework aims to promote consistency and alignment between global knowledge sharing efforts. In this initial stage, the Framework draws out the importance of sharing relevant information which is informative and supports the needs of the emergent CCS industry. Information collection is supported by a standardised reporting framework for collecting and disseminating information on publicly funded, early-mover CCS projects.

Within the second stage of developing an effective Framework, the more tacit forms of knowledge, such as experience with organising and delivering a project, become the focus. While a number of existing knowledge sharing initiatives employ both face-to-face and digital approaches to gather the more tacit forms of knowledge, these lessons will be incorporated in the Framework in a later stage.

The current phase of developing an effective the Framework takes a two-tiered approach to provide:

- a set of knowledge sharing principles to help Governments and project developers maximise the benefits of CCS demonstration programs through implementation of effective knowledge sharing arrangements; and
- a reporting framework to ensure that regional knowledge sharing efforts can effectively exchange equivalent information on a reciprocal basis with a view to supporting the rollout of next-mover projects.

Subsequent consultation with industry representatives has verified this Framework as viable and suitable model for sharing knowledge from publicly funded early-mover CCS demonstration projects. Industry parties consulted included representatives from Air Products, Alstom Power, AMEC, Collie Southwest Hub, Progressive Energy, ROAD, Rotterdam Climate Initiative (RCI), ScottishPower and Total.

Knowledge sharing principles

The purpose of knowledge sharing between large-scale CCS demonstration projects is to:

- de-risk CCS with regard to follow-on projects and scaling up to commercial size;
- accelerate deployment of safe and commercially viable CCS;
- increase the understanding of and confidence in CCS by the wider public;
- support capacity and capability development in the global CCS community; and
- inform future policy-making.

Knowledge sharing is of particular importance to derive additional value for the public good where large sums of public money are involved.

To this end, the following points present a set of high-level guidelines or principles to assist governments design and implement effective knowledge sharing structures which maximise the benefits of publicly-funded large-scale CCS demonstration programs and provide necessary reassurances to the public.

CCS demonstration programs will seek to deliver objectives in accordance with the policies most relevant to the implementing jurisdiction. Therefore, consideration of these knowledge sharing principles should be made in the context of the appropriate legislative and regulatory regimes of the implementing jurisdiction. To facilitate effective knowledge sharing between participants and across regions, implementing arrangements for knowledge sharing should, to the greatest extent possible, be consistent between participants.

- A position of extensive knowledge sharing should be default, except where a valid and clear risk of commercial infringement is apparent. Such infringement concerns should be serious, legitimate and

substantiated. Nevertheless, minimum requirements that will deliver the policy objectives for knowledge sharing should be established and should respect legislation designed to protect commercial rights.

  - Negotiations around the type and detail of knowledge to be shared should be established by the relevant jurisdiction in line with their particular policy objectives and legislative instruments. The outcomes sought should consider relevant negotiations with equivalent demonstration projects in order to avoid overlap.

- Project reporting should, as far as practicable, be in a standardised format and should address consistent criteria, in order to monitor the project's progress effectively over the support period.
  - Project reporting should be in addition to knowledge sharing through sharing activities, not instead of.
  - Knowledge sharing activities may utilise a range of different mediums, such as project network events or web forums, to ensure effective communication.
  - Data and relevant project reports should be made available in a timely manner which ensures quality, veracity and accuracy.
- Knowledge sharing between projects should be coordinated to ensure that value is added to all contributing parties.
  - Jurisdictions, acting where possible in regional groupings, should promote the formation of project networks to facilitate knowledge sharing between peer projects.
  - Jurisdictions should retain the option to establish sub-groups of projects working on similar issues or on a similar basis in order for local sharing to occur more openly and/or effectively whilst conclusions are developed.
  - Where knowledge sharing goes beyond the minimum criteria prescribed, the pursuit of mutual benefit and reciprocity should be encouraged, as far as is practicable.
- Clear and transparent governance arrangements are required to support trust and establish opportunities for knowledge exchange. Knowledge sharing arrangements within a project network should have clear and transparent governance arrangements to support knowledge content and information channels.
  - The establishment of governance arrangements should be the responsibility of the implementing jurisdiction, but should be to a standard broadly common between the CCS projects
  - In designing knowledge sharing networks, activities should be proactive rather than reactive in order to capture current issues and drive demonstration forward. Wherever practicable, stakeholders, such as government and the local community, should be engaged in program activities and provided with the opportunity to provide input.
- The purpose of knowledge sharing should be transparent and responsible personnel should be fully aware of the desired outcomes. Knowledge sharing should form an integral part of CCS projects receiving public funding support.

