Publishable Summary for 25REG01 METRONOME
Metrology support for the development of standardised methods for methane emission detection and quantification

Overview

Methane, the second largest contributor to anthropogenic greenhouse gas emissions, has a short atmospheric lifetime, therefore cutting methane emissions has a major impact on climate change. The EU's Methane Action Plan supports the Global Methane Pledge to reduce global methane emissions by 30 % by 2030, and the EU has introduced Methane Regulations for the energy sector. This project will address the need identified by CEN TC264 by i) developing performance standards and methods for the use of methane controlled released to validate measurement methods at component scale, ii) providing tools for industry to efficiently locate and report source levels emissions, updating EN15446 which is used to locate leaks and support the development of new methods e.g. use of Optical Gas Imaging (OGI) for Leak Detection and Repair (LDAR), iii) supporting the development of a toolbox of validated methods for site/sub-site scale emission reporting, iv) developing good practice to validate technologies using model-based and controlled release approaches, and v) providing guidance for meteorological measurements and on uncertainty determination.

Need

Reducing anthropogenic methane emissions has a major impact on climate change and has been identified as a priority through global initiatives such as the Global Methane Pledge. In order to address some of the most readily actionable emissions and address a gap in the Union legal framework on emissions reduction in the energy sector, the EU introduced Methane Regulations (EUMR), which addresses emissions from the energy sector. The regulation requires the establishment of standards to enable industry to measure, monitor, report and reduce emissions and to verify this. To enable the regulation to function correctly and to support the top-level reporting and monitoring standards, there is an immediate need for reliable, validated, standardised measurement methods, as identified by CEN TC264. Inherent in the development of the much-needed standards is the need to validate their performance and develop robust uncertainty estimates for the results they produce.

Specifically, the project will address the following specific needs arising from the requirements in the EUMR:

- Capabilities to validate measurement methods for methane emissions at different scales to demonstrate methods meet the target detection levels.
- Traceability of leak detection and quantification methods and reference materials to ensure harmonisation across Europe.
- Verified methods for detecting leaks at the required sensitivity described in the EUMR, for Type 1 and Type 2 leak detection surveys.
- Tools to create model datasets to challenge site scale methane quantification methodologies, to enable cost effect validation of methods.
- Assessment of the uncertainty in meteorological data needed for emissions monitoring.
- Uncertainties in the results reported by measurement methods, to support reporting to regulatory authorities.

Report Status:
PU – Public, fully open

Publishable Summary

Issued: July 2026

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or EURAMET. Neither the European Union nor the granting authority can be held responsible for them.

The project has received funding from the European Partnership on Metrology, co-financed from the European Union's Horizon Europe Research and Innovation Programme and by the Participating States.

Objectives

The overall objective of the project is to establish a metrological framework for standardised methodologies to provide national regulatory authorities and industry with the tools necessary to detect, quantify, report and reduce methane emissions as set up in the Regulation (EU) 2024/1787. The specific objectives are:

1. To develop methods for controlled methane release and validation studies. This should include the development of (i) protocols defining performance standards for the measurement sensors and technologies that will be used in Objectives 2 and 3, (ii) the capability to produce methane reference leaks, in the low range of admissible leaks, including methods to ensure the traceability of calibrations, and (iii) procedures to evaluate the sensitivity of portable methane leak detectors along with guidance for quality control/quality assurance for field use.
2. To support the development of standardised methods for leak detection and repair at source (i.e. component) scale. This should include (i) the development of measurement protocols and uncertainty estimation procedures for component level leak quantification methods, and (ii) the provision of updated correlation curves for use in the revision of EN15446 for leak detection and quantification in industry.
3. To develop metrological methods for methane quantification at site scale. This should include determining the performance of meteorological measurements (wind speed/direction) and atmospheric variability, including their impact on the calculation of mass emissions of methane and the uncertainty. In addition, different sampling approaches, complex wakes (i.e. scenarios) and the impact of mobile sampling systems on the local wind field should be determined to enable meteorological measurement protocols to be developed.
4. To develop an improved understanding of the uncertainties associated with the methane measurement methods developed in Objectives 2 and 3 and their implications for regulation, including support for the methane quantification standards that are being developed by TC 264 WG38. The quality infrastructure, i.e. calibration tools (reference leaks/artifacts), good practice guides and a proficiency testing framework, should also be developed to support methane measurement providers.
5. To contribute to the standards development work of the technical committees CEN TC 264, CEN TC 234 and CEN TC 12 (via ISO/TC 67) related to Regulation (EU) 2024/1787 to ensure that the outputs of the project are aligned with their needs, communicated quickly to those developing the standards and to those who will use them, and in a form that can be incorporated into the standards at the earliest opportunity.

