

# European Metrology Programme for Innovation and Research

Delivering Impact



## A new standard for accurate billing at hydrogen refuelling stations

Hydrogen is emerging as a clean carbon-neutral alternative to petrol and diesel, especially for heavy-duty vehicles. To ensure its uptake continues to grow, consumers must be sure that the price they pay for fuel accurately reflects the hydrogen dispensed into their vehicle. However, this process has been challenging due to a lack of standards to calibrate flow rates at hydrogen refuelling stations.

### Europe's National Measurement Institutes working together

The European Metrology Programme for Innovation and Research (EMPIR) has been developed as part of Horizon 2020, the EU Framework Programme for Research and Innovation. EMPIR funding is drawn from 28 participating EURAMET member states to support collaborative research between Measurement Institutes, academia and industry both within and outside Europe to address key metrology challenges and ensure that measurement science meets the future.

## Challenge

The European Union aims to become fully climate-neutral by 2050. Key to this ambition will be phasing out internal combustion engines in both light and heavy-duty vehicles. Electric vehicles based on hydrogen fuel cells are viable alternatives and it has been estimated by the European Commission that these cells could represent 32 % of fuel demand by 2050. For hydrogen to see wide-spread uptake, however, a robust infrastructure of hydrogen refuelling stations (HRS) must be established across Europe.

Previous EMPIR project [16ENG01 MetroHyVe](#) identified key factors needing to be addressed to make this possible. In particular, the project highlighted that it was not possible to accurately measure the amount of hydrogen dispensed from an HRS at 700 bar, the pressure used for filling light-duty vehicles. This meant a certain level of uncertainty between the amount fueled and the amount charged 'at the pump'. The project also highlighted that testing HRS compliance to regulation (in particular OIML R139) was slow and expensive. To improve HRS, reduce prices and ensure hydrogen's uptake as an alternative fuel, traceable methods to calibrate HRS flow rates were needed.

## Solution

During the [MetroHyVe 2](#) project, a mobile secondary measurement standard and method to verify HRS flow rates in the field were developed by Cesame-Exadebit s.a., a Designated Institute in France. Cesame has now integrated these into a new calibration service, able to calibrate HRS across a range of flow rates and temperatures at both 350 and 700 bar (for both heavy and light duty vehicles). The standard, based around a Coriolis mass flow meter, is traceable to primary standards developed during the MetroHyVe and MetroHyVe 2 projects. It has an uncertainty of better than 0.6 %, which is compliant with OIML R139, and allows HRS to be verified 50 % faster than before.

## Impact

TotalEnergies is a global energy supplier with a 100-year history in the industry. More recently, the company has joined with French gas supplier AirLiquide to form TEAL Mobility, a European network of HRS. As well as standards related to safety and the environment, such as the EU Pressure Equipment Directive, these stations must conform to OIML R139. However, as highlighted by the MetroHyVe project, the certification process was both costly and time-consuming.

Following the development of the secondary standard during the MetroHyVe 2 project, TotalEnergies was able to use Cesame's new service to calibrate HRS owned by TEAL Mobility. This has allowed the HRS to be OIML-certified in a timely and cost-effective way. Through this partnership, TotalEnergies has gained expertise and key knowledge about both the certification process and legal metrology for hydrogen.

The work of MetroHyVe 2 will continue bolstering consumer confidence in fair pricing at HRS, improving uptake of hydrogen as a fuel for all types of vehicles. This will help end reliance on petroleum, reducing carbon emissions and pollution. The Partnership project [MetroHyVe3](#) builds on this work.

## Developing metrology for zero-carbon hydrogen vehicles

The MetroHyVe 2 project has developed metrology for hydrogen refuelling stations (HRS) to support the uptake of hydrogen as a zero-carbon transport fuel. This includes:

- Developing the first harmonised hydrogen sampling equipment, methodologies and reference materials, which have been validated through inter-laboratory comparisons
- Developing new primary and secondary standards to calibrate flow rates in HRS dispensers, for both heavy-duty and light-duty vehicles, ensuring correct charging for customers
- Performing the first sampling intercomparison between all strategies used in Europe for hydrogen sampling at the HRS nozzle
- Developing standardised protocols for automotive fuel cell stack testing to determine thresholds for key hydrogen contaminants, as well as new infrastructure to test fuel cell electrical vehicle tanks
- Creating several good practice guides and guidelines including for sampling at HRS, measuring hydrogen contaminants, minimising HRS uncertainty and for operating online analysers which are used over long periods



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[www.euramet.org/19ENG04](http://www.euramet.org/19ENG04)

Thomas Bacquart	Rémy Maury
NPL, UK thomas.bacquart@npl.co.uk	Cesame-Exadebit s.a., France r.maury@cesame-exadebit.fr