NHYRA

PRE-NORMATIVE RESEARCH ON HYDROGEN RELEASES ASSESSMENT

Project ID	101137770
PRR 2025	Pillar 5 - Cross-cutting
Call Topic	HORIZON-JTI-CLEANH$_2$-2023-05-03
Project Total Costs	2 086 683.75
Clean H$_2$ JU Max. Contribution	2 086 683.75
Project Period	01-01-2024 - 31-12-2026
Coordinator Beneficiary	SNAM S.P.A., IT
Beneficiaries	LINDE GMBH, NUOVO PIGNONE TECNOLOGIE SRL, ENAGAS TRANSPORTE SA, GERG LE GROUPE EUROPEEN DE RECHERCHES GAZIERES, EQUINOR ENERGY AS, INSTYTUT NAFTY I GAZU - PANSTWOWY INSTYTUT BADAWCZY, THE REGENTS OF THE UNIVERSITY OF CALIFORNIA, FONDAZIONE BRUNO KESSLER, NPL MANAGEMENT LIMITED, ENGIE, DEUTSCHES ZENTRUM FUR LUFT - UND RAUMFAHRT EV, UNIVERSITY OF SURREY, AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE, ALMA MATER STUDIORUM - UNIVERSITA DI BOLOGNA

https://nhyra.eu/

PROJECT AND GENERAL OBJECTIVES

Several studies and analyses indicate that by 2050 hydrogen will become a pillar of the energy system potentially accounting for up to 20% of global energy demand. As a result, anthropogenic hydrogen (H_2) emissions—which have an indirect impact on the greenhouse effect—are also expected to increase.

Furthermore, there are currently large uncertainties regarding both the total amount of hydrogen that will be released from the H_2 value chain, and the climate effect of the hydrogen released in the atmosphere.

The general objective of NHyRA is to perform an assessment of potential H_2 releases along the entire H_2 value chain. In particular, the project aims to:

- Fill the critical knowledge gaps regarding technologies, methodologies and protocols for detecting and quantifying the H_2 releases.
- Develop H_2 release scenarios that will allow for the identification of the most critical elements of the H_2 value chain in terms of emissions.
- Propose mitigation strategies, guidelines and recommendations for standardisation bodies in order to support the definition of a dedicated normative framework.

NON-QUANTITATIVE OBJECTIVES

- To increase knowledge, foster collaboration, and support standardisation bodies and policy makers.
- To enhance understanding of hydrogen (H_2) releases across its value chain, facilitating informed decision-making among policymakers, stakeholders, and industries.
- To support the development of regulations, codes, and standards (RCS) related to hydrogen technologies and systems, ensuring safer and more efficient deployment.
- To promote open science, dissemination of research findings, and engagement with stakeholders to maximise the project's impact beyond its direct technical goals.

PROGRESS, MAIN ACHIEVEMENTS AND RESULTS

Insights into hydrogen supply chain dynamics and emissions inventory.

- Archetypes of the H_2 supply chain have been identified, detailing its components, operational conditions, and potential emission sources.
- Technologies with a readiness level above 6 have been evaluated through desk research and experts' input, focusing on parameters such as pressure and temperature.
- A report has been submitted covering a detailed dataset on primary technologies, pinpointing hydrogen losses and emissions.
- A report has been submitted addressing the data gap concerning hydrogen's environmental impact by developing a comprehensive emissions inventory. Leveraging natural gas (NG) methodologies, it categorises emissions into fugitives, vented, and incomplete combustion, facilitating scenario analyses and mitigation strategies. This inventory will be continuously updated throughout the NHyRA project to enhance data accuracy and standardisation.
- Advancing methodologies for quantifying hydrogen releases have been investigated.
- A report has been submitted identifying and evaluating hydrogen detection and measurement technologies, including both commercial and emerging solutions. The report establishes criteria for selecting and validating monitoring methods, defines data quality metrics, and sets reporting standards. Additionally, it provides a comparative analysis of existing techniques, highlighting their strengths and limitations, and concludes with a review of commercially available instruments.
- The first priority list of the most critical elements is about to be released.
- A qualitative multi-criteria approach has been developed to prioritise these elements across the value chain. To this end, different methodologies were compared, and all partners contributed through interviews, surveys, and other participatory methods.

FUTURE STEPS AND PLANS

- The first version of a hydrogen release inventory was accomplished, which is the core element of the NHyRA project.
- Once the most critical units processes of the H_2 value chain, in terms of H_2 release, have been identified, dedicated methodologies will be developed to determine suitable techniques and instruments for the detection and measurement of hydrogen leakages.
- Measurement-based methods will be developed for detecting and quantifying H_2 emissions, considering both fugitive and vented emissions, but also calculation-based methods will be defined in order to estimate the hydrogen emissions when

PRR 2025 PILLAR
Cross-cutting

Clean Hydrogen Partnership
Co-funded by the European Union

direct measurement will be too complicated or even not possible (for example in cases of accidents or unburned fuel).

- The methodologies developed will be tested for validation, both in laboratories and in real cases, and these experimental data collected will also feed the hydrogen release inventory.
- The total potential H_2 releases will be quantified along the different H_2 supply chains and mitigation strategies will be developed.
- H_2 releases scenarios will be developed, including different H_2 supply chains, considering different time horizons.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?
Project's own objectives	Workshop for H_2 Production, 1 brochure with overview of H_2 leakage in production.	Number	1	-	
	Workshop for H_2 transport and storage, 1 brochure with overview of H_2 leakage in TandS.	Number	1	-	
	Workshop for H_2 end-use, 1 brochure with overview of H_2 leakage in end-use.	Number	1	-	
	Engagement with EU/national association.	Number	2	1	
	Dissemination in Clean Hydrogen Mission countries and universities from at least 9 countries.	Number	9	7	
	Workshop presenting results relevant to policy makers.	Number	1	-	
	Number of archetype technologies assessed in terms of H_2 releases and implemented into the simulation tool.	Number/ project	12	-	
	Measurement-based methods for detecting hydrogen emissions from individual elements of the value chain.	Number/ project	2	-	
	Measurement-based methods for quantifying fugitive or vent emissions for point or subarea sources.	Number/ project	2	-	
	Participation in 1 conference on energy markets/finance to engage financial stakeholders.	Number	1	-	
	Presentation at a suitable measurement related conference e.g CEM.	Number	1	-	
	At least 2 meetings with standardisation committees.	Number	2	-	
	Methods for estimating the amount of hydrogen emissions, from incomplete combustion, accidents, hard-to-measure sources using calculation-based methods.	Number/ project	18	-	
	Number of assessed hydrogen economy scenarios in terms of overall emissions from mitigated and unmitigated operating regimes.	Number/ Project	3	A selection will be performed on the basis of geographical boundaries and technological categorisation.	
	Prioritization of the critical elements for the detection and/or estimation of H_2 releases.	Number/ project	1	-	
	H_2 releases of H_2 economy scenarios and effects of mitigation actions.	Number/ project	1	-	
	H_2 supply chains' unit processes review.	Number/ project	1	1 Review of the main technologies related to H_2 production, transportation, storage and utilisation.	
	H_2 Release Inventory	Number/ project	1	1 First version issued to be updated continuously until the end of the project through literature review and surveys to industrial stakeholders.	✓
	Invitation to the Advisory Board: providers of H_2 detection technol. and equip. manufacturers.	Number	1	1	
	Communication toolkit tailored to non-technical audience.	Number	1	1	