Progress beyond the state of the art and results

For regulation to effectively support the reduction of methane emissions, it is necessary for the appropriate measurement tools to be in place. Currently such a suite of appropriate standards does not exist, and only limited elements exist as guidance, industry best practice or in some cases standardised methods. Top level standards providing the industry specific approaches for leak detection and reporting are being prepared and the state of the art in provision of the monitoring standards to support these will need to be extended.

This project builds on previous EURAMET EMPIR and Partnership projects ENV60 IMPRESS, 21GRD06 MetCCUS, 21GRD10 quantiAGREMI and 24GRD01 MetNH3Energy and it will progress beyond the state of the art specifically in the following areas related to the objectives.

<u>Objective 1: Validation of methods and traceability</u>

This project will review available methods and existing performance data and identify any gaps. A focused programme of tests will be used to address these gaps using methane-controlled releases. Protocols for the use of controlled releases and performance standards for their use will also be developed. The science of the detection and measurement of leaks will be improved through the provision of the metrology infrastructure such as traceable reference leaks and good practice to support the future provision of proficiency testing (PT) for measurement service providers.

<u>Objective 2: Source scale emission detection and quantification</u>

This project will develop improved correlations curves for EN15446 and provide performance data and validation protocols for a new standard for OGI for leak detection, which will enable the identification of leaks from inaccessible locations and support the discrimination of leaks from process emissions. A revision (an

extension) of the EN15446 correlation curves beyond 100 000 ppmv will be provided as an alternative to the use of bagging and Hi-Flow Sampler (HFS) methods. The project will also develop best practice guidance to assess quantification techniques including Quantified Optical Gas Imaging (QOGI) and hi-flow based approaches. Validated and traceable controlled leaks will be developed to improve the metrological traceability and calibration of leak detection and quantification methodologies. The project will improve the current level of quality and traceability in leak detection by developing best practice and the basis of training and PT services utilising leak test rigs.

Objective 3: Site scale measurements

This project will develop tools to enable a harmonised approach to the assessment and validation of site and sub-site scale methane quantification approaches. It will develop best practice for the use of controlled release, and these procedures will be used to assess some key methods used for methane emission quantification. The project will also make use Computational Fluid Dynamics (CFD) modelling to challenge and assess these methods taking into account a range of operating environments, complex topography and infrastructure and determining the operating modelling linked to the experimental protocols. The project will provide measurement results and analysis to better understand the metrological performance and atmospheric variability of meteorological measurements (wind speed/direction) their impact on the calculation of mass emission of methane and the impact on the uncertainty in conversion of concentration measurements to mass emission (for different sampling approaches) including the impact of wind / air flow measurement. The project will assess the uncertainty in the methods used to determine the wind data, including developing good practice in the deployment of the sensors, particularly in complex industrial environments.

Objective 4: Uncertainties

Data will be obtained from both controlled release/test rig and CFD modelling studies to enable support the development of methods for the calculation of uncertainties at source scale and site scale for methane emission quantification methods. For these methods the contribution to the uncertainty of the meteorological data will be determined. A good practice guide will also be developed for conducting validation studies and proficiency test schemes for these measurement methods.

