

EGHOST

ESTABLISHING ECO-DESIGN GUIDELINES FOR HYDROGEN SYSTEMS AND TECHNOLOGIES



Project ID	101007166
PRR 2025	Pillar 5 - Cross-cutting
Call Topic	FCH-04-3-2020
Project Total Costs	1 133 541.25
Clean H ₂ JU Max. Contribution	998 991.25
Project Period	01-01-2021 - 31-05-2024
Coordinator Beneficiary	Fundacion IMDEA Energia, ES
Beneficiaries	SYMBIO, SYMBIO FRANCE, THE INSTITUTE OF APPLIED ENERGY, FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON, UNIVERZA V LJUBLJANI, COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES

<https://eghost.eu/>

PROJECT AND GENERAL OBJECTIVES

eGHOST aims to establish the first milestone in the development of eco-design criteria in the European hydrogen sector by providing a framework for the eco-(re)design of mature and emerging products and by promotion of fuel cell hydrogen (FCH) technologies as a sustainable investment.

Two guidelines for specific fuel cell hydrogen (FCH) products will be prepared and the lessons learnt will be integrated into the eGHOST white book; a reference guidance book for any future eco-design project on FCH systems. It addresses the eco(re)design of mature products (proton-exchange membrane fuel cells) and those emerging with low technology readiness levels (solid oxide electrolyzers) in such a way that sustainable design criteria can be incorporated from the earliest stages of product development.

Moreover, eGHOST will contribute to positioning FCH as a sustainable investment by developing the first preparatory study of a hydrogen product under the guiding principles of the Eco-design Directive.

NON-QUANTITATIVE OBJECTIVES

- eGHOST aimed to contribute to FCH systems' sustainability; eco-designed products will improve their sustainability performance.
- eGHOST aimed to contribute to social acceptance; sustainable products are better accepted by end users and stakeholders, including civil society.

PROGRESS, MAIN ACHIEVEMENTS AND RESULTS

Two guidelines for specific FCH products (proton-exchange membrane fuel cells (PEMFC) and solid oxide electrolysis cell (SOEC) stacks) have been completed and the lessons learnt were integrated into the eGHOST White Book, a reference guidance book for any future eco-design project of FCH systems. Achievements included:

- Life cycle sustainability assessment of a PEMFC and SOEC stack.
- Evaluation of the PEMFC stack in accordance with the EU eco-design directive.
- Proposal for alternative design concepts for both PEMFC and SOEC stacks from a sustainability perspective.
- Prioritisation of product concepts as a function of the impact reduction goals.
- Issuing of methodological and technical eco-design guidelines for both PEMFC and SOEC stacks.

eGHOST has improved the understanding of FCH technologies as a sustainable investment under the EU Taxonomy. In addition, eGHOST has pioneered the development of a social life cycle assessment in hydrogen-related projects looking at sustainable-by-design technologies that minimise environmental, economic and social impacts from the product-design phase.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?	SoA result achieved to date (by others)	Year for reported SoA result
Project's own objectives	Eco-design guidelines	Number	2	2	✓	N/A	N/A
	Cumulative environmental reduction	%	10	37-86 depending on product concept		18-44% carbon footprint reduction	2013
	Cumulative cost reduction	%	3	28-52 depending on product concepts		from 2.6 % reduction to 46% increment	2013
	Eco-efficiency improvement	%	10	>100 for all product concepts		N/A	N/A

ELVHYS

ENHANCING SAFETY OF LIQUID AND VAPORISED
HYDROGEN TRANSFER TECHNOLOGIES IN PUBLIC
AREAS FOR MOBILE APPLICATIONS



Project ID	101101381
PRR 2025	Pillar 5 - Cross-cutting
Call Topic	HORIZON-JTI-CLEANH ₂ -2022-05-02
Project Total Costs	1 433 960.00
Clean H ₂ JU Max. Contribution	1 433 960.00
Project Period	01-01-2023 - 31-12-2025
Coordinator Beneficiary	NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET NTNU, NO
Beneficiaries	KARLSRUHER INSTITUT FUER TECHNOLOGIE, HEALTH AND SAFETY EXECUTIVE, UNIVERSITY OF ULSTER, L AIR LIQUIDE SA, NATIONAL CENTER FOR SCIENTIFIC RESEARCH "DEMOKRITOS", DEUTSCHES ZENTRUM FUR LUFT - UND RAUMFAHRT EV, ALMA MATER STUDIORUM - UNIVERSITA DI BOLOGNA

<https://elvhys.eu/>

PROJECT AND GENERAL OBJECTIVES

ELVHYS addresses a critical gap in international standards related to liquid and cryogenic hydrogen transferring technologies for mobile applications such as filling trucks, ships, and stationary tanks. Since there is limited experience in this area today, significant challenges for safety and efficiency in hydrogen transfer operations exist. ELVHYS has the overarching objective to develop inherently safer and more efficient liquid and cryogenic hydrogen technologies and protocols for mobile applications.

This objective is pursued through innovative safety strategies and engineering solutions, including the selection of effective safety barriers and hazard zoning strategies. The project utilises an interdisciplinary approach, combining experimental, theoretical, and numerical studies to address various aspects of liquid and cryogenic hydrogen transfer.

