OPTHYCS

OPTIC FIBRE-BASED HYDROGEN LEAK CONTROL SYSTEMS

Project ID	101101415
PRR 2025	Pillar 2 – H_2 storage and distribution
Call topic	HORIZON-JTI-CLEANH$_2$-2022-02-02
Project total cost	EUR 2 499 428.75
Clean H_2 JU max. contribution	EUR 2 499 428.75
Project period	01-01-2023 - 31-12-2025
Coordinator Beneficiary	ENAGAS TRANSPORTE SA, ES
Beneficiaries	GRTGAZ, FEBUS OPTICS, LUMIKER APLICACIONES TECNOLOGICAS SOCIEDAD LIMITADA, GERG LE GROUPE EUROPEEN DE RECHERCHES GAZIERES, FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON, FUNDACION TECNALIA RESEARCH and INNOVATION

https://opthycs.eu

PROJECT AND GENERAL OBJECTIVES

OPTHYCS aims to develop a new system for continuous leak detection based on optic fiber sensor technologies, ensuring the safety and sustainability of a hydrogen-based energy system. Acknowledging the critical need for effective leak detection methods in light of the environmental impact of hydrogen emissions, OPTHYCS introduces an innovative approach by developing a solution that includes cutting-edge coating materials for fibre Bragg gratings (FBGs) and the creation of a combined detection system merging FBGs with distributed acoustic and temperature-based detection technologies.

NON-QUANTITATIVE OBJECTIVES

The outcomes OPTHYCS are poised to significantly impact the field, offering safer and more reliable solutions for the hydrogen-based energy landscape.

PROGRESS, MAIN ACHIEVEMENTS AND RESULTS

Evaluation under laboratory conditions:

- Design baseline specifications and technical requirements for the H_2 sensing system were defined, in collaboration with all consortium partners, during the initial months of the project.
- Evaluation of FBG H_2 leak detection sensor prototypes under laboratory conditions.
- Ongoing assessment of H_2 sensor configurations.
- Development of coating materials for FBG sensors using advanced plasma techniques to ensure strong adhesion and enhanced hydrogen sensitivity.
- Initial evaluation of sensor configurations using Palladium and Tungsten Oxide, providing valuable insights for future prototype development and assessing the performance and adaptability of these materials in hydrogen detection applications.

Prototyping and manufacturing:

- Development and manufacturing of the first hydrogen leak detection sensor prototypes, exploring various coatings and configurations, and representing a significant advancement toward improving leak detection technology.

Development of a proof of concept and laboratory testing protocol:

- Establishment of protocols for proof of concept and laboratory tests to ensure proper control of critical variables such as humidity, temperature, and hydrogen concentration.
- A first field campaign in 2025, allowing for system optimisation, including the FBG interrogator and interpretative software. Subsequent field tests throughout 2025 will be crucial in assessing the system's performance and identifying the most efficient use cases within the H_2 industry.

FUTURE STEPS AND PLANS

- Ongoing optimisation of coating materials for FBG sensors using advanced plasma techniques.
- Laboratory tests enabling the evaluation of sensor responses under controlled environmental conditions, managing variables such as temperature, humidity, and hydrogen concentration.
- Development of FBG interrogators with focus on integrating optical components for signal amplification and testing configurations that enable a single interrogator to measure a large number of sensors. This breakthrough will significantly enhance the system's scalability while maintaining accuracy and response time.
- Multiple field campaigns throughout 2025 to further optimise the FBG sensors, interrogator, integration of various technologies, and final software solution. This marks the final stage of the OPTHYCS project, including validation of the combined H_2 detection system in predefined use cases, such as pipelines, flanges, valves, and an operational hydrogen refueling station.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives	Minimum leak concentration detected	%	0.4	
	Time of response	sec	30 (Max. response time of 1 sec at a concentration of 0.4% -vol.)	
	Detection threshold	ln/min	0.4 (blending operation) 1.2 in pure H_2)	
	Time of recovery	sec	20 – 60 (depending on application)	
	Potential interferences	-	The sensor's sensitivity to hydrogen is not affected by the presence of other gases.	

Clean Hydrogen Partnership
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