PROMETH$_2$O

20IND06 PROMETH2O

Metrology for trace water in ultra-pure process gases

WP4 Creating impact

Project kick-off meeting

14th of June 2021

EMPIR EURAMET
The EMPIR initiative is co-funded by the European Union's Horizon 2020 research and innovation programme and the EMPIR Participating States

Involved partners in WP4

WP1
Methods

WP2
Traceability

WP3
Demonstration

WP4
Impact

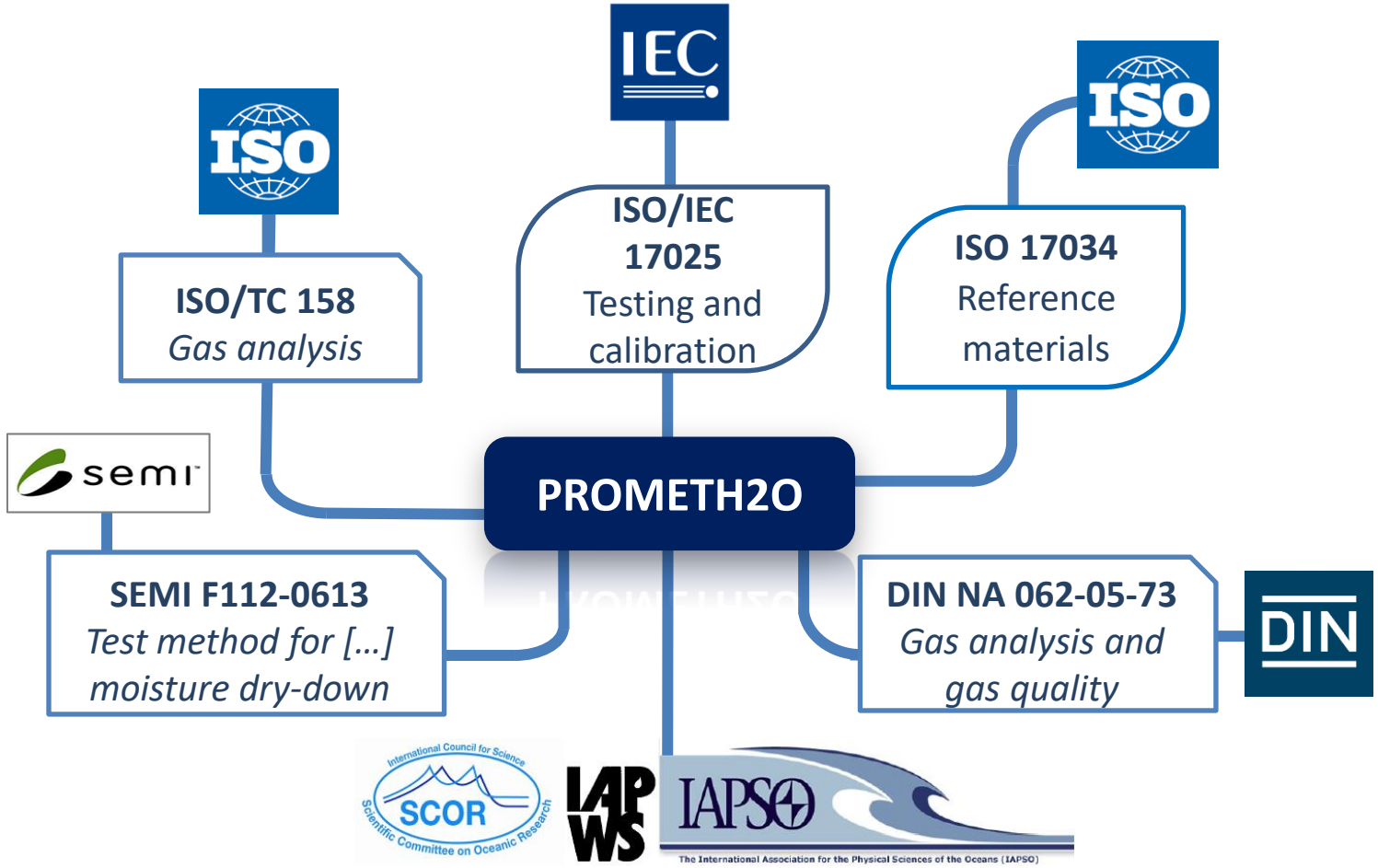
WP5
Management

Impact on industry and economy

- Drivers
  - Global market for industrial gas reached $97 billion in 2018. It grew at 5 % per year.
  - In Europe, in 2018, the gas market reached a value of about € 15.7 billion.
  - European PV market is forecast for double-digit yearly growth. It grew by >100 % in 2019.
  - OLEDs for next-generation flexible displays – a booming market to be worth $3 billion in near future.
- Impact
  - Early industrial impact expected on UHP gas manufacturing and supply.
  - Improved, traceable, measurements of trace water in UHP gas production and supplies to serve advanced industrial sectors.
  - On site calibrations/checks using transportable references for improved process efficiency.
  - Sustains innovation and competitiveness of European instrument makers and service providers.
  - Contributes to renewable and sustainable technologies – solar, PV, low-energy light sources, etc.

Impact on metrology and standards

- Extended-range primary standards and measurement traceability for trace water in UHP gases.
- Integration of metrology infrastructure in Europe and leadership of European NMIs in this developing field.
- Underpinning of metrology of trace water for wider reference gases (e.g. H2, Ar).
- Better knowledge of measurement techniques and of real humid gas mixtures.
- A CIPM comparison enabled in the trace water range.



Task 4.1: Knowledge transfer

- A4.1.1 set up, host and maintain the project website (**CETIAT**, all partners) – **M36**
  - The website will have a public and restricted area and it will be set up within 3 months from the start of the project and will be updated at least every 9 months (**M3**, **M12**, **M21**, **M30**, **M36**)
  - A protected cloud storage for the exchange of information and documents has been already set up by INRIM and will be maintained for the lifetime of the project

Task 4.1: Knowledge transfer

- A4.1.2 set up a stakeholder's **Steering Board** (SB) (**INRIM**, all partners) – **M6**, **M36**
  - The SB will be established within 6 months from the start of the project (**M6**)
  - The aim of SB is to clarify the needs, to feed these into the different activities (e.g. A1.3.1, A2.3.2 and A3.1.1) and to keep the project aligned with the needs to maximise impact
  - SB members will be regularly invited to attend the public part of the project meetings

Task 4.1: Knowledge transfer

- A4.1.3 dissemination to key standards bodies and committees (**INRIM**, all partners) – **M36**

Standards Committee / Technical Committee / Working Group	Partners involved	Likely area of impact / activities undertaken by partners related to standard / committee
ISO/TC 158 WG3	VSL, CEM	VSL and CEM will disseminate to ISO/TC 158/WG3 the outputs of the project in order to update ISO 19229: 2019 '*Gas analysis - Purity analysis and the treatment of purity data*' with the project results that are metrological traceable. This ISO group holds meetings twice per year.
SEMI, Gases Global Technical Committee.	CETIAT	CETIAT will liaise with SEMI, Gases Global Technical Committee to disseminate the outputs of the project from WP2 and contribute to a future update of SEMI F112-0613 - *Test Method for Determination of Moisture Dry-Down Characteristics of Surface-Mounted and Conventional Gas Delivery Systems by Cavity Ring Down Spectroscopy* (CRDS) This SEMI, group holds meetings once per year.
DIN NA 062-05-73 AA	PTB	PTB will disseminate to the DIN NA 062-05-73 AA committee the outputs of the project from WP2 to contribute to the discussion on gas supplier industry. This DIN group holds meetings twice per year.
CIPM CCT WG-Hu CCT	INRIM, CETIAT, INTA, PTB, VTT	INRIM, CETIAT, INTA, PTB, and VTT will disseminate to CIPM CCT WG-Hu the outputs of the project from WP1 to contribute on the consultations for the protocol for CIPM inter-comparison. This WG-Hu holds meetings in conjunction with CCT plenary, in general every 3 years.
CIPM CCQM GAWG	PTB	PTB will disseminate to CIPM CCQM GAWG the outputs of the project from WP1 and WP2 to contribute on the consultations for the protocol for CIPM CCT inter-comparison and liaise with such committee This WG holds meetings generally once per year.
IAPWS WG TPWS	INRIM, PTB, VTT	INRIM, PTB, and VTT will disseminate to IAPWS WG TPWS the outputs of the project from WP2 to contribute on the consultation on non-ideal humid gas mixtures and water vapour enhancement data and correlation. This WG holds meetings generally once per year.
JCS	INRIM, PTB, VTT	INRIM, PTB, and VTT will disseminate to JCS the outputs of the project from WP2 to contribute on the consultation on non-ideal humid gas mixtures and water vapour enhancement data and correlation equations. This JCS group holds meetings once per year.
EURAMET TC-T	INRIM, CETIAT, INTA, PTB, VTT	INRIM, CETIAT, INTA, PTB, and VTT will disseminate to EURAMET TC-T the outputs of the project from WP1 and WP2 to inform the metrology community. The EURAMET TC-T holds meetings once per year.
EURAMET TC-MC SCGA	PTB	PTB will disseminate WP1 and WP2 output to EURAMET SCGA and will liaise with this gas metrology committee. The EURAMET TC-T holds meetings once per year.

Task 4.1: Knowledge transfer

- A4.1.4 ≥ 20 presentations (oral and poster) in national or international conferences (**CETIAT**, all partners) – **M36**
  - The target international conferences are:
    - International Metrology Congress (CIM) 2023, International Measurement Confederation (IMEKO) World Congress 2023, World Gas Conference (GAS) 2022, Symposium on Temperature and Thermal Measurements in Industry and Science (TEMPMEKO) 2023, International Temperature Symposium (ITS) 2023, European Conference on Thermophysical Properties (ECTP) 2023, Symposium on Thermophysical Properties (STP) 2024, International Association for the Properties of Water and Steam (IAPWS) Annual Meeting
  - The target national conferences and media are:
    - Electronic Journal e-medida, Spanish Congress of Metrology, Tutto Misure, Revue Mesures

Task 4.1: Knowledge transfer

- A4.1.5 ≥ 8 peer-reviewed open access publications to scientific journals (**CETIAT**, all partners) – **M36**
  - Typical content:
    - i) ultra-trace water vapour standards, ii) methods and procedures developed to improve the ultra-trace water vapour measurements with their corresponding uncertainty budgets, iii) results on the enhancement factor in real gas matrices and saturation vapour curves
  - The authors will clearly acknowledge the financial support provided through the EMPIR
    - This project (EMPIR 20IND06 PROMETH2O) has received funding from the EMPIR programme co-financed by the Participating States and from the European Union's Horizon 2020 research and innovation programme
  - The authors will ensure that the following meta data is submitted and included for each paper
    - Funder name: European Metrology Programme for Innovation and Research, Funder ID: 10.13039/100014132, Grant number: EMPIR 20IND06 PROMETH2O

Task 4.1: Knowledge transfer

- A4.1.6 ≥ 4 e-newsletters (**CETIAT**, all partners) – **M9**, **M18**, **M27**, **M36**
  - SB + website

- A4.1.6 information package (**CETIAT**, all partners) – **M36**
  - Provide materials to facilitate project presentations and to promote consistency on what is shared

- A4.1.6 social media account (**CETIAT**, all partners) – **M36**
  - **Linkedin and research gate**

Task 4.2: Training

- A4.2.1 training course on site and workshop (**Nippon Gases**, all partners) – **M34**
  - The course will be targeted to industry and will consist of one-day training session
  - The course will be provided with special focus on measurements of trace water in ultra-pure gas production and on-site process humidity sensors calibration
  - The course will use data/instruments/methods resulting from A1.2.6 and A3.2.2
  - The workshop
    - The targeted number of attendees is at least 40 for online mode, 20 in presence.

- A4.2.2 Final workshop and final project meeting (**CETIAT**, all partners) – **M36**
  - The workshop
    - The workshop will be addressed to technicians/engineers/researchers of NMIs, gas and instrument makers, accredited laboratories, and the industry.
    - It will present the results achieved by the project, such as instrument development (A1.2.6 and A3.2.2), trace water standards (A2.1.6) and software tool(s) (A2.3.3)
    - It will allow time for discussion of the results
    - The targeted number of attendees is at least 40 for online mode, 20 in presence.

- A4.3.1 Communication and exploitation plan (**CETIAT**, all partners) – **M2**, **M9**, **M18**, **M27**, **M36**
  - The focus points of this exploitation plan will be to detail how the project will ensure dissemination of the project activities and take up of the technology and measurement infrastructure developed in the project

Task 4.3: Uptake and exploitation

- A4.3.2 New primary and reference standards and calibration and measurement capabilities (**CETIAT**, INRIM, VTT, PTB, CEM, UL, CMI) – **M36**
  - Range of generators based on mixed-flow principle extended below -80 ºC at pressures up to 1 MPa and with N_2 and air (CETIAT)
  - Range of generators based on saturation down to -105 ºC and pressures up to 1 MPa in N_2, Ar (INRIM) and air (VTT)
  - Coulometric generator for water vapour amount fraction between 5 ppb and 5 ppm at 0.1 MPa in N_2 and Ar (PTB)
  - Certified reference gas materials (N_2, Ar and H_2) with trace water vapour (CEM)
  - Saturation-based generator extended below -80 °C at pressures up to 1 MPa operating with N_2 and Ar (CMI, UL)

- A4.3.3 New primary and reference standards and calibration and measurement capabilities (**CETIAT**, INRIM, VTT, PTB, VSL) – **M36**
  - calibration services for hygrometers down to -100 ºC in N2, Ar or air
  - resulting from A2.1.1, A2.1.3, A2.1.5 and A2.2.2 after the project completion.

- A4.3.4 Exploitation of closed-loop trace water calibrator (**Qrometric**) – **M36**
  - Qrometric will exploit the portable, closed-loop, trace water calibrator from A3.2.5 down to -90 °C frost point in N_2 or air

- A4.3.5 Analysis of trace water vapour in N_2, Ar, and H_2 (**CEM**) – **M36**
  - CEM will exploit the improved analysis of trace water vapour in N2, Ar, and H2 from A2.2.3

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Thank you for your attention

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