Key objectives of the ELVHYS project include:

- Providing a comprehensive report on the state-of-the-art of cryogenic hydrogen transfer operations, including knowledge gaps, international standards, regulatory challenges, and safety strategies.
- Identifying hazards and incident scenarios associated with cryogenic hydrogen transferring operations and prioritising areas with the highest risk and least knowledge.
- Conducting experimental campaigns to investigate cryogenic hydrogen transfer operations and associated phenomena, such as releases, fires, and explosions.
- Developing and validating numerical simulation models for cryogenic hydrogen transfer operations and mitigation techniques.
- Proposing innovative safety strategies and engineering solutions based on experimental and modelling results.
- Disseminating project results to the fuel cell and hydrogen community, including authorities, standard development organisations,

and other stakeholders.

- Contributing to the development of international standards for cryogenic hydrogen transferring technologies.

These objectives are achievable thanks to the expertise and resources of the consortium members, who possess unique experimental facilities, theoretical and numerical research capabilities, and practical experience in hydrogen safety. ELVHYS aims to not only fill existing knowledge gaps but also to lay the groundwork for sustainable impact through continued collaboration and dissemination beyond the project duration. By addressing these objectives, ELVHYS seeks to significantly enhance the safety and efficiency of cryogenic hydrogen transferring technologies on a global scale.

NON-QUANTITATIVE OBJECTIVES

ELVHYS will contribute to many objectives of the Clean Hydrogen JU SRIA such as (i) increase the level of safety and (ii) support the development of regulations, codes and standards (RCS) for hydrogen technologies and applications.

- Increasing the safety level of hydrogen technologies and applications is the cornerstone of the ELVHYS project. It will be addressed through top-edge research that closes numerous knowledge gaps in the understanding of the underlying physical phenomena governing liquid hydrogen transfer, specifically heat and mass transfer at cryogenic temperatures and under multiphase flow conditions. The project will advance the state-of-the-art through the generation of new knowledge, the development of innovative prevention and mitigation strategies, and the proposal of risk-informed recommendations and guidelines for cryogenic hydrogen transfer technologies.
- Supporting the development of RCS for hydrogen technologies and applications, with the focus on standards that will be



addressed through the developed science-based recommendations for RCS, beyond the state-of-the-art guidelines on fuelling, bunkering and transfer procedures.

PROGRESS, MAIN ACHIEVEMENTS AND RESULTS

Key Achievements of ELVHYS in the field of cryogenic and liquid hydrogen (LH₂) transfer technologies are:

- Operational insights and best practices: Extensive data collection from existing LH₂ facilities helped define best practices and establish a baseline for safe and effective transfer operations.
- Ecosystem Mapping: A comprehensive overview of the LH₂ transfer infrastructure, technologies, and applications was developed.
- System Design & Safety Devices: Detailed Piping and Instrumentation Diagrams (P&IDs) were created, along with an inventory of current safety devices used in LH₂ systems.
- Safety-Focused Research Programme: A dedicated research plan was established to address safety challenges specific to LH₂ transfer systems.
- Risk Analysis & Methodological Review: Initial risk analyses were conducted, and gaps in existing safety approaches were identified for further investigation.
- Regulations, Codes, and Standards (RCS): A complete list of relevant RCS and regulatory bodies was compiled to ensure alignment with international safety standards.

- Fire & Explosion Modelling Support: Computational models were selected to simulate fire and explosion scenarios, aiding in hazard assessment and mitigation planning.
- LH₂ Transfer Modelling Tools: Engineering tools were developed to simulate LH₂ transfer processes, which will be validated through physical tests.
- Experimental Testing:
 - Successful tests in November 2024 on (i) Condensed phase explosion scenarios and (ii) LH₂ release into cold environments.
 - Experimental setups for (i) Fire and BLEVE (Boiling Liquid Expanding Vapor Explosion) tests on LH₂ hoses; (ii) Material resistance tests under LH₂ jet impingement.
 - Transfer System Test Readiness: LH₂ transfer experimental setups were designed and reviewed, with readiness assessments ensuring test safety and effectiveness.
- Hazard Identification & Consequence Analysis: Comprehensive hazard assessments were completed, and preliminary consequence analyses were performed for selected LH₂ transfer scenarios.

FUTURE STEPS AND PLANS

ELVHYS aims to provide a supportive regulatory and standardisation framework.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?	SoA result achieved to date (by others)	Year for reported SoA result
Project's own objectives	Safety, PNR/RCS Workshops	Number/year	2	2	✓	1	2020
	Impact on standards at scope	Number/project	1	0.6	⚙️	0.6	2020

