Performance of Flow Meters with Dense Phase CO_2 and CCS Recovery Streams

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1. Background

Commercialisation of CCS will require accurate flow measurement for a range of commercial and regulatory purposes *[1-3]*, as current technologies employed in metering volumetric CO_2 flows by pipeline are unable to provide the required levels of accuracy, particularly when the CO_2 stream arises from anthropogenic sources containing significant levels of contaminants *[4-5]*.

- The DECC CCS Roadmap for Innovation and R&D has identified a short term R&D needs (5 – 10 years) to develop *appropriate strategies for CO_2 accounting [1].*
- The APGTF has clearly stated that R&D needs to meet short-term objectives in 'Whole Systems and Cross-Cutting Issues' are to prioritise developing CO_2 accounting, monitoring and measurement techniques for *CO_2 and impurities* and influence development of *CO_2 standards* taking account of different sources and applications *[2].*
- A key short term priority in transport identified by UKCCSRC RAPID is 'The development of methodologies and equipment for metering the CO_2 into and out of the pipeline and for on-line monitoring of the components and composition in the pipeline.' *[3]*

2. State of the art R&D

The APGTF report states that currently there are only two R&D programmes in CO_2 metering, namely DECC CCS Innovation Programme COMET (Coriolis Metering Technology in CO_2 Transportation for CCS- Heriot Watt University and Interconnector UK) and the CO_2 measurement test facility at TUV-NEL [4-5].

The project investigators have now completed work under the COMET project to research the optimum metering technology for dense phase CO_2 in terms of accuracy, cost efficiency and scalability.

- The literature search conducted under COMET as well as the review of measurement issues published by NEL have concluded that the best technical solution for metering dense phase CO_2 must be based on metering mass flows.
- Amongst mass-based flowmeters, a Coriolis meter should be able to operate across the full range of phase conditions that may occur in CCS applications, as it remains undamaged by changes in fluid phase.
- Under COMET project, Heriot-Watt University has built a first of a kind laboratory rig to test flow meters performance and developed a gravimetric calibration method. The trials conducted have assessed the accuracy and repeatability of mass flow measurement over a range of pressure, temperature and flow conditions using pure dense phase CO_2.

3. Aim of the project

The aim of this research project is to provide a complete assessment of meters for accurate flow measurement within CCS streams.

- This research will advance the specification for accurate metering within CCS developments for the power generation sector.
- This project *builds on the knowledge generated by COMET* and being able to access a unique purpose built metering system that has been validated and calibrated for testing meters under large scale CCS representative operating conditions, in terms of flowrates, pressure and temperature.

4. National Importance

This project focuses on the development and validation of meters for CO_2 flow. This has been identified as a key R&D topic by the DECC CCS Roadmap for Innovation and R&D *[1],* Advanced Power Generation Technology Forum (APGTF) *[2]* and UKCCSRC RAPID handbook *[3].* All these key documents identify the need for the development of metering technologies for CO_2 flow, including managing the impact of impurities, within fiscal metering standards. This research project is therefore of national importance as it addresses key gaps for the development of flow meters with dense phase CO_2 and CCS recovery streams. This research will advance the specification for accurate metering within CCS developments.

References

[1] DECC CCS Roadmap for Innovation and R&D, 2012.

[2] Cleaner Fossil Power Generation in the 21st Century – Moving Forward, APGTF report, 2014.

[3] UKCCSRC RAPID handbook, 2012.

[4] A study of measurement issues for CCS, TUV-NEL, Report No: 2009/54, 2009.

[5] CCS metering challenges and options, TUV-NEL, G Leslie, 2009.

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