Hydrogen injection to retrofit existing natural gas grid

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MOTIVATION AND SCOPE

In the hydrogen (H_2) supply chain, pipeline is considered the most attractive option for transporting over long distances. The most effective way to distribute H_2 and H_2-NG mixtures in the short term could be the utilization of the natural gas (NG) grid by strategically retrofitting the existing infrastructure. However, its suitability is a question to be addressed. The gap primarily lies on the lack of normative regulations for H_2 injection and of the experimental evaluations of the effect on the asset facilities. The THOTH2 "Novel methods of testing for measurement of natural gas and hydrogen mixtures" project focuses on the analysis of the metrological performances of the currently installed devices when operating with different H_2-NG blends. The consortium comprises five TSOs and DSOs, covering approximately 40% of the European transmission grid, along with research institutes and national metrological institutes.

METHODS

The core objective involves the development of specialized methodologies for testing various measuring devices installed in gas transmission and distribution grid in conjunction with an experimental campaign which aims to fill the experimental data shortage, particularly lacking in the TSO sector due to the large structures and pressures involved. Tens of measuring devices are currently under test across partner laboratories. The framework includes gas meters, pressure transmitters, trace waters, and leak detectors.

	Methodology steps
1.	*Definition of the state-of-the-art (SoA) of the installed metering devices by means of data provided by the industrial partners.*
2.	*Selection of samples for experimental testing according to their distribution, models, and underlying technologies.*
3.	*Development of test protocols through the knowledge of partners metrological institutes.*
4.	*Experimental activities across partner laboratories.*
5.	*Data processing to support an economic assessment for repurposing the existing gas grid.*

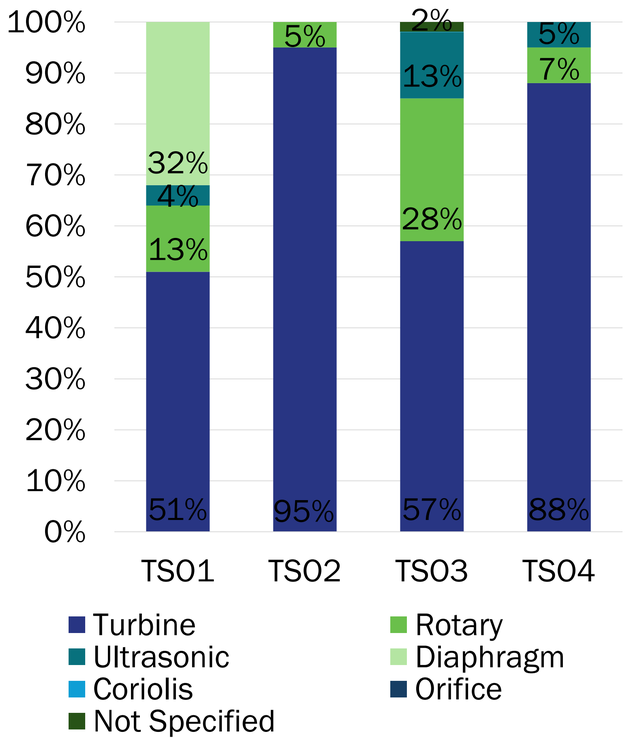
For a clear cost estimate for the natural gas grid retrofitting, the project aims to build upon and refine the previous industry evaluations. The most relevant analysis is a study achieved by Marcogaz association which reached a preliminary cost estimation of H_2 admission into the existing NG infrastructure. The investigation associated repurposing costs for different asset categories, addressing an analysis for various

CESAME calibration test bench

mixture concentrations. Despite the well-structured methodology, this approach does not rely on an extensive and robust dataset. The quantitative estimates provided lack strong reliable rigor, and in some geographical contexts, relevant data are missing. THOTH2 can help to address these limitations by leveraging a more accurate and comprehensive dataset about measuring instrument.

To quantify the costs related to the gas network, at least two aspects should be considered: the installation site, which affects excavation and material costs, and the connections to utilities and ancillary works. Furthermore, it is important to consider the behavior of the system: the presence of H_2 causes an increase in the volumetric flow rate, so it is necessary to evaluate the need for a change in the size of the meter.

PRELIMINARY RESULTS



Barriers and biases in metering devices have been identified, especially with respect to the regulatory framework for H_2 injection and the mixture concentrations that existing measuring instruments can accommodate. The overview of devices currently installed in the NG network displays that, for the transmission grid, turbine meters represent the most common metering technology, followed by rotary meters. In contrast, Coriolis meters are slightly employed in this sector.

Gathering direct information from producers regarding their compatibility with H_2, it was found that a good part have been tested with different concentrations. Turbine meter manufacturers reported suitability to H_2 mixture up to 20 %vol at least. A significant share of ultrasonic meter manufacturers claimed resistance to concentrations up to pure hydrogen.

CONCLUSION

The feasibility for H_2 injection in the existing NG grid passes through several aspects that need to be addressed. THOTH2 project intends to provide a technical support, dealing with the lack of deep experimental data on the behavior of measurement devices. It seeks to consider most of the existing technologies by conducting a testing campaign on instruments of different sizes and technologies, under concentrations of 25 and 100 %vol. of H_2 and with various operating pressures. In addition, it intends to exploit these data to refine the previous industry research cost estimate for the NG grid retrofitting.

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