E-SHYIPS

ECOSYSTEMIC KNOWLEDGE IN STANDARDS FOR HYDROGEN IMPLEMENTATION ON PASSENGER SHIP



Project ID	101007226
PRR 2025	Pillar 5 - Cross-cutting
Call Topic	FCH-04-2-2020
Project Total Costs	2 500 000.00
Clean H ₂ JU Max. Contribution	2 500 000.00
Project Period	01-01-2021 - 31-12-2024
Coordinator Beneficiary	POLITECNICO DI MILANO, IT
Beneficiaries	DAMEN RESEARCH DEVELOPMENT and INNOVATION BV, DAMEN GLOBAL SUPPORT BV, IDF - INGEGNERIA DEL FUOCO SRL, LEVANTE FERRIES NAFTIKI ETAIREIA, DIMOS ANDRAVIDAS-KYLLINIS, ATENA SCARL - DISTRETTO ALTA TECNOLOGIA ENERGIA AMBIENTE, TEKNOLOGIAN TUTKIMUSKESKUS VTT OY, GHENOVA INGENIERIA SL, UNI - ENTE ITALIANO DI NORMAZIONE, DNV HELLAS SINGLE MEMBER SA, OY WOIKOSKI AB, SCHEEPSWERF DAMEN GORINCHEM BV, DANAOS SHIPPING COMPANY LIMITED, Proton Motor Fuel Cell GmbH, CINECA CONSORZIO INTERUNIVERSITARIO, UNIVERSITA DEGLI STUDI DI NAPOLI PARTHENOPE, AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE

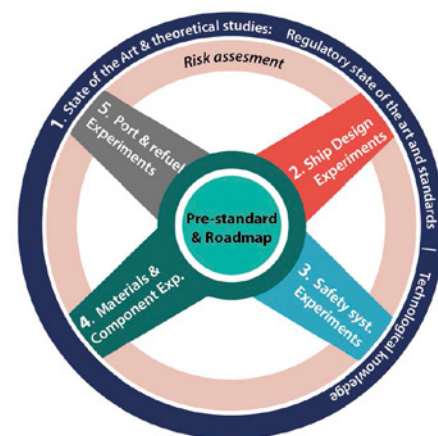
<https://e-shyips.com/>

PROJECT AND GENERAL OBJECTIVES

Hydrogen is considered an option for reaching emission reduction targets; however, a regulatory framework applicable to hydrogen-fuelled ships is not yet available. e-SHYIPS brings together hydrogen and maritime stakeholders to gather new knowledge based on a regulatory framework review and experimental data. The approach is vessel independent, and is focused on the risk and safety assessment methodologies. e-SHYIPS will define a pre-standardisation plan for an update of the International Code of Safety for Ships using Gases or other Low-flashpoint Fuels for hydrogen-based-fuels passenger ships and a roadmap to boost the hydrogen maritime economy.

NON-QUANTITATIVE OBJECTIVES

- e-SHYIPS aims to define project concept functional scenarios. In close cooperation with its industrial maritime partners, the technical and functional requirements of hydrogen-based-fuels passenger ships will be elicited in operational profile scenarios.
- Use cases for vessel design will be defined in line with the requirements of industrial maritime partners and the stakeholders.
- e-SHYIPS aims to determine vessel scenario and bunkering functional and technical requirements. The functional and technical requirements of hydrogen-based-fuels passenger ships, which are meant for a scenario report, were elicited from operational profile scenarios. The technical features will be described for the associated subsystem (e.g. pumps, hoses, etc.). The metrics and safety-related analyses to be conducted will be communicated and specified for the purposes of the risk assessment process. Operational features, such as bunkering procedures and hydrogen fuel conditions, will also be described, defining the limits for the scope of the analysis.
- e-SHYIPS aims to determine risk and safety best practices for the maritime sector. Therefore e-SHYIPS will report on technical knowledge gaps and models for risk assessment



and risk management of gaseous hydrogen and liquid hydrogen, and hydrogen-based alternative fuels on ships, in 2024.

PROGRESS, MAIN ACHIEVEMENTS AND RESULTS

- The analysis of emergency hydrogen discharge or major leaks from the vessel focusing on piping/venting mast arrangements for emergency hydrogen discharge, and the dispersion of hydrogen outside the ship.
- The guidelines for ship design and operation regarding emergency hydrogen discharge for different types and sizes of vessels and hydrogen storages.
- Fuel cell stack inclination testing (IR).
- Fuel cell salt spray testing.
- HAZID Analysis for Gas Compressed Hydrogen.
- Safety System Review.
- HAZID Analysis for Liquid Hydrogen.
- Explosion Risk Assessment.
- Testing of new forcing/damping methods in OpenFOAM.
- Optimisation of mesh focused on seakeeping.
- Validation of zero hull velocity wave-hull interaction simulation (LINCOSIM).
- Test of new LincoSim production web application to external expert users.

FUTURE STEPS AND PLANS

- e-SHyIPS will continue to develop the hydrodynamic analysis. Implementation on the LINCOSIM platform using the updated mesh and wave-hull interaction simulation.
- The safety assessment for each vessel design for each scenario is completed.
- The H₂-based fuel bunkering systems basic design technical report has been completed.

