Potential European Partnership on Metrology
Call 2021 – Green Deal and Normative

Selected Research Topic number: **SRT-v09**
Version: 1.1

Important information about these documents

This call is being held ahead of any agreement from the Commission that the relevant funding will be available. At present the relevant legislation is still under discussion in both Council and Parliament, and there is no certainty on the detailed arrangements for funding selected projects. The funding of any selected project, and the terms and conditions of participation in the projects, are dependent on completion of the legislative process and the subsequent contractual processes between the European Commission and EURAMET. Proposers submit to this call at their own risk.

Background

Last year, EURAMET submitted a draft proposal to the EC for a further research programme to be established under article 185 of the Treaty on the Functioning of the European Union (TFEU) to follow on from EMRP and EMPIR. This was published by the EC at https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/european-partnerships-horizon-europe/candidates-digital-industry-and-space_en

The initiative would be called the European Partnership on Metrology and would aim to create, by 2030, a sustainable and effective system for metrology at European level that ensures Europe has a world-class metrology system that:

- Provides metrology solutions, fundamental metrological reference data and methods, offering fit-for-purpose solutions supporting and stimulating European innovation and responding to societal challenges.
- Supports and enables effective design and implementation of regulation and standards that underpin public policies that address societal challenges.

The Commission commissioned an impact assessment into this proposal and 11 others in similar priority areas, and, based on those findings, published their own proposal for the Partnership, their response to the impact assessment and a draft of the Decision on 23rd February 2021. See:

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:89:FIN

https://ec.europa.eu/commission/presscorner/detail/en/ip_21_702

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021SC0035&qid=1614677899327

That draft Decision is currently under discussion in the European Council and the European Parliament.

Under the assumption that the Council and Parliament pass the basic act which would form the legal basis for this research programme, and that the participating countries named in the Draft Decision submit the required commitment letters, EURAMET is publishing these potential Selected Research Topics and draft guidance notes. These documents are not approved by the Commission nor will they lead to a binding decision by EURAMET e.V. for any further negotiation or funding. All published guides and templates are subject to amendment by the EC and EURAMET e.V. as further information becomes known.

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Title: Metrology for the hydrogen supply chain

Abstract

The EU Green Deal sets ambitious targets for the transformation towards a climate neutral continent. Hydrogen plays a key role as an energy in this ambition, yet the metrological infrastructure to support the entire hydrogen supply chain is underdeveloped. Research addressing this SRT should focus on key aspects of determining quality and quantity of hydrogen, monitoring and regulatory conformity, providing the necessary measurement standards, methods, models and best practices for the production, storage, transmission, and distribution of hydrogen.

Keywords

Hydrogen, purity, hydrogen-enriched natural gas, fiscal metering, odorisation, leak quantification, totalisation.

Background to the Metrological Challenges

Key aims of the EU Green Deal include its ambition for the supply of clean, affordable, and secure energy. In the transition from fossil energy to renewable energy sources, hydrogen is playing a key role as articulated in the Hydrogen Europe initiative and in its Strategic Research and Innovation Agenda, and the expressed needs of industry.

The uses of hydrogen are predominantly in ammonia production and in the refinery of oil. For ‘new’ applications, such as blending hydrogen into natural gas grids, going to 100 % hydrogen gas grids and mobility, requirements need to be met with respect to custody transfer, health, safety, environment and efficiency in production and use. The outputs of past and current projects are laying a foundation for the envisaged infrastructure needed to calibrate gas meters at a larger scale for hydrogen and hydrogen-enriched natural gas under the conditions of use. However, these projects have been unable to correlate hydrogen quality at the end user’s point with the production sources, and regarding impurities in particular, primary and transfer standards have been developed, but results of comparisons on measurement standards show a lack of equivalence with key measurands.

Furthermore, there is little or no infrastructure for calibration and performance checking of equipment under the conditions of use in industry, which hampers the conformity assessment of fuel quality where it is needed. It also hampers demonstrating compliance with regulations. Most of the measurement equipment used is installed onsite during its entire lifetime, and rarely are results compared with equipment providing metrologically traceable results.

Many measurement results along the supply chain are generated by sensors and built-in measurement equipment, from which it is not always evident that they are operating within their expected accuracy intervals. Metrological validation systems, procedures and standards are needed to validate and calibrate or check online instruments and sensors so that it can be assured that they are operating within their specifications.

