EMPIR Call 2020 – Fundamental, Industry and Normative

Selected Research Topic number: **SRT-n07**
Version: 1.0

Title: Metrology for SI-traceable biomethane conformity assessment

Abstract

EN16723 standards have provided a sound basis for the conformity assessment of biomethane before it is injected into the natural gas grid, and primary standards have been developed for the key reactive components. However, gas transfer standards are needed for the dissemination of traceability from the primary standards to the test laboratories and field measurement facilities, where they are used for instrument calibration and performance evaluation. Therefore, cost-effective traceable gas transfer standards should be developed for the impurities specified in the EN16723 standards and they need to be validated for use in biomethane conformity assessment. In addition, a performance evaluation protocol should be developed and validated to benchmark and characterise the analytical systems that are used for the conformity assessment of biomethane. This protocol should be provided as a contribution to the standards development work of technical committees, including ISO/TC193/SC1/WG25 “Biomethane”.

Keywords

Biomethane, conformity assessment, gas analysers, gas transfer standards, EN16723, impurities, performance evaluation, traceable protocol

Background to the Metrological Challenges

The transition from fossil to renewable fuels is urgently needed in Europe to reduce the dependency on natural gas imports, which has resulted from the decline in European natural gas resources. To meet the goals of the 2016 Paris agreement on climate change and the priorities set by the European Green Deal, the natural gas grid needs to be decarbonised to reduce greenhouse gas emissions. To foster sustainable growth, the second renewable energy directive 2018/2001 specifies that by 2030, 32 % of energy consumption should come from renewable sources. In order to meet this target, there is an urgent need to significantly increase the amount of biomethane used within the existing natural gas infrastructure. The ability to blend biomethane with natural gas, has provided a direct route into the established and robust European infrastructure, which has helped to facilitate market growth. To provide necessary support for this growing market and to increase biomethane uptake, EN16723 standards have provided a sound basis for the conformity assessment of biomethane. Dedicated measurement standards and test methods will be required to implement EN16723, although, the measurement standards and lab-based test methods required for these impurities have already been developed.

Gas transfer standards are required for the dissemination of traceability from the primary standards to the test laboratories and field measurement facilities, where they are used to calibrate the instruments that measure biomethane conformity. Recent progress has included the development of primary gas standards in high pressure cylinders (e.g. for siloxanes, halogenated VOCs) and in sorbent tubes (e.g. for amines), as well as the development of in-situ dynamically generated gas standards (e.g. for hydrogen chloride) and various methods for measuring trace levels of the impurities specified in EN16723. However, cost-effective traceable gas transfer standards need to be developed for these impurities and they need to be validated for use in biomethane conformity assessment. In addition, robust test methods need to be developed, such as those for the working standards that are used for the evaluation of the cross-interference caused by biomethane impurities and by the gas matrix. These working standards should contain a number of different groups of impurities to reduce the total number of gas standards needed for biomethane conformity assessment. Cost-effective methods to prepare the required transfer standards will be key to ensure industrial uptake and the cost-effective production, transmission and distribution of biomethane.

Thus far, the gas analysers that are used for biomethane conformity assessment have only been developed to perform trace measurements for a subset of potential impurities. In addition, the calibration of these gas

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analysers and the measurement results obtained currently lack metrological traceability. Different impurities in biomethane, as specified in EN16723, can interfere with each other and with the matrix gas, and this can affect the signal output of the instruments. This issue cannot be ignored because different impurities can be present simultaneously in real biomethane samples and this interference can result in unrepresentative biomethane conformity assessment results. Existing methods for impurity monitoring have not been traceably tested for sensitivity to gas matrix- and cross-interferences. Therefore, robust test methods need to be developed for measuring multi groups of impurities. This type of evaluation will be essential to enable the impurities to be simultaneously monitored and to prevent bias in reported results. This will prevent interruptions to the supply of biomethane into the European gas infrastructure, caused by over-reporting, and damage to the infrastructure caused by under-reporting.

ISO10723 describes the evaluation of the performance of natural-gas gas-analysers. However, a protocol needs to be developed for the sampling, analysis and performance evaluation of the gas analysers that are used for biomethane conformity assessment. The protocol will need to be validated using lab-based analysers, sampling and test methods. In addition, it should be suitable for determining the repeatability and reproducibility, the limit of detection and the uncertainty. It should also be suitable for evaluating the cross-interference caused by the gas matrix and biomethane impurities. This protocol is expected to become an essential part of the measurement chain for biomethane conformity assessment, as reliable measurement results can only be obtained with equipment of known performance, and from which the sensitivity, selectivity and metrological traceability have been assessed in full.

