Technology Collaboration Programme
by IEA

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Global Storage Capacity Workshop 2021

IEA GREENHOUSE GAS R&D PROGRAMME

International Energy Agency

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Virtual Workshop: Global CO_2 Storage Capacity

Tuesday 21st September 2021

Introduction

This workshop was a joint effort between the Clean Energy Ministerial (CEM) CCUS Initiative, the United States Department of Energy (DOE), the United States Geological Survey (USGS) and the IEA Greenhouse Gas R&D Programme (IEAGHG). Held on the 21st September 2021, this virtual workshop welcomed 59 invited attendees involved with and interested in CO_2 storage.

The aims of this workshop were to review current methodologies and initiatives for quantifying CO_2 geological storage, review current data availability and assess gaps, establish core international contacts and a community with direct interest in CO_2 storage resource. The workshop also discussed opportunities on how to address the identified data gaps in various parts of the world, through either bilateral or multilateral collaboration and via an international network to collate and refine estimates of CO_2 storage capacity.

The workshop facilitated in-depth discussions between participants in sessions that looked at current methodologies and initiatives, the status of base data, priority development areas and storage resource refinement, and setting up an international network to build CO_2 storage resource assessment.

Current methodologies & initiatives

Speakers gave insights into the National Energy Technology Laboratory (NETL) best practice methods for subsurface storage, USGS CO_2 storage formation assessment methodology, the CO_2 Storage Resources Management System (SRMS) and the Oil and Gas Climate Initiative (OGCI) CO_2 storage resource catalogue. Advances in assessment methodologies, recent accomplishments, the extent of complementarity between different approaches and limitations of methodologies were also discussed.

Discussion on the complementarity between different approaches highlighted some mismatches between models, noting that the project description is essential for developers. Basic evaluations must be done before resources can be classified. The NETL and USGS methodologies are a starting point to establish base storage capacity (pore space). This initiation can then be applied to resource-based classifications. Data availability is therefore a key factor. The British Geological Survey (BGS) are working from a European perspective and have attempted to review prospective storage resources that don't have enough data.

There is difficulty in conveying to non-technical and technical stakeholders the level of understanding required for meaningful data interpretation. BGS have prepared 'CO_2 storage readiness levels' which fit in with the SRMS. This is a different way of thinking about resources that may not have sufficient data. This work addresses the challenge of communication by explaining what has been understood about a resource but recognises what still needs to be done. The readiness levels attempt to bridge this gap and this framework is a competent communication tool. There has been other work in Europe on the United Nations Framework Classification (UNFC) resource classification (launched in 2016) and the European Commission (EC) CO_2 storage database, 'CO2STORE', an evaluation of European Union (EU) potential resources. It would be interesting to see how these match with the SRMS.

Key questions to tackle would be how potential project developers can be helped with existing databases and, if there are regions without basic surveys and data, what approach should be recommended. Complementarity between different systems is a key issue. It will be important to learn how the level of resource measured by one system can be compared and classified against a different system. Communication is an important issue and careful thought is needed on how technical ideas are communicated so that resource systems provide clarity to policymakers and other stakeholders. It would be interesting to see from an industry point of view what could be done by government surveys and other organisations to enable further cataloguing of data and where the biggest data gaps are.

Status of base data

This discussion explored underlying base data requirements to establish initial basin and formation resource estimates, formats of data, variability and gaps in data, best practice in data accessibility, formats and analogues. Identification of priority regions / countries of interest and discussion of available data, access to the data, and management of confidential information were also raised.

A crucial issue that was highlighted is legacy wells and historical records of well plugging. Often the information from the oil and gas industry doesn't exist in digital format so it is not readily accessible. A better understanding is needed on the content of legacy records. Big databases may indicate the presence of hydrocarbon, but not necessarily fluid flow within an aquifer or well locations. There is data available on these factors in the US but lacking elsewhere. Norway has information on well location but the data on plugging has not been published. Work has been done to try and populate databases with the well information. Wells are a key component in storage resources. If there is a problem with legacy wells the resource may be compromised because of the potential leakage risk.

A key area in some regions that requires improvement is the lack of digital data. Mixed levels of data from different countries, i.e., some countries have a wealth of oil and gas data for characterisation, others may not, could be a significant challenge for resource estimation.

Dynamic capacity (pressure constraints) is a key enabler of storage projects and such information (or proxies) would be of value in accessible information. Pressure interference from multiple injection sites, and plume migration, are factors that influence and potentially constrain storage resource within target formations. Funding to drill and test carbon capture and storage (CCS) exploration wells (and collect other subsurface data) would be valuable to acquire dynamic data. This was done in the UK by EU European Energy Programme for Recovery (EEPR). The funding paid for a significant amount of the well cost for the White Rose project exploration well, which was used to characterise the Endurance CO_2 store (a central formation for two of the UK's key CCS clusters).

Analogues are helpful but there is no CO_2 flooding analogue at basin scale which is a limitation for storage resource assessment. The UK has started the National Data Repository (NDR) for the oil and gas industry and it has analogue reports. It is highly variable in terms of what data is available. Different locations will have different requirements on what data must be released.

A key question is how much data is actually needed for a site-specific project. What needs to be ascertained is the measure between how much is required versus how much operators want. It could be dangerous to have too little, but also inefficient to have too much data. The subsequent analysis of data is also crucial and decisions based on more refined storage estimates would help governments to see if CCS is a viable option.

A list (not exhaustive) of storage databases can be found below:

- CO2STORE (EU) (http://www.cgseurope.net/Sections.aspx?section=491.492.509)
- OGCI Storage Catalogue (https://www.ogci.com/co2-storage-resource-catalogue/)
- The Norwegian Petroleum Directive (NPD) CO_2 Storage Atlas (www.arcgis.com)
- UK National CO_2 Storage Database (http://www.co2stored.co.uk/home/index)
- NETL Carbon Storage Open Database (https://edx.netl.doe.gov/group/carbon-storage-open-database)
- CO2StoP (https://egdi.geology.cz/record/basic/5f05c318-082c-493d-bb75-15990a010833)

Priority development areas and capacity resource refinement

Deployment strategy requirements govern operator priorities and for regulators the level of confidence they can place on the amount of CO_2 that could practically be injected into and stored in a formation. In terms of priority development areas, it would be impossible to populate the entire globe with data needed for reliable storage resource evaluation. The first step to broaching this challenge would be to identify potential storage formations, and to help countries assess their total accessible storage resource.

Dynamic storage capacity is a key aspect of a storage site. Formation and fracture pressure information, available within a database, would be of value to help operators assess this parameter. It would also be useful to include some indication of the potential injection rates that could be achieved at a site. This information would help potential operators to rank sites.

Facilitating processes to build regional and global CO_2 storage capacity resource assessments

Several important points for consideration were put forward:

- What would it take to get a coalition to work towards characterisation in regions where there are gaps?
- Can key opportunities for government action be identified and championed?
- Could getting governments engaged be an efficient way to disseminate information?
- How can capacity building in government and geological institutions in developing countries be supported?
- How can the Clean Energy Ministerial (CEM) and others work as a global community to coordinate efforts across regional platforms?

The CEM, DOE, USGS and IEAGHG are eager to address these points and create a small team to continue the progress of this dialogue, looking at short-term priorities and long-term ambitions. Two streams of ongoing discussions will be key: 1) deploying methodologies in countries that have not done as much work yet in this area; and 2) improving existing methods in regions with good data resources. Looking into other potential methodologies that could contribute to project-based and contingent-based resources should be considered.

Moving forward, it will be essential to engage with the relevant national geological survey organisations, and/or other relevant authorities, as well as industry, at a regional or country-specific level.

Public support will be important in helping countries with limited resources to compile the geological data needed to get storage resource evaluation started. Funding for this activity could come from private sources, government, development banks etc. The CEM Carbon Capture Utilization and Storage (CCUS) Initiative can help bring countries with experience, and countries that are only beginning storage resource assessment, together into discussions.

Summary & key messages

This workshop discussed the opportunity to facilitate a process to address the identified data gaps in various parts of the world, through either bilateral or multilateral collaboration and establishing an international network to collate and refine estimates of CO_2 storage capacity.

Key messages from the workshop include:

- Data exists in several countries, but access is not always clear
- Data availability is a key factor
- In terms of the status of current data, themes raised in the discussion were:
    - Legacy wells and plugging data
    - Dynamic capacity and injection rates
    - Pressure fronts cross-border
    - Plume migration cross-border
    - Digitisation of data
- A better understanding of what countries are looking at CCS as a priority and how can international initiatives be effective
- More refinement is needed in dataset content, access and quality
- The digitisation of paper-based data would be a huge benefit
- Priorities identified include:
    - Industry view is to emphasise project-specific work (as opposed to total country coverage)
    - Looking at emerging countries with little or no hydrocarbon exploration (and hence limited data of relevance for storage resource assessment)
    - Harmonising terminology and methods of communication (in terms of language, word choice matters and terminology)
- The choice of vehicle and establishment of a key lead group to drive this effort will be essential
- A clear and credible implementation plan should be established
    - Timeline and actions towards CEM-13 (2022)

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