Project Reporting Framework

CCS project factsheet

Knowledge collected from CCS demonstration projects should be readily comparable between projects in order to support the effective mapping and tracking of project development, as well as the analysis and useful dissemination of relevant knowledge.

The following 'factsheet' for capturing information against key criteria presents a framework for collecting and presenting summary background data on projects. The objective is to enable projects to be compared through their life cycles and across technology types. The use of a standardised format also provides a means of identifying sub-groups of projects that might be valuably engaged in tailored knowledge-sharing activities.

Facility name and location

- County, state and/or province
- GIS coordinates

Project participants

- Consortium members, suppliers, etc.
- Research and Development partnerships.
- Existing and proposed links, collaborations or partnerships to research or other groups in home country or internationally (purpose of links, duration, funding arrangements, etc).

Facility type

- E.g. power generation, aluminium, cement, refining chemicals, fertiliser, iron and steel, pulp and paper, mining, CO_2 transportation, gas processing, etc.

Facility feedstock

- E.g. bauxite, biomass, coal (black, bituminous, lignite, etc), coal seam methane, gas, oil, etc.

Asset lifecycle stage and timeline

- Identify, evaluate, define, execute, or operate.
- Anticipated timescale for CCS project delivery and operation.
- Year of plant establishment and operation (for retrofit).

Size and scale

- E.g. 500MWe net power plant output, commercial scale (before CCS application).
- Full load capture rate ($MtCO_2$ per year).

CCS Project type

- E.g. Integrated CCS project, capture only, transport only, storage only.
- Capture type (volume and percentage).
- Transport type (volume, distance).
- Storage type (EOR, deep saline aquifer, etc) location and volume.

Integration

- Is the project integrated and, if so, how? Is the project dependent on other entities for any part of the CCS chain?

Project context

- What is the policy driver or incentive?
- Are there regulatory mechanisms (i.e. carbon taxes) in place to offset the costs of project deployment?
- Have necessary regulatory approvals been obtained?

Brief description of the project and its aims

- milestones

CCS project reporting criteria

To ensure a degree of consistency between the different types of CCS project knowledge that is collected and shared amongst stakeholders, the following information categories are proposed to ensure that regional knowledge sharing efforts can effectively exchange equivalent knowledge on a reciprocal basis.

In order to allow the full participation of regional knowledge sharing initiatives, the proposed framework for project reporting was originally established through an inter-governmental consultation and refinement process, but has subsequently been reviewed and verified through an industry consultation process. The process has been coordinated so as to establish a core set of knowledge categories which may be usefully collected over the life cycle of early-mover CCS projects with a view to providing support for future projects. Central to supporting a commercially sustainable CCS industry, participation will add value for all projects, irrespective of their life-cycle stage, by establishing best practice, promoting innovation, accelerating technology transfer and

driving cost reduction, and doing so in such a way that does not allow one project to reverse engineer the technology used in another.

It is intended that reporting against these criteria will build on the more static information collected in the 'CCS project factsheet' by capturing valuable practical project data and experiences.

Periodic (biannual) reporting against these standardised criteria will set a baseline for monitoring project delivery and will capture key findings on issues such as health and safety, environmental impact, stakeholder profiling, plant and site layout and design, onshore/offshore transport, CO_2 sink monitoring and storage reports.