At the moment industrial gas analysers cannot be reliably evaluated for precision, bias and matrix interference. Therefore, the planned new protocol needs to be used to evaluate the performance of the different types of industrial gas analysers, which are used for biomethane conformity assessment. The new protocol also needs to be used to evaluate existing sampling and test methods, and it should be suitable as input for new or revised ISO standards.

Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them in order to maximise the overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the protocol.

The JRP shall focus on metrology research necessary to support standardisation in the SI-traceable conformity assessment of biomethane.

The specific objectives are

1. To develop cost-effective gas transfer standards, for the impurities specified in EN16723, for use in biomethane conformity assessment. Specific working standards should also be prepared for the evaluation of the cross-interference caused by the gas matrix and biomethane impurities. This should enable metrological traceability to be transferred from the primary standards to the test laboratories and to measurements in the field.
2. To develop a protocol for the sampling, analysis and performance evaluation of the gas analysers that are used for biomethane conformity assessment. The protocol should be validated using lab-based analysers, sampling and test methods. In addition, the validation should determine the repeatability, reproducibility, the limit of detection, and the uncertainty, and it should evaluate the cross-interference caused by the gas matrix and the biomethane impurities (specified in EN16723).
3. To use the protocol, developed in objective 2, to evaluate the performance of different types of relevant industrial gas analysers, based on e.g. spectroscopy or gas chromatography, which are used for laboratory and field-based biomethane conformity assessment. The protocol should also be used to evaluate the existing sampling and test methods.
4. To collaborate with the technical committee ISO/TC193/SC1/WG25 “Biomethane”, and the users of the standards they develop to ensure that the outputs of the project are aligned with their needs, including the protocol for the evaluation of the performance of gas analysers and recommendations for incorporation of this information into future standards at the earliest opportunity.

The proposed research shall be justified by clear reference to the measurement needs within strategic documents published by the relevant Regulatory body or Standards Developing Organisation or by a letter signed by the convenor of the respective TC/WG. EURAMET encourages proposals that include representatives from industry, regulators and standardisation bodies actively participating in the projects. The proposal must name a “Chief Stakeholder”, not a member of the consortium, but a representative of the user

community that will benefit from the proposed work. The “Chief Stakeholder” should write a letter of support explaining how their organisation will make use of the outcomes from the research, be consulted regularly by the consortium during the project to ensure that the planned outcomes are still relevant, and be prepared to report to EURAMET on the benefits they have gained from the project.

Proposers should establish the current state of the art, and explain how their proposed research goes beyond this. In particular, proposers should outline the achievements of the EMRP projects ENG01 GAS and ENG54 Biogas and the EMPIR projects 16ENG05 Biomethane, 18NRM06 NEWGASMET, 18NET01 Energy Gases and how their proposal will build on those.

EURAMET expects the average EU Contribution for the selected JRPs in this TP to be 0.8 M€, and has defined an upper limit of 1.0 M€ for this project.

EURAMET also expects the EU Contribution to the external funded partners to not exceed 30 % of the total EU Contribution across all selected projects in this TP.

Any industrial partners that will receive significant benefit from the results of the proposed project are expected to be unfunded partners.

Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community, describing how the project partners will engage with relevant communities during the project to facilitate knowledge transfer and accelerate the uptake of project outputs. Evidence of support from the “end user” community (e.g. letters of support) is also encouraged.

You should detail how your JRP results are going to:

- Address the SRT objectives and deliver solutions to the documented needs,
- Feed into the development of urgent documentary standards through appropriate standards bodies,
- Transfer knowledge to the biomethane sector.

You should detail other impacts of your proposed JRP as specified in the document “Guide 4: Writing Joint Research Projects (JRPs)”

You should also detail how your approach to realising the objectives will further the aim of EMPIR to develop a coherent approach at the European level in the field of metrology and include the best available contributions from across the metrology community. Specifically, the opportunities for:

- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards
- the metrology capacity of EURAMET Member States whose metrology programmes are at an early stage of development to be increased
- organisations other than NMIs and DIs to be involved in the work.

Time-scale

The project should be of up to 3 years duration.