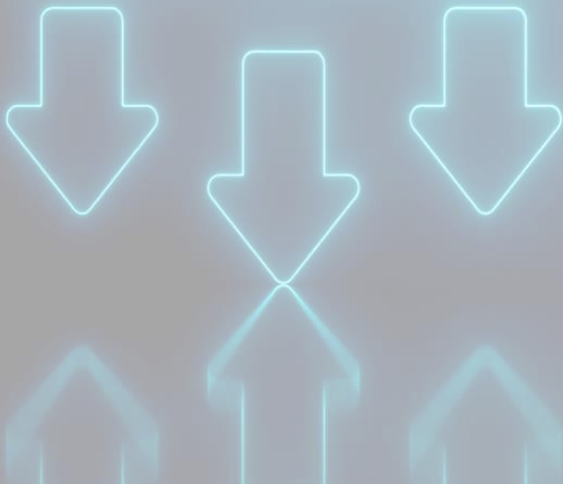


NEWSLETTER

*Metrology Support for Carbon Capture
Utilisation and Storage*



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MetCCUS seminar

Click here to find presentations and recordings



Measurement needs and challenges for the CCUS industry

More than ever, solutions to accelerate decarbonisation and hence to counteract global warming, are crucial if Europe is to become the first carbon neutral continent by 2050 as stated in the European Green Deal. Measures such as improvements in energy efficiency and more renewable energy capacity are not sufficient; further efforts are imperative to reduce Greenhouse Gas (GHG) emissions drastically. Carbon dioxide (CO₂) is the primary GHG emitted through human activities (e.g. fossil fuel combustion, deforestation, cement production), therefore, tackling CO₂ emissions becomes critical. Carbon Capture Utilisation and Storage (CCUS) technologies are mature technologies readily available to be able to capture large amounts of CO₂, for subsequent transport and permanent sequestration.

There are, however, measurement needs required by the various CCUS processes to ensure safe and efficient operation and environmental integrity. For that reason, the MetCCUS project kicked-off in October 2022, with funding from the European Partnership on Metrology. MetCCUS is the first project fully dedicated to develop metrological sound measurement standards and methods to support the CCUS industry.

MetCCUS addresses four measurement challenges which are described in this newsletter. The first objective is to develop a metrology infrastructure for monitoring the CO₂ gas and liquid flow as required by the CCUS industry with low target uncertainties. It also aims to support the measurement and reporting of CO₂ emissions to air from different stages of the CCUS processes. Then, it focuses on gas composition measurements, such as CO₂ purity and other key impurities which determine the CO₂ quality. The final objective is to establish the metrological infrastructure to support the design, monitoring and maintenance of industrial infrastructure for carbon capture, transportation, utilisation, and storage; this includes experimental measurements of CO₂ thermophysical properties and empirical modelling.

MetCCUS team at the Kick-Off meeting in NPL facilities in Teddington, UK



This project will develop and validate primary standards and calibration methods. Based on the results, good practice guides will be set up and articles will be published. The research will support the development of key documentary standards and provide input for specifications and regulations. By making use of metrological sound measurement techniques, the CCUS industry will be able to perform accurate measurements, obtain reliable measurement results and comply with specifications. Furthermore, the developments will help the CCUS industry to successfully grow in Europe and ensure efficient and safe operation. Eventually ensuring industry can meet the ambitious European target to become carbon neutral by the year 2050 to overcome climate change.

MetCCUS: Metrology support for Carbon Capture, Utilisation and Storage

Flow Metering

The consortium is working to develop a metrology infrastructure for monitoring CO₂ gas-flow and CO₂ liquid-flow in MetCCUS. Based on industry needs, priorities are defined to provide the support needed for various types of measurements along the CCS value chain, including the calibration of devices such as flow meters, considering that fiscal metering is highly dependent on traceable and accurate flow measurements of CO₂. An analysis of the regulatory framework applicable for CCS fiscal metering has already been conducted.

One key activity is to develop **primary standards for gaseous CO₂** and an investigation of the transferability of the calibration. For this purpose, participants have been upgrading their own facilities, particularly in Denmark and the Netherlands, so that these can operate with CO₂ under representative conditions of pure gaseous CO₂. An intercomparison in the gas phase is also going to be conducted; the consortium has already pre-selected flow meters for this purpose and is developing the corresponding transfer package, for both intermediate and large scale comparison.

MetCCUS is also assessing the **requirements for a liquid CO₂ primary standard** and traceable flow measurement uncertainty. The current state of the art of the traceable measurement of liquid CO₂ has been concluded, types of meters studied include Coriolis, turbine and ultrasonic flow meters; more insights will be shared soon.

Emissions Monitoring

Since CCUS technologies aim to directly contribute to decarbonisation, another essential subject of the MetCCUS project is CO₂ emissions monitoring. Ultimately, the goal is to provide the metrological support needed to enable the measurement and reporting of emissions to air from different stages of the CCUS process.

