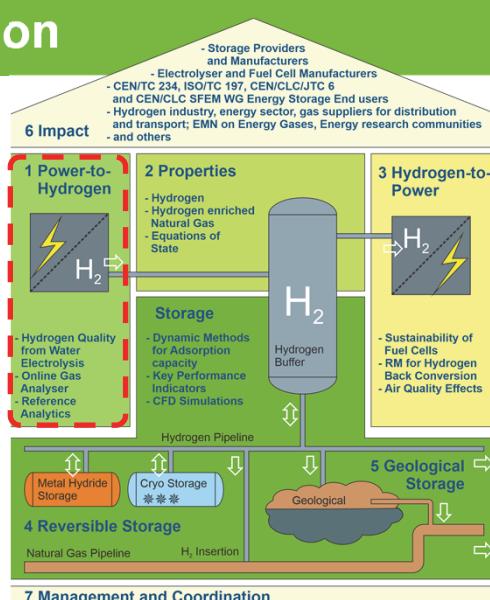


Metrology for Hydrogen Quality from Power-to-Hydrogen (WP1)

National Physical Laboratory (United Kingdom), (United Kingdom), Physikalisch-Technische Bundesanstalt (Germany), Commissariat à l'Énergie Atomique et aux Énergies Alternatives (France), DBI Gas und Umwelttechnik GmbH (Germany), Regasificadora del Noroeste, S.A (Spain)

MefHySto Introduction

- Duration 2020–2023
- EU Funding 2.3 M€
- Coordinator BAM
- 14 Partners



- Ambitious new EU energy target of using 32 % of renewable energy by 2030
- Cannot be reached without advanced energy storage solutions, e.g., H₂ storage
- Measurement science is critical for realisation of this commitment
- Financial concerns of amount of hydrogen generated – stored – back-converted

Work Package 1 Introduction

- Quality from Water Electrolysis
- Online Gas Analysis
- Reference Analytics



Task 1: New metrology for realisation and measurement of H₂ key impurities with fast response

Water vapour and oxygen identified as key impurities.

Water vapour step change facility with a 4-way switching valve developed with traceability to NPL Primary Standard Humidity Generator.



Figure 1: NPL facility for testing hygrometer response time to step changes in hydrogen water content



Validation of water vapour spectrometer (WVS) for impurity measurement in H₂ at PTB.

Figure 2: Chosen WVS for validation (source Tiger Optics)

Task 2: Testing and validation of instruments for measuring H₂ key impurities

Hygrometers with seven different measurement principles tested including: SAW, metal oxide dew-point probe, fibre optic, chilled-mirror, electrolytic and spectrometry.

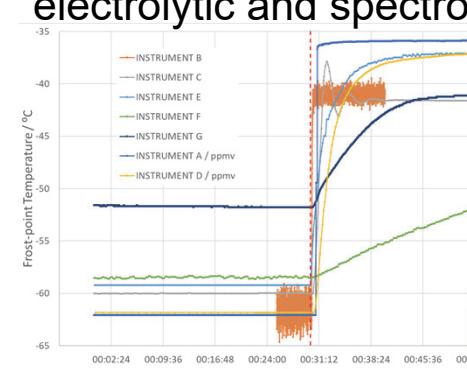
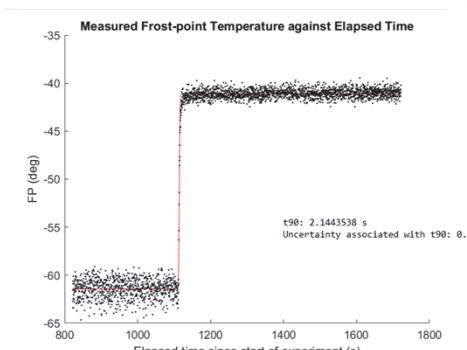


Figure 3: t_{90} response time analysis for seven hygrometer types.

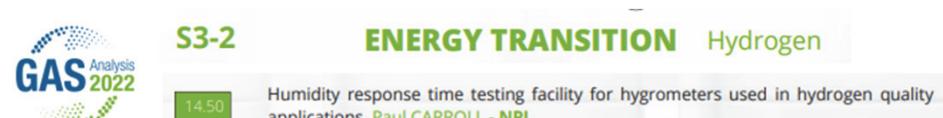
Instrument	t_{90} response time / s	Unc. in t_{90} estimate ($k = 2$) / s
INSTRUMENT A	19.30	0.33
INSTRUMENT B	2.14	0.09
INSTRUMENT C	26.83	1.21
INSTRUMENT D	164.84	1.84
INSTRUMENT E	306.13	4.43
INSTRUMENT F	6872.48	8.52
INSTRUMENT G	786.62	2.80



Fitting function to response time data developed to estimate t_{90} values with uncertainties.

Figure 4: Rising series response time data fit

More details in presentation on Thursday 19th May @ 14:50:



Response time testing facility for O₂ in H₂ in preparation.

Task 3: Trials of rapid response analysis of H₂ key contaminants from electrolysis in-situ

Two laboratory electrolyser setups prepared at NPL and CEA with online impurity measurement at the cathode.

Impact of operating conditions and transient profiles on the cell performances and on the quality of produced hydrogen to be studied with online sensors (including μGC and GC-methaniser-FID).



Figure 5: PEMWE testing at single cell level test bench specifications