- On-board H₂ dispersion and explosion model test
 - Test results from material and component testing and postmortem analysis are expected
- Initial results for the fuel delivery and bunkering solutions for ships are expected

PROJECT TARGETS

Target source	Parameter	Achieved to date by the project	Target achieved?
Project's own objectives	Constant operation of stack possible	-	✓
	To find materials which do not induce additional degradation to fuel cell compared to baseline	Certain EPDM materials identified which may be suitable for cathode side	
	Performance degradation (potential loss at constant current) (mV)	-10 to -20 mV (during UI curve) -13 mV during continuous operation	
	Generate new and missing knowledge to define a standardised knowledge database	150 Gaps in existing knowledge identified (literature) 90 gaps in IGF Code identified (35 matched to existing hydrogen standards)	
	Propose a pre-standardisation plan for IGF	Pre-normative plan for H ₂ applications to passenger ships included in CWA WSESH001:2024 "e-Ships"	
	Hydrogen-based fuels adoption roadmap definition for passenger ships	-	

HYACADEMY.EU

THE EUROPEAN HYDROGEN ACADEMY



Project ID	101137988
PRR 2025	Pillar 5 - Cross-cutting
Call Topic	HORIZON-JTI-CLEANH ₂ -2023-05-02
Project Total Costs	2 987 233.75
Clean H ₂ JU Max. Contribution	2 987 233.75
Project Period	01-01-2024 - 30-06-2028
Coordinator Beneficiary	VYSOKA SKOLA CHEMICKO-TECHNOLOGICKA V PRAZE, CZ
Beneficiaries	RIJKSUNIVERSITEIT GRONINGEN, Future.Solutions Sàrl, BERTZ ASSOCIATES LTD, TECHNOKRATI LTD, KIC INNOENERGY SE, FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON, EUREC EESV, DVGW DEUTSCHER VEREIN DES GAS- UND WASSERFACHES - TECHNISCH-WISSENSCHAFTLICHER VEREIN EV, UNIVERSITE DE TECHNOLOGIE DE BELFORT - MONTBELIARD, UNIVERSITA DEGLI STUDI DI MODENA E REGGIO EMILIA, UNIVERSITATEA POLITEHNICA DIN BUCURESTI, TRAKIYSKI UNIVERSITET, UNIVERSITY OF ULSTER, THE UNIVERSITY OF BIRMINGHAM, POLITECNICO DI TORINO, UNIVERSITE LIBRE DE BRUXELLES

<http://www.hyacademy.eu>

PROJECT AND GENERAL OBJECTIVES

HyAcademy.EU will coordinate and support the delivery of hydrogen education and training across a network of over 600 educational institutions, providing education to over 5 000 individuals and tens of thousands of school children and young adults. It will also establish a network of more than five joint training laboratories for hydrogen technologies.

HyAcademy.EU will capitalise on the European Commission and Member States' investments in education and training activities. The consortium brings together representatives from multiple projects, enabling previous outputs to be consolidated and exploited, maximising the Academy's impact and reach.

To realise its objectives, by the project midterm, the European Hydrogen Academy aims to:

- Build and sustain a network of over 100 universities (the 'Network 100') offering recognised qualifications, specialisations, and degrees in hydrogen technologies.
- Build and sustain a network of over 500 schools integrating hydrogen topics into their science teaching, including technical schools and colleges offering more specific technical training.

- Create a network of five hands-on, physical training laboratories.
- Offer a portal to showcase and link the educational programmes available in the network and beyond, in order to supply prospective trainees with accurate and detailed information on training and career opportunities, allowing them to access documents focused on hydrogen topics at least 100 000 times.
- Provide lecturers and teachers with free training materials in all EU languages to enable educational staff to deliver the vast body of educational measures necessary.
- Develop and integrate novel (online) teaching methodologies into university, college and school curricula, and train educational staff to successfully employ these.
- Create and implement an organisational structure and a successful business case allowing for the the post-funding continuation of the project activities establishing a European Hydrogen Academy spanning all levels and types of education and training.

HyAcademy.EU will considerably contribute to the EU goals of offering access to high-quality education, supporting the creation of a highly-skilled workforce and more and better jobs





in the European hydrogen industry. Through the school activities it will foster public awareness and acceptance of hydrogen technologies.

PROGRESS, MAIN ACHIEVEMENTS AND RESULTS

- Universities, technical schools, training institutions, and schools are currently being contacted for information.
- Around 80 programmes and activities have been recorded in the web-based database.
- Network membership is being offered.
- Tables of content and authors have been compiled and identified for a series of 12 textbooks on Fuel cell hydrogen technologies (FCHT).

FUTURE STEPS AND PLANS

- First textbooks to be completed by December 2025.
- Growing networks and establishing the business entity to continue work beyond June 2028.
- Building the databases.
- Building an industry network.
- Trialing the Net-Zero Hydrogen Academy pilot on the KIC Skills Institute site.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?
Project's own objectives	Schools network (Network500)	Number	500	100	
	Network of universities (Network100)		105	70	
	Pupils trained		5 000		
	Social media followers		3 500	120	
	Training lab network		5	6	
	Access to project web site		100 000	1 000	
	Platform users		5 000	50	

