

Title: Metrology to support standardisation of hydrogen fuel sampling for heavy duty hydrogen transport

Abstract

Hydrogen is integral to the transition to zero emission heavy-duty transport with ambitious European Commission targeting 100 000 trucks by 2030. The European industry needs to achieve the zero emission for transport especially for heavy-duty as hydrogen is fast becoming a systemic element in the European Union's (EU) efforts to transition to a climate neutral society in 2050. To support it, hydrogen fuel sampling is under standardisation by ISO/TC197 WG33. This project aim is to provide scientific evidence for standardisation of hydrogen fuel sampling for heavy-duty applications. The topic objectives identified by standardisation committees is on the development of reference sampling method for heavy-duty transport, heavy-duty sampling representativity, methodology to validate sampling systems and establish uncertainty budgets.

Keywords

ISO 19880-9; heavy duty vehicles; hydrogen fuel; standardisation; hydrogen quality.

Background to the Metrological Challenges

Hydrogen is expected to become a crucial energy path and transition alongside renewable electricity by replacing coal, oil and gas across different segments of the economy, especially in transport. Hydrogen for transport is growing quickly for the heavy-duty sector. Heavy-duty transport is one of the main pillars of hydrogen industry as identified by Hydrogen Europe roadmap to support the transition to zero emission transport in Europe for 2050. Despite the information gathered on the durability of light-duty fuel cell electrical vehicles on the current infrastructure, the challenge is higher for heavy-duty application as heavy-duty vehicles need longer lifetime, better durability, and reliable performance. Also, there is a need to support the fast-paced transition with the relevant standards on hydrogen quality as reliability of a measurement is directly linked to the representativity and reliability of the sampling itself. Standardising and homogenise sampling at hydrogen refuelling stations ensure the reliability of the actual hydrogen quality.

ISO TC197 on hydrogen technologies has recently started a working group to standardise hydrogen sampling at hydrogen refuelling station to support hydrogen quality at hydrogen refuelling stations. This new draft standard is focussing on the sampling for passenger HRS due to the lack of technical evidence and system for heavy-duty HRS (hydrogen refuelling stations) and the ISO committee can benefit from guidance documents, reliable dataset, experimental feedback, and other materials supporting a harmonised and efficient implementation of the novel and improved methods.

Since the sampling for heavy-duty HRS is different from passenger HRS in term of infrastructure, filling protocol, flow, and hardware (e.g., receptacle, nozzle) thus, the need for developing a sampling system with adapted safety features to comply (e.g., high flow involved in heavy-duty HRS up to 300 g/s). There is a current gap in the sampling practice around this fast-growing area. It is a critical need to provide robust evidence to the approach in the standard and develop guidance on how to validate sampling approaches for heavy-duty applications.

In addition, providing the necessary standard and good practice guides to support the uptake of hydrogen for heavy duty transport including new and proven sampling system and safety feature for reliable and safe sampling can reduce the risk of incident and increase the safety of operators and public on HRS premises. The new standard and new sampling capabilities can enable cost in hydrogen quality and optimisation of hydrogen quality monitoring promoting hydrogen in mainstream human life, as well as supporting the ambition of hydrogen Europe and of the European commission in tackling the climate change challenges.

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 hydrogen fuel sampling for heavy duty applications. The specific objectives are

1. To develop reference method based on new hardware for interfacing relevant nozzle geometries for hydrogen heavy duty applications. This includes addressing methods for both gaseous and particulate phase. In addition, method comparison with existing methods for sampling for light duty application is documented to demonstrate equivalence or identified bias.
2. To develop methodologies for validation of sampling systems. This includes method validation including evidence of impact of physical parameters (e.g. pressure and flow) on sampling representability. Gas sampling validation includes accurate gas contamination and assessment of recovery yield. System is laboratory based for flexibility in fluid physical parameter control and gas composition. Uncertainty of the validation methodologies include uncertainty budget.
3. To develop guideline for evaluation of uncertainty of sampling, sampling representativeness (including minimum sampling size) and sample volume/gravimetric requirements by performing repeated samplings under varying conditions.
4. To support the safety standardisation of heavy-duty sampling involving safe sampling of hydrogen: venting of hydrogen, risk assessment and training of stakeholders.
5. To contribute to the standards development work of the technical committees CEN TC 268 and ISO TC 197 to ensure that the outputs of the project are aligned with their needs, communicated quickly to those developing the standards and to those who should use them, and in a form that can be incorporated into the 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 convener 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 EMPIR projects 16ENG01 MetroHyVe and 19ENG04 MetroHyVe 2 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 1.2 M€ for this project.

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

Any industrial beneficiaries that will receive significant benefit from the results of the proposed project are expected to be beneficiaries without receiving funding or associated 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 transportation 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 the Partnership 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.