Developing the First Traceable Liquid CO_2 Flow Calibration Facility for CCUS

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Decarbonisation is crucial for achieving the 2015 Paris Agreement targets and mitigating the climate crisis. Industrial sources account for up 20% of Europe's CO_2 emissions, with many processes being complex, costly or technically unfeasible to fully decarbonise at present. Carbon Capture, Utilisation and Storage (CCUS) can provide hard-to-abate industries with a tool to mitigate their atmospheric CO_2 emissions, enabling the implementation of long-term decarbonisation technologies while maintaining critical supply chains.

Presently, CCUS is built on a framework of government subsidies, regulations and commercial contracts which are underpinned by quantity and quality measurements of the CO_2 captured, transported and stored. To maintain confidence in these measurements' accuracy, calibration of the flow meters and composition analysers is critical. However, no traceable calibration test laboratories currently exist for liquid and supercritical CO_2 worldwide.

To address this gap, TÜV SÜD National Engineering Laboratory (NEL), through the ENCASE Project and the Flow Programme, has developed the first primary standard flow calibration facility for liquid and supercritical CO_2 (i.e. dense phase). This facility will provide SI-traceable calibrations, ensuring measurement reliability.

This poster details the facility's design, operational capabilities, and traceability framework. It outlines the primary standard (piston prover) calibration methodology and its uncertainty, with a focus on the key uncertainty sources for CO_2 operations. The poster describes strategies employed to manage and mitigate these uncertainties through rigorous calibration and operational controls.

Development of this calibration facility represents a significant advancement in CCUS measurement testing infrastructure, supporting both industrial and regulatory efforts toward net-zero emissions.