HYPEF

PROMOTING AN ENVIRONMENTALLY-RESPONSIBLE HYDROGEN ECONOMY BY ENABLING PRODUCT ENVIRONMENTAL FOOTPRINT STUDIES



Project ID	101137575
PRR 2025	Pillar 5 - Cross-cutting
Call Topic	HORIZON-JTI-CLEANH ₂ -2023-05-01
Project Total Costs	1 499 431.25
Clean H ₂ JU Max. Contribution	1 499 431.25
Project Period	01-01-2024 - 31-12-2026
Coordinator Beneficiary	Fundacion IMDEA Energia, ES
Beneficiaries	ECOINNOVAZIONE SRL, ADVANCED ENERGY TECHNOLOGIES AE EREUNAS and ANAPTYXIS YLIKON and PROIONTONANANEOSIMON PIGON ENERGEIAS and SYNAFON SYMVOULEFTIKON Y PIRESION, EIFER EUROPAISCHES INSTITUT FUR ENERGIEFORSCHUNG EDF KIT EWIV, HEXAGON PURUS GMBH, ISTITUTO DI STUDI PER L'INTEGRAZIONE DEI SISTEMI (I.S.I.S) - SOCIETA'COOPERATIVA, ENGIE, AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE

<https://www.hypef.eu/>

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives	Set of policy recommendations based on the interplay between FCH-PEFCRs and RCS	Number	1	
	Sets of drafted FCH-PEFCRs	Number	3	
	Life-cycle environmental profiles calculated for FCH products	Number	12	
	LCIs ready for implementation in the LCDN	Number	12	
	List of FCH product categories	Number	1	✓

PROJECT AND GENERAL OBJECTIVES

Fuel cells and hydrogen (FCH) systems are increasingly considered in energy and climate policies, roadmaps and plans all over the world. In order to avoid past criticalities, such as those leading to a climate emergency situation, sustainability criteria are being progressively implemented in these initiatives, for example, by promoting low-carbon renewable hydrogen in Europe. In this regard, science-based criteria and procedures are required to guarantee the environmental suitability of FCH products, reporting their life-cycle environmental profile according to the principles of transparency, traceability, reproducibility, and consistency for comparability. While these principles are aligned with those of the general methodological guidance for product environmental footprint (PEF) studies, further specification is required to effectively implement them when addressing FCH products. Hence, the HyPEF project aspires to support and promote the establishment of an environmentally-responsible hydrogen economy by developing and testing the first product environmental footprint category rules (PEFCRs) specific to FCH products, while paving the way for subsequent related initiatives in the FCH sector.

NON-QUANTITATIVE OBJECTIVES

HyPEF advancements are expected to have a very large international impact as they will enable similar future PEF initiatives dealing with FCH product categories other than those addressed in HyPEF.

PROGRESS, MAIN ACHIEVEMENTS AND RESULTS

The interdisciplinary approach behind HyPEF leads to crucial advancements regarding (i) the first development and application of well-accepted PEFCRs tailored to three selected FCH product categories (electrolysers for hydrogen production, tanks for hydrogen storage, and hydrogen fuel cells intended for electricity production), (ii) increased high-quality data availability for consistent environmental assessment and benchmarking of FCH products, and (iii) the first product environmental footprint-oriented policy recommendations regarding the official qualification of an FCH product as an environmentally-responsible investment.

FUTURE STEPS AND PLANS

HyPEF started in January 2024. During the first year of the project, scientific efforts focused on preparing the ground for FCH-PEFCRs by analysing relevant existing product environmental footprint (PEF) category rules (CRs) and exploring FCH systems for product categorisation. Moreover, the HyPEF Advisory Working Group and the Stakeholder Platform were set up. HyPEF efforts also address the definition and screening of the PEF for three representative products, and the management of the FCH-PEFCRs development process.

HYPOP

HYDROGEN PUBLIC OPINION AND ACCEPTANCE



Project ID	101111933
PRR 2025	Pillar 5 - Cross-cutting
Call Topic	HORIZON-JTI-CLEANH ₂ -2022-05-01
Project Total Costs	1 062 755.00
Clean H ₂ JU Max. Contribution	1 062 754.50
Project Period	01-06-2023 - 30-09-2025
Coordinator Beneficiary	PARCO SCIENTIFICO TECNOLOGICO PER L'AMBIENTE ENVIRONMENT PARK TORINO SPA, IT
Beneficiaries	CLUSTER TWEED, BALKANSKI VODORODEN KLASER, REGIONALNA IZBA GOSPODARCZA POMORZA, INSTITUTE FOR METHODS INNOVATION, CLUSTER TECHNOLOGIES WALLONNE ENERGIE - ENVIRONNEMENT ET DEVELOPPEMENT DURABLE, CENTRO NACIONAL DE EXPERIMENTACION DE TECNOLOGIAS DE HIDROGENO Y PILAS DE COMBUSTIBLE CONSORCIO, Fundacion IMDEA Energia, AGENZIA PER LA PROMOZIONE DELLA RICERCA EUROPEA

<http://www.hypop-project.eu/>

PROJECT AND GENERAL OBJECTIVES

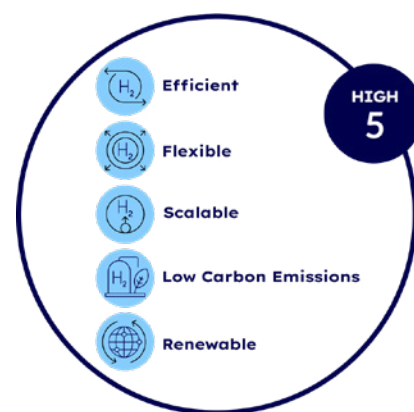
HYPOP will support hydrogen deployment in Europe by enhancing the involvement of citizens and providing guidelines to increase trust in hydrogen implementation. Clear communication will be key to hydrogen technological development with social acceptance. HYPOP's overall objective is to raise public awareness of and trust in hydrogen technologies and their systemic benefits, through: (i) the preparation of guidelines and good practices that will help to define more effectively how citizens, consumers/end-users and stakeholders can be involved in the implementation of H₂ technologies, and (ii) the creation of a web platform collecting communication material (mainly videos) on new hydrogen technologies, developed based on early findings of public engagement activities. HYPOP will focus on two applications of hydrogen technologies that will enter people's daily life, residential and mobility.

NON-QUANTITATIVE OBJECTIVES

- An assessment of current public opinion on hydrogen technologies will be undertaken resulting in a final scientific paper to share with the stakeholders and the scientific community.
- HYPOP will improve the availability of information, citizens' understanding of their own roles in hydrogen implementation and their ability to understand the topic of hydrogen and develop their own opinions on it and the transition strategy. Part of the information will come from the stakeholders' consultation and direct involvement in HYPOP.

PROGRESS, MAIN ACHIEVEMENTS AND RESULTS

- Analysis of Member States' H₂ strategies to assess hydrogen implementation in Europe. The analysis also focuses on hydrogen-related public engagement activities at the national, regional and local levels (projects and hydrogen valleys).



- Analysis of survey data and public perceptions. Secondary data analysis of the Public Opinion Survey (Clean Hydrogen Partnership Joint Undertaking, May 2023) and state-of-the-art analysis of public perceptions, and reactions to hydrogen and fuel cell technologies are ongoing.
- Analysis of public engagement with H₂ via social media across the EU. This included the identification of the main individual-level determinants of public understanding and acceptance of FCH technologies.
- Stakeholders' requirements for H₂ technology installation. These are mainly permit-issuing, certification and safety requirements.
- Development of public information and engagement strategies as part of the hydrogen communication plan targeting decision-makers, industry stakeholders, and the general public.
- Local and international workshops to introduce the hydrogen systems potential and their applications to citizens.
- Local and international workshops to discuss permitting and safety procedures all over Europe, involving institutions and industry.



- Finalisation of FCH tailored social life cycle assessment (SLCA) approach to support decision-makers into the hydrogen systems implementation considering socio-environmental dimensions.
- Launch of the digital H₂ projects showcase to show hydrogen technology installation evidences and their application in industrial cases or real-life situation, such as hydrogen refueling station (HRS) and mobility-synergic collaborations and meetings with over 30 EU Projects (e.g. hydrogen valleys, demo projects, Interreg Projects).

FUTURE STEPS AND PLANS

- Citizens' engagement workshops in each of the HYPOP countries (Italy, Spain, Belgium, Poland, Bulgaria, Ireland) and two international events to inform citizens about

the project and increase public trust in H₂ implementation.

- Stakeholders' engagement workshops in each of the HYPOP countries (Italy, Spain, Belgium, Poland, Bulgaria, Ireland) to report the results from the requirement lists for permit issuing, safety and certification analysis.
- One public-oriented guideline reporting best practices to involve citizens.
- Three guidelines collecting the results coming from the involvement of stakeholders' groups (first responders, permitting authorities, certification bodies).
- A web platform gathering information on hydrogen projects and related initiatives.
- Videos and infographics to support the HYPOP hydrogen awareness campaign.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives	Number and type of target groups engaged.	Number	> 3 target groups reached/country across the 6 HYPOP countries (including 1 industrial group)	
	Trained professionals in TIER 2 (Belgium, Netherlands, Austria, Sweden, Norway, Finland, Latvia, Spain and Italy).	Number	> 50	
	Trained professionals in TIER 3 countries: rest of EU countries and associated countries.	Number	>30	

JUST-GREEN AFRH2ICA

PROMOTING A JUST TRANSITION TO GREEN HYDROGEN IN AFRICA



Project ID	101101469
PRR 2025	Pillar 5 - Cross-cutting
Call Topic	HORIZON-JTI-CLEANH ₂ -2022-05-05
Project Total Costs	999 995.00
Clean H ₂ JU Max. Contribution	999 995.00
Project Period	01-02-2023 - 31-01-2025
Coordinator Beneficiary	UNIVERSITA DEGLI STUDI DI GENOVA, IT
Beneficiaries	TEKNOLOGIE SOLUTIONS LIMITED, AFRICAN HYDROGEN PARTNERSHIP, IMPACT HYDROGEN B.V., STAM SRL, BLUENERGY REVOLUTION SCRL, INSTITUT DE RECHERCHES EN ENERGIE SOLAIRE ET ENERGIES NOUVELLES, STRATHMORE UNIVERSITY, ARTELYS, Fundacion IMDEA Energia, NOORDWES-UNIVERSITEIT, FORSCHUNGSZENTRUM JULICH GMBH, COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES

<https://just-green-afrh2ica.eu/>

PROJECT AND GENERAL OBJECTIVES

JUST GREEN AFRH2ICA aims to develop a green hydrogen just transition roadmap that would make African-European transition pathways to H₂ synergic, sustainable (from environmental and social points of view), while avoiding any new EU hydrogen colonisation of Africa, and promoting a mutually beneficial collaboration between the two continents for the development of independent and collaborative hydrogen economies, research and development ecosystems and value chains. To do so, JUST GREEN AFRH2ICA has involved key partners from both the EU and African Union (AU) sides, such as the African Hydrogen Partnership (AHP) and Hydrogen Europe, along with representatives from academia, research and technology organisations, and policymakers. JUST GREEN AFRH2ICA aims to be a stepping stone to a collaborative hydrogen roadmap that, based on the analysis of different AU green H₂ scenarios at the socio-economic-technical level via partners' tools (also assessing local resources for green hydrogen production, among which renewable energy sources and water are the key ones), will also drive future investments and policies and the setup of local manufacturing lines.

NON-QUANTITATIVE OBJECTIVES

- Support the mutual benefit collaboration between Africa and Europe on green hydrogen initiatives.
- Promote a Just Green Hydrogen transition in both continents.
- Stimulate the sharing of know-how between the continents.
- Identify the most interesting African countries for investing in green hydrogen looking at both domestic markets and exports to Europe.

PROGRESS, MAIN ACHIEVEMENTS AND RESULTS

- Modelling of the identified use cases via techno-economic, sustainability assessment, socio-economic, hydrogen potential assessment, water availability assessment via tools developed and properly adapted to the African context.
- Assessment of the impact of green hydrogen import from Africa on the EU energy system.
- Continuous assessment of AU countries' national hydrogen strategies and updates.





- Assessment of African manufacturing and knowledge capabilities to setup an EU green hydrogen manufacturing value chain.
- Assessment of financing instruments relevant to support green hydrogen transition in Africa.
- Realisation of JUST GREEN AFRH2ICA financing, policy and manufacturing roadmaps.
- Engagement with stakeholders through surveys and events to gather input for project tasks.
- Promotion of the second training package on the E-Learning platform.
- Organisation of fifteen physical training events and five web events.
- Participation in more than 35 events: speeches at international conferences, organisation of seven stakeholder workshops, robust social media campaign, release of project videos.
- Publication of three open access journal papers.

FUTURE STEPS AND PLANS

The project has been successfully completed in January 2025.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?
Project's own objectives	Modelling tools from the consortium updated.	Number	5	5	✓
	Number of trainees registered to trainings workshops/events and E-Learning.	Number	> 200	> 600	
	Number of AU countries' policies analysed.	Number	10	25	
	Approval from the stakeholders of the Project roadmaps.	%	> 70	60	
	Stakeholder interaction - Number of stakeholders engaged in activities.	Number	At least 25 stakeholders always present and active in foreseen stakeholders driven activities.	>25	
	Modelling AU Green H ₂ scenarios via unique consortium tools.	Number	4		
	Number of Users of the JUST GREEN AFRH2ICA Matchmaking/stakeholder platform.	Number	> 150	157	

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 (H₂) 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 H₂ 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 H₂ releases along the entire H₂ value chain. In particular, the project aims to:

- Fill the critical knowledge gaps regarding technologies, methodologies and protocols for detecting and quantifying the H₂ releases.
- Develop H₂ release scenarios that will allow for the identification of the most critical elements of the H₂ 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 (H₂) 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 H₂ 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 H₂ value chain, in terms of H₂ 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 H₂ emissions, considering both fugitive and vented emissions, but also calculation-based methods will be defined in order to estimate the hydrogen emissions when

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 H₂ releases will be quantified

along the different H₂ supply chains and mitigation strategies will be developed.

- H₂ releases scenarios will be developed, including different H₂ 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	

SH₂E

SUSTAINABILITY ASSESSMENT OF HARMONISED HYDROGEN ENERGY SYSTEMS: GUIDELINES FOR LIFE CYCLE SUSTAINABILITY ASSESSMENT AND PROSPECTIVE BENCHMARKING



Project ID	101007163
PRR 2025	Pillar 5 - Cross-cutting
Call Topic	FCH-04-5-2020
Project Total Costs	2 142 778.75
Clean H ₂ JU Max. Contribution	1 997 616.25
Project Period	01-01-2021 - 30-06-2024
Coordinator Beneficiary	Fundacion IMDEA Energia, ES
Beneficiaries	SYMBIO FRANCE, THE INSTITUTE OF APPLIED ENERGY, SYMBIO, FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON, GREENDELTA GMBH, FORSCHUNGSZENTRUM JULICH GMBH, COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES

<https://sh2e.eu/>

PROJECT AND GENERAL OBJECTIVES

The goal of SH₂E is to provide a harmonised (i.e. methodologically consistent) multidimensional framework for the life cycle sustainability assessment (LCSA) of fuel cells and hydrogen (FCH) systems. To that end, SH₂E will develop and demonstrate specific guidelines for the environmental, economic and social life cycle assessments (LCAs) and benchmarking of FCH systems, while addressing their consistent integration into robust FCH LCSA guidelines. The aim of these guidelines is to be globally accepted as the reference document for LCSA of FCH systems and to set the basis for future standardisation.