Flow meters and other devices used for mass or volume measurement require traceable calibration. Currently, measurement standards and calibration methods are lacking for most hydrogen-related applications, concerning both pure hydrogen in liquid and gas phase, as well as blends of hydrogen with other energy gases, such as natural gas. Therefore, compliance cannot be demonstrated with regulatory requirements with respect to e.g., OIML R139, OIML R140, and the Measurement Instruments Directive. To identify the main uncertainty contributors for custody transfer of hydrogen and thereby identify which are the metering gaps that need to be filled, uncertainty budgets for complete supply chains are required also. In addition, for the safety of distribution networks and end-users, gas standards are needed to support the odorisation of hydrogen and blends of hydrogen and natural gas.

With regards to purity analysis there is a need to develop and validate low-cost analysers. Without facilities to validate online analysers, the industry will not be able to deploy the hydrogen monitoring required, hampering the uptake of hydrogen in Europe.

With respect to models for calculating fluid properties (equations of state), calorific value and auxiliary parameters such as speed of sound, substantial research has been done or is ongoing. However, practically no research has been done on the totalisation of quantity, energy, or purity exposure. Current practices in ISO and the Technical Association of the European Gas Industry, Marcogaz, rely on unrealistic assumptions, that affect the reliability of those calculations, even more so in gas grids with more widely varying gas composition. Grid owners have indicated their concerns in this respect in meeting customers’ and regulators’ requirements.

Improved models are needed that can deal with time-dependent data to support billing, risk assessment and mitigation.

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 the entire supply chain of hydrogen, from production to storage and end use. There is a need to disseminate metrological traceability to the field, so that measurement results become fit-for-purpose for meeting requirements with respect to health, safety, environment, and fiscal purposes.

The specific objectives are

1. To develop calibration and measurement methods to support reliable, traceable, and accurate measurements of hydrogen in production processes and end-user applications, in view of safety, process efficiency and environmental issues, such as for purity, leak detection, odorisation, and materials performance, ensuring that online measurement instruments and sensors are operating within their specifications (ISO 14687, OIML R139, and OIML R140).
2. To develop measurement standards to enable calibration and validation of flow metering equipment under actual conditions (pressure, temperature), used to accurately quantify flow rates of hydrogen (including blended hydrogen) through the hydrogen supply chain, and to ensure compliance with respect to e.g. OIML R139, OIML R140, and the Measurement Instruments Directive.
3. To develop and improve measurement standards and methods to enable traceable validation and performance evaluation of gas quality measurement methods, to thus improve on the current lack of equivalence for e.g. oxygen, hydrogen sulphide, moisture content, and for reactive components such as hydrogen chloride and chlorine. To develop and improve analysers for critical impurities for online monitoring changes in gas quality, through the supply chain and processing equipment, to ensure the gas quality is meeting the required specifications (ISO 14687).
4. To develop novel methods for the evaluation of measurement uncertainty along the supply chain as a whole, namely with regard to the measurement of quantity, and energy and impurity content of hydrogen and hydrogen blends.
5. To facilitate, in cooperation with the European Metrology Network Energy Gases, the take up of the technology and measurement infrastructure developed in the project by the measurement supply chain (accredited laboratories, instrumentation manufacturers for hydrogen), standards developing organisations (ISO, OIML) and end users (ammonia production, oil refining).

These objectives will require large-scale approaches that are beyond the capabilities of single National Metrology Institutes and Designated Institutes. To enhance the impact of the research, the involvement of the appropriate user community such as industry, standardisation and regulatory bodies is strongly recommended, both prior to and during methodology development.

Proposers should establish the current state of the art, and explain how their proposed project goes beyond this. In particular, proposers should outline the achievements of the EURAMET EMN for Energy Gases, and EMPIR projects 15NRM03 Hydrogen, 16ENG01 MetroHyVe, 18NRM06 NEWGASMET, 19ENG03 MefHySto, 19ENG04 MetroHyVe 2, 20IND11 MetHyInfra, and 20IND13 SAFEST, and how their proposal will build on those.

EURAMET expects the average EU Contribution for the selected JRPs in this TP to be 2.2 M€, and has defined an upper limit of 2.7 M€ for this project.

EURAMET also expects the EU Contribution to the external funded partners to not exceed 35 % of the total EU Contribution across all selected projects in this TP.

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 hydrogen supply chain.

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 the potential European Partnership on Metrology 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.