In the carbon capture process, MetCCUS is investigating existing and new methods to measure emissions flue post capture, as well as air pollutants

that may result from the **capture process**, for example potential degradation of products from capture solvents such as amines. These activities are ongoing and currently a report is being produced on the range of pollutants and the existing regulatory framework used to monitor them.

The team is also assessing measurement and quantification of CO₂ emissions from **CCUS equipment and infrastructure**. For this purpose, a report is currently being produced on CO₂ leak measurement requirements and potential technologies for monitoring leaks, both at components and facility scales. Calibration and testing will be performed further in the project. Additionally, the **geological storage** environment is being studied to assess different approaches for the detection and quantification of emissions of CO₂, considering that the demonstration of long-term integrity is critical. More details on the methods evaluated will be shared eventually.

Chemical Metrology

MetCCUS is developing new standards and measurement methods to support European industries with performing the gas composition measurements that are required for CO₂ within CCUS. This refers to both the purity of the carbon dioxide and the key impurities.

In order to prepare primary reference materials (PRMs) for impurities in CO₂, the team started with a literature review on commercially available cylinders for the preparation of PRMs ([see report here](#)). Key impurities have already been identified for the preparation of mixtures with relevant amount fractions, that will be monitored and validated. More details on the specific impurities selected will be shared next time. For the material compatibility when sampling CO₂, some experiments will be undertaken in the near future. For now, you can read the literature review on the current state of the art for the material compatibility of the vessels that are used to sample CO₂ ([see report here](#)).



Analysis of gaseous reference materials at VSL

The consortium is studying both on-line and off-line monitoring methods for **CO₂ purity monitoring**. A review and comparison of existing specifications, methods, instruments and sensors was conducted to set a baseline for the subsequent validation and demonstration of specific methods that are planned, for example for CO₂ purity analysis. More information about the methods to come soon.

Physical properties of CO₂ to support CCUS infrastructure

Metrological support is needed for the design, monitoring and maintenance of industrial infrastructures dedicated to carbon capture, transportation, utilisation and storage. For that purpose, understanding the thermophysical properties of CO₂ is essential and that is why MetCCUS plans to conduct experimental measurements of **thermophysical properties** on representative mixtures of aqueous amine and CO₂, some which have already been prepared.

The first report is now available! ([link](#)) Stay tuned to learn more about the properties being measured!

In addition to the experimental measurement of properties, equations of state and empirical models are essential tools to predict the thermodynamic properties of specific mixtures. Some tasks in MetCCUS evaluate the formulation of relevant equations of state to try to propose simplified formulations, both for mixtures in the liquid and gas phases.

MetCCUS also aims to provide procedures, measurements and the specific instrumentation needed to provide confidence in the safe and efficient operation of pipelines transporting CO₂ mixtures.

Creating Impact

MetCCUS has been presented in various countries like France, the United States, Germany and the Netherlands. More places to come!

Many stakeholders have joined the Stakeholder Advisory Board (SAB) of the project, with one first meeting in December 2022 and the second one in August 2023. If you would like to join the SAB or collaborate, feel free to [contact us](#) anytime!

Remember that you can now register ([link](#)) to the event of the year, organised by MetCCUS: Seminar on metrology support for carbon capture utilisation and storage. Don't miss this opportunity to hear **over 10 speakers** that will share various insights on measurement challenges within the CCUS industry, such as metering, emissions monitoring and CO₂ specifications. Thank you to the stakeholders and participants in the consortium for volunteering to give multiple interesting presentations related to CCUS and metrology!

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OTHER NEWS

- ◆ The European Commission launched the **EU CCUS Strategy consultation** in June this year. The public consultation was open until the 31st of August, 2023. The Commission adoption is planned for the fourth quarter of 2023 → [link to this initiative](#)
- ◆ **EU regulation for the development of the market for CO₂ transport and storage** published in May 2023. The objective is to analyse options for a regulatory framework to support the infrastructure for CO₂ transport and storage and business models in Europe → [link to publication](#)
- ◆ **NZIA: Net Zero Industry Act.** The European Commission introduced the NZIA on 16 March 2023 to create the necessary conditions to facilitate investments in net-zero technology manufacturing projects and makes it easier for project promoters to build up net zero industrial manufacturing. Carbon Capture and Storage (CCS) technologies are among the strategic net-zero technologies for which scaling up manufacturing capacity is critical to reaching the EU's climate goals → [more information](#)

Metrology or CCUS term of the newsletter

REFERENCE MATERIAL

Material, sufficiently homogeneous and stable with reference to specified properties, which has been established to be fit for its intended use in measurement or in examination of nominal properties (source: JCGM).

PROJECT PARTNERS