Outcomes and impact

Key dissemination and communication activities

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Outcomes for industrial and other user communities

Industry will directly benefit from the outputs of the project. The improvement of the methods used for quantifying methane emissions will support industry to meet regulatory requirements and to reduce methane emissions. Within the EUMR there is a recognition of two complementary measurement needs, firstly the detection and repair of leaks, and secondly the reporting of methane emissions which includes within the reporting framework of Oil and Gas Methane Partnership (OGMP) source scale and site scale quantification. The specific outputs from this project will support these objectives. Specifically, the project will provide better performance data and metrological infrastructure to enable revision of EN15446 which is used to quantify fugitives (for example, due to leaks) by many EU gas operators.

To facilitate uptake of the project's outputs there will be considerable engagement throughout the project with industrial stakeholders, manufacturers of methane measuring devices and with the regulatory community, including national competent authorities. The strong participation of industrial participants within the project and the establishment of a Stakeholder Committee will ensure that the outcomes of the project are aligned with industrial needs. In addition, at least one international workshop, and presentations to the relevant standardisation groups, will share project outputs and engage with the target user communities.

Outcomes for the metrology and scientific communities

The project will provide several outputs to the metrology and scientific communities, including datasets in anonymised and agreed formats that will be stored in accordance with the data management plan. These will include data on performance of component scale methods, updated correlation curves for conversion of concentration to leak rate, data from the site measurements for CFD model, meteorological data and ancillary information from the field campaign and data from the site scale-controlled release campaign.

Building on the outputs of the project, an extended capability for reference leak traceability will be developed, which will provide traceability within the metrology community and services to research and commercial measurements. Additionally, the outputs of the project will be utilised to develop the basis of a potential commercial PT Scheme which could be implemented utilising controlled leak rigs. This will be underpinned by the leak traceability infrastructure developed. Some participants will also develop CFD site modelling capabilities to develop a new approach to the validation of site scale methane emissions quantification methods.

Outcomes for relevant standards

This project is directly aligned with metrology support required by standardisation in support of the EUMR, and in particular CEN TC264 WG38 in the development and validation of its standards for methane leak detection and site scale methane emission quantification. Amongst the many contributions expected to standardisation, to be achieved through contributions to CEN TC234, CEN TC264, ISO TC 146, and IMEKO TC 20, the project will specifically input to the revision of EN15446, and new standards on i) the use of OGI for leak detection, ii) site and sub-site scale emissions quantification, and iii) the deployment and use of meteorological measurement techniques to derive the wind field.

Longer-term economic, social and environmental impacts

This project will have significant economic impact by supporting energy security and enabling the effective transition of the EU energy landscape through reduced emissions from natural gas use. The development of standardised methods for emissions monitoring which will ensure comparable, traceable and reliable emissions data will reduce financial risk to industry and support an effective and efficient measurement infrastructure and supply chain. In terms of social impact, the project will provide a means to alleviate the social cost of climate change by reducing methane emissions. It will also support a stable and managed transition of the gas energy supply chain, with knock on impacts to protect energy consumers from instabilities in the market. By supporting the European contribution to global challenges this project will support wider societal impacts through the development of harmonised validation procedures, enabling wider international uptake of EU manufacturers methane measurement capabilities. This project will have a clear environmental impact by enabling the implementation of effective regulation and voluntary emission reduction schemes and underpinning methane reporting for the energy sector of strategic importance for the European Union. Reducing methane emissions will have a significant impact on achieving climate commitments including supporting moves towards net zero.

List of publications

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This list is also available here: https://www.euramet.org/repository/research-publications-repository-link/

Project start date and duration:		1 June 2026, 36 months
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Internal Beneficiaries: 1. NPL, United Kingdom 2. CMI, Czechia 3. IPQ, Portugal 4. PTB, Germany 5. TUBITAK, Türkiye 6. VSL, Netherlands	External Beneficiaries: 7. BVE, France 8. EnagasTSO, Spain 9. FORCE, Denmark 10. GERG, Belgium 11. INERIS, France 12. INIG, Poland 13. NaTran, France 14. NOVA, Portugal	Unfunded Beneficiaries: