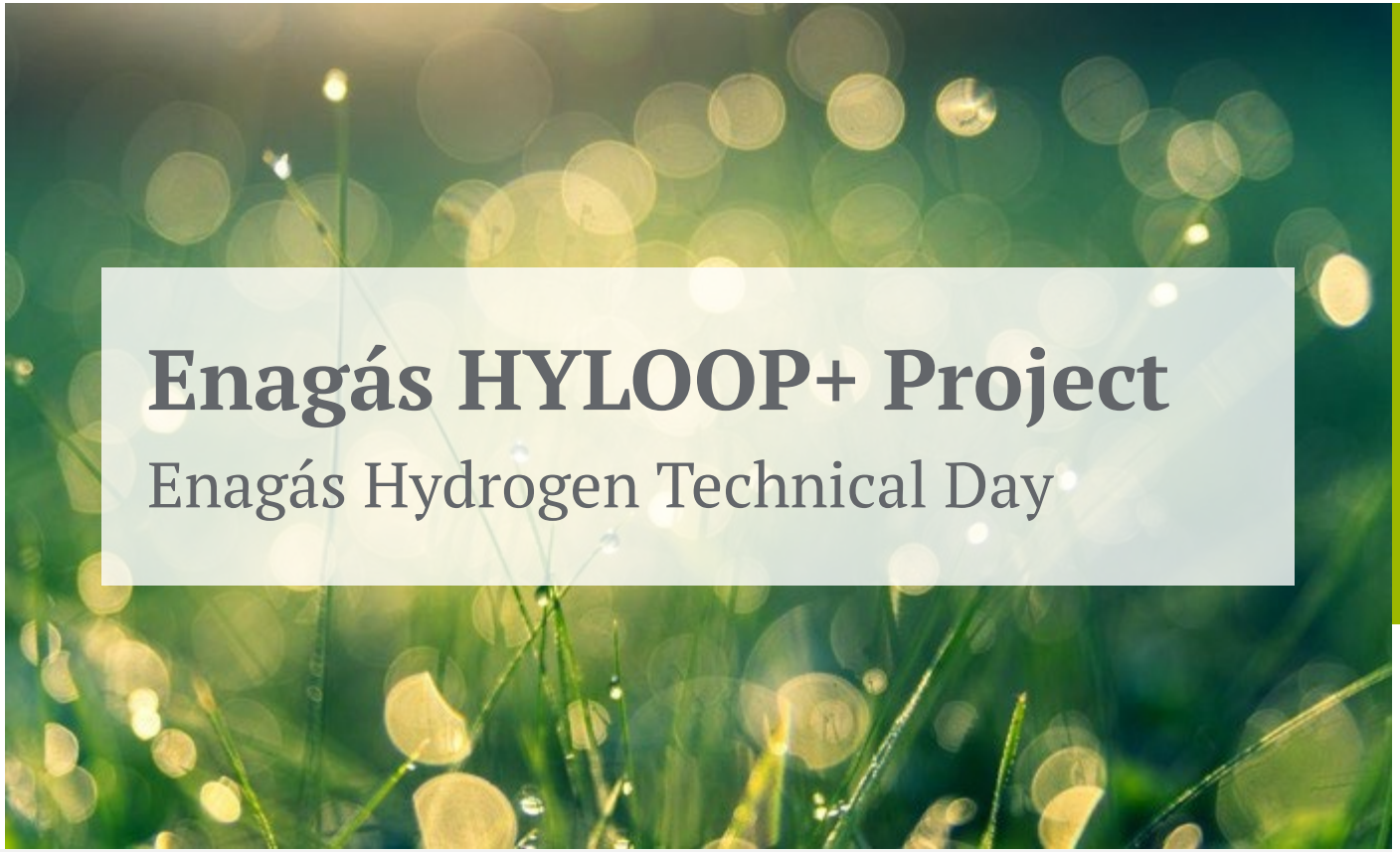


# Enagás HYLOOP+ Project

## Enagás Hydrogen Technical Day

**10th June 2026**

# Enagás Metrology and Innovation Centre (CMI)


Offices

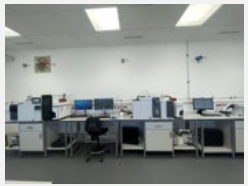
**Central Laboratory of Enagás** (LCE)

Inauguration 1988

DPC

## Gas Analysis and Quality Laboratory 1988

- Analysis of natural gas, biomethane, Hydrogen, dew point, sulphur compounds...
- Homologation tests



## Instrumentation Laboratory 1998

- Calibration of standard instruments (P and T)
- Homologation tests

## Meters calibration Labs

- BC0 Laboratory **1989** Calibration of industrial meters with air at atmospheric conditions
- BC7 Laboratory: Calibration of household meters with air at atmospheric conditions

- BC10 / LACAP Laboratory **2012**: Calibration of industrial meters with natural gas at high pressure, and homologation test.
- Laboratorio colaborador del CEM desde **2014**

# Motivation for a new laboratory

**Spanish hydrogen backbone will require control of the transported energy, as in the case of natural gas network**

- Gas meters must be **calibrated periodically**, to correct **systematic errors**
- In the short term, it is necessary to have a **meter calibration laboratory valid for operation with hydrogen and HENG**
- This Laboratory must be part of a **traceability chain** and have a quality system that guarantees the **minimum possible uncertainty**, reducing **economic risk**

**Enagás existing natural gas network**

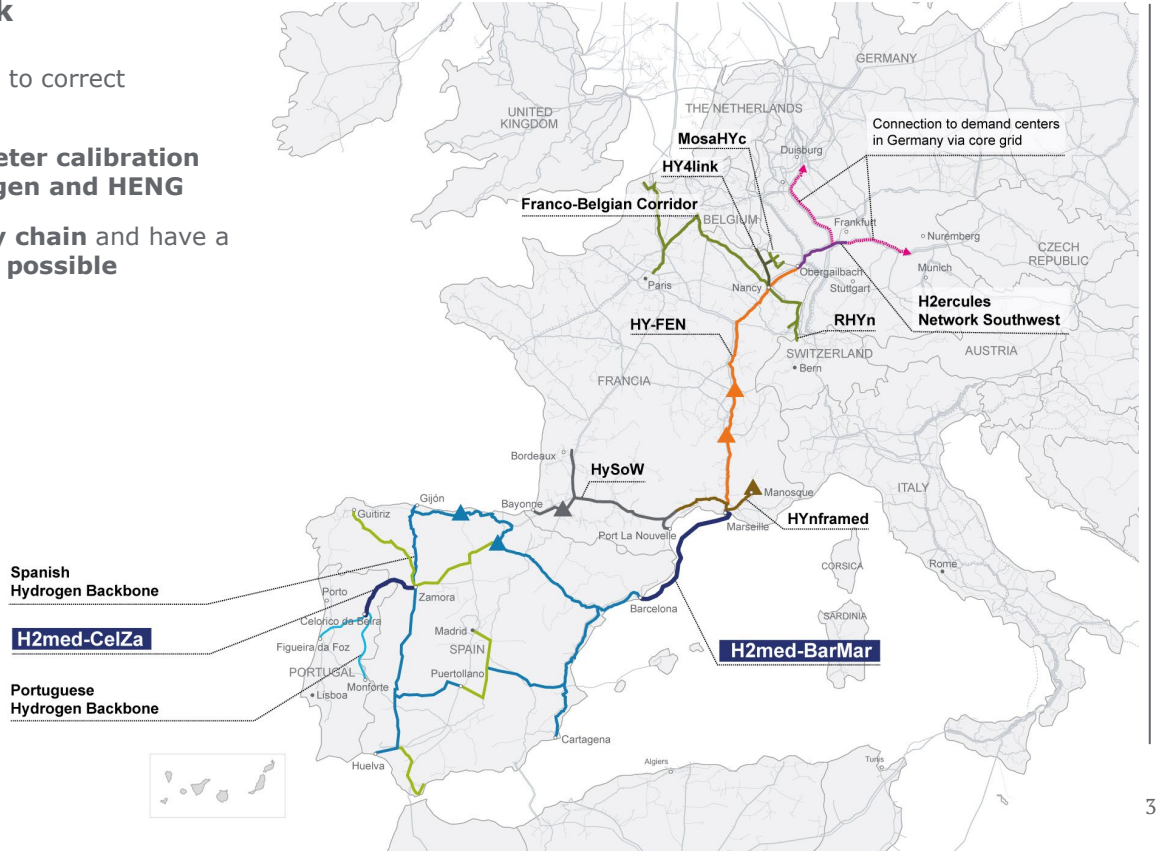
**> 400** metering stations

**> 1,500** meters

Recalibration of meters at delivery points every **6 years**

**Enagás future hydrogen network**

**> 500** metering stations (2033)



# Specifications

## HYLOOP+ Project

**Calibration closed loop**

- **Extended range** gas natural flowmeters calibration
- **Pure $H_2$ and HENG** (up to 20mol-% H2) flowmeters calibration

**Primary Reference System**

- Traceability chain development to **$m^3$ of natural gas**
- Traceability chain development to **$m^3$ of hydrogen**

Independent national traceability chain*

CEM CENTRO ESPAÑOL DE METROLOGÍA

**Contributions of the HyLoop+** (multi-gas laboratory)

- **First industrial installation with Primary Standard-HPPP** (High Pressure Piston Prover) for hydrogen at high pressure (90 bar), covering operating pressures of H2 network. Elimination of **external laboratories dependency**
- **Accredited laboratory** (ISO/IEC 17025)
- **Collaboration with the CEM** (Spanish Metrology Centre) for European intercomparisons, reinforcing the national metrological structure
- Ability to **disseminate traceability to standard H2 flowmeters** of other laboratories

(* *Based on the fundamental units of length and time*)

## Laboratory HYLOOP+

**Gas pressure**
Up to 90 barg*

**MUT** diameters**
2-6”

+

**Primary standard**
3-170 $m^3/h$ (actual conditions)

**Flowrate**
3-650 $m^3/h$ (actual conditions)

**Calibration lines**
1 (up to 3 MUT** in series)

* ANSI 150, 300 & 600

** MUT ‘Meter Under Test’:
- **Ultrasonic** gas meters
- **Coriolis** gas meters
- **Rotary displacement** gas meters
- **Turbine** gas meters

**BMC ‘Best Measurement Capability’:**
- HPPP: < 0.1 %
- Laboratory:
  - < 0.2 % NG & HENG
  - < 0.2 % $H_2$ (volume)
  - < 0.3 % $H_2$ (mass)

# 3D Model. Closed loop

## HYLOOP+ Project

**HPPP 'High Pressure Piston Prover'**

Reference system with traceability to primary standards of length, national and international

Periodical calibration of working standards with HPPP and transfer standards for bootstrapping procedure

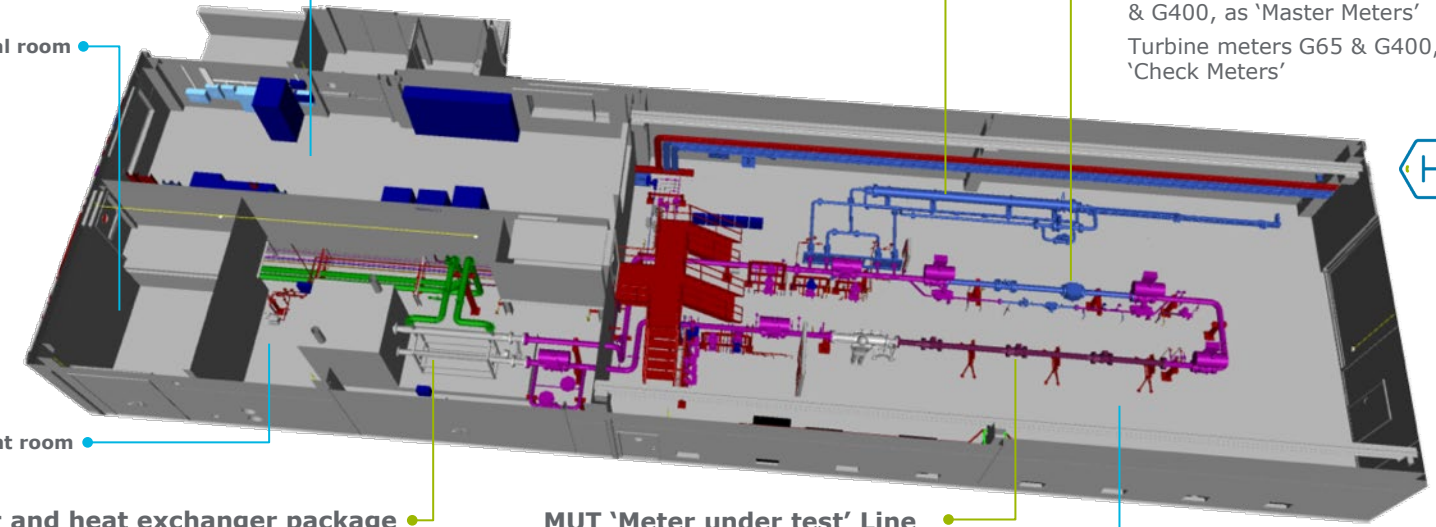
**Control room**

**Electrical room**

**Working standard meters**

Rotary displacement meters G65 & G400, as 'Master Meters'

Turbine meters G65 & G400, as 'Check Meters'



**Equipment room**

**Blower and heat exchanger package**

This package allows the fluid circulation in the loop with a stable temperature. Blower driven by an electric motor

**MUT 'Meter under test' Line**

Calibration up to 3 MUT in series from 2" (DN50) to 6" (DN150)

**Calibration room**

# Primary Reference System

## HYLOOP+ Project

- **Innovative and pioneering** development at **european and international level**.

- **The largest primary reference system in the world for hydrogen measurement** in pipeline transmission networks.

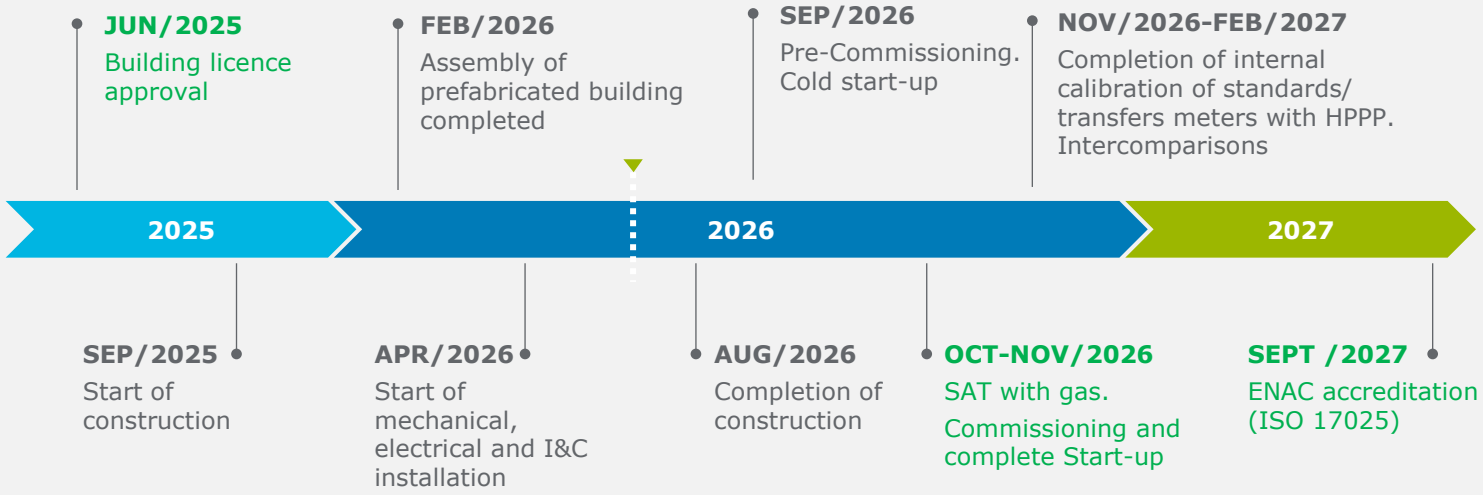
- Based on **High Pressure Piston Prover (HPPP) technology**, unprecedented for:
  - **Hydrogen** operation (previous experience for natural gas)
  - Operation at such **high pressure** (previous experience up to 65 bar)
  - Operation with **hydrogen, natural gas and mixtures**

- **Direct integration** in HYLOOP+ Laboratory, enabling Enagás to operate with the **lowest possible uncertainty** and **ensure metrological traceability**.

# Planning

## HYLOOP+ Project

### Construction and commissioning phases



# Construction progress

**HYLOOP+ Project**

- **Construction in progress** since September 2025


# Construction progress

**HYLOOP+ Project**

# Services

## HYLOOP+ Project

**From Feb/2027**
(before ISO 17025 Accreditation)

- **Interlaboratory comparison** (ILC) with other $H_2$ Laboratories
- **Participation in innovation projects** for $H_2$ metrology
- **Collaboration** with manufacturers / vendors / others for gas meters testing

**From sept 2027**
(after ISO 17025 Accreditation)

- **Gas meters calibration with competitive uncertainty** (accredited certificate)
  - **Lowest uncertainty in case of direct calibration with HPPP** (working standard meters of other laboratories, etc.)

### Enagás Metrology and Innovation Centre (CMI) / Central Laboratory

**Gas meters calibration Laboratories**

| | |
|---|---|
| **Air** | • Atmospheric pressure<br>• 5 - 10,000 $m^3/h$ *<br>• 2 - 24” meters |
| **NG** | • Up to 50 bar / 90 bar (≤ 650 $m^3/h$)<br>• 3 - 10,000 $m^3/h$ *<br>• 2 - 24” meters |
| **$H_2$** | • Up to 90 bar<br>• 3 - 650 $m^3/h$ *<br>• 2 - 6” meters |
| **HENG** (20% $H_2$) | • Up to 90 bar<br>• 3 - 650 $m^3/h$ *<br>• 2 - 6” meters |

* Flowrate in actual conditions

Thank you