Recognising that the experiential knowledge and practical information created through project delivery may not be adequately captured by reporting against these criteria, key reports and planning documents should also be made available to the network secretariat or relevant parties for dissemination. These knowledge reports and practical insights, as arise from experience, should seek to gather and disseminate as much detailed information as possible at key milestones in a project's development, for example at the pre-FEED and post-FEED design stages, in addition to the list of criteria for more regular reporting set out below.

Technical set-up and performance[1]

- Performance without CO_2 capture, if appropriate.
    - Gross/net power output (MWh/year).
    - Generated and emitted CO_2 (tCO_2/year).
- Performance with CO_2 capture.
    - Gross/net power output(MWh/year).
    - Generated and emitted CO_2 (tCO_2/year).
    - Volume of CO_2 captured/stored (tCO_2/year).
    - Per cent increase in fuel demand.
    - Average monthly availability (per cent) and hours operated of each step in value chain (i.e. capture, transport and storage).
    - Composition of the CO_2 stream and any technical impacts of components on operation of the facility (mainly CO_2, H_2S, H_2O, O_2, H_2, NOX, SOX in ppm).
- Project development.
    - Modification of plant and site layout made during project delivery, including reasoning for changes.
    - Major modifications of plant and equipment made during project delivery, including the reasons for the changes.
    - Subsurface – wells, production technology, geoscience and production chemistry, reservoir engineering and field development.
    - Operating procedures, including start-up and shutdown.
    - Other pertinent information on project development and design (as arises from experience).

Investment and operating costs (including cost revisions) along full CCS value chain[2]

- Projected (including accuracy and assumptions) and actual investment costs per step in CCS value chain (i.e. capture, transport and storage).
- Projected and actual operating costs per step in CCS value chain (i.e. capture, transport and storage), including labour costs.
- Projected variable operating costs such as chemical consumption, waste disposal, other input costs (water, LPG, NG, etc), by-products and emissions, equipment maintenance.
- Source(s) of funds for capital and operating expenditure.
- Other pertinent information on investment and operating costs (as arises from experience).

Project management

- Planned/actual build period.
- Program management plan for individual project stages and for overall project.

[1] Although it is not possible to share data that is not available pre-operation, there is considerable value in the sharing of *expected* values and their updates in advance of plant operation.

[2] Any sharing of cost information must be subject to applicable competition laws

- Delays encountered and their causes, including unplanned outages.
- Lessons learned and recommended practice in developing projects.
    - Approvals, consents and legislative/regulatory interactions.
    - Project planning, including integration of capture, transport and storage elements.
    - Public and stakeholder communications.
    - Storage site characterisation/selection.
    - Measurement, monitoring and verification (MMV), including[1]:
        - MMV arrangements, planned and in place; and
        - results.

- Strategies to minimise the environmental impact (e.g. waste minimisation included as a part of the design concept).
- Risk identification and management strategies.
    - Project risk assessments, including major project risks and risks of program delay.
    - Management strategies, including mitigation measures.
    - Allocation and insurability of risks, including risk matrices.

Environmental impact, including[1]:

- gaseous emissions (other than CO_2) (kg/MWh);
- increase in consumption of water, solvents and chemicals due to CCS (kg/MWh);
- losses and leakage from CO_2 transport (percentage CO_2, or kg/MWh);
- CO_2 migration (freshwater contamination or soil acidity);
- behaviour of displaced brine through CO_2 injection and behaviour of the CO_2 plume and pressure front in comparison to simulations; and
- other pertinent information on transport and storage monitoring (as arises from experience).

Health and safety, including[1]:

- safety incidents in operation (location, output, impact, environmental emissions, cause of incident, resolution measures taken, key lessons learned);
- health issues during routine operations (e.g. hazardous substances or situations and their potential impacts); and
- other pertinent information on health and safety (as arises from experience).