NON-QUANTITATIVE OBJECTIVES

- SH₂E aims to contribute to FCH systems' sustainability. The development of harmonised guidelines contributes to assessing the sustainability of FCH systems.
- SH₂E aims to contribute to social acceptance. Better knowledge of FCH systems' social and environmental impacts will contribute to their acceptance.
- SH₂E aims to contribute to standardisation. Harmonised guidelines pave the way for a standard.

PROGRESS, MAIN ACHIEVEMENTS AND RESULTS

- SH₂E reviewed the existing LCA guidelines.
- SH₂E reviewed case studies and projects.
- Environmental LCA guidelines have been issued.
- Life cycle cost assessment guidelines have been issued.
- Social life cycle assessment guidelines have been issued.
- Criticality indicator has been proposed.
- LCSA guidelines have been issued.
- The software tool for performing FCH life cycle studies has been issued.

FUTURE STEPS AND PLANS

SH₂E has been successfully completed.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives	1 document of FCH-LCA guidelines	Number	1	✓
	1 integrated FCH-LCA/LCC/SLCA/LCSA software tool	Number	1	
	1 document of FCH-LCSA guidelines with illustrative case studies after third-party review	Number	1	
	1 document FCH-LCSA guidelines	Number	1	
	Material criticality indicator	Number	1	
	1 document of FCH-LCC guidelines and 1 document of FCH-SLCA guidelines	Number	2	
	2 FCH systems assessed and benchmarked	Number	2	

SHIMMER

SAFE HYDROGEN INJECTION MODELLING AND MANAGEMENT FOR EUROPEAN GAS NETWORK RESILIENCE



Project ID	101111888
PRR 2025	Pillar 5 - Cross-cutting
Call Topic	HORIZON-JTI-CLEANH ₂ -2022-05-03
Project Total Costs	3 037 265.00
Clean H ₂ JU Max. Contribution	2 999 156.25
Project Period	01-09-2023 - 31-08-2026
Coordinator Beneficiary	SINTEF AS, NO
Beneficiaries	INRETE DISTRIBUZIONE ENERGIA S.P.A., REDEXIS GAS SERVICIOS SL, REDEXIS SA, SNAM S.P.A., ENAGAS TRANSPORTE SA, GERG LE GROUPE EUROPEEN DE RECHERCHES GAZIERES, OPERATOR GAZOCIAGOW PRZESYLOWYCH GAZ-SYSTEM SPOLKA AKCYJNA, INSTYTUT NAFTY I GAZU - PANSTWOWY INSTYTUT BADAWCZY, GASSCO AS, BUNDESANSTALT FUER MATERIALFORSCHUNG UND -PRUEFUNG, FUNDACION TECNALIA RESEARCH and INNOVATION, POLITECNICO DI TORINO, NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO

<https://shimmerproject.eu/>

PROJECT AND GENERAL OBJECTIVES

To accelerate the transition to a low-carbon economy while exploiting existing infrastructure, hydrogen can be injected into the natural gas network. However, there are many technical and regulatory gaps that should be closed and adaptations and investments that should be made to ensure that multi-gas networks across Europe will be able to operate in a reliable and safe way while providing gas of highly controllable quality and meeting energy demand. Recently, the European Committee for Standardization concluded that it was impossibility to set a common limiting value for hydrogen injected into the European gas infrastructure, instead recommending a case-by-case analysis. In addition, there are still uncertainties related to the material integrity of pipelines and networks components with regard to their reduced lifetimes in the presence of hydrogen.

Results from previous and ongoing projects on the hydrogen readiness of grid components should be summarised in a systematic manner together with the assessment of the existent transmission and distribution (T and D) infrastructure components at European level to provide stakeholders with decision support and risk reduction information to drive future investments and the development of regulations and standards.

SHIMMER aims to enable higher levels of hydrogen integration and safer hydrogen injection management in multi-gas networks by contributing to the knowledge and understanding of hydrogen projects and their risks and opportunities.

NON-QUANTITATIVE OBJECTIVES

- To map and address European gas T and D infrastructure in relation to materials, components, technology, and their readiness for hydrogen blends.
- To define methods, tools and technologies for multi-gas network management and quality tracking, including simulation,



prediction, and safe management of transients, with a view to widespread hydrogen injection across Europe.

- To propose best practice guidelines for the safe handling of hydrogen in the natural gas infrastructure including risk management.

PROGRESS, MAIN ACHIEVEMENTS AND RESULTS

- Selection of key information for the infrastructure database to be implemented as part of the SHIMMER homepage. This includes details on European infrastructure, pilot projects, material testing standards, test qualifications for hydrogen readiness, and operational conditions for gas networks under hydrogen injection.
- Ongoing data collection on gas grid components and materials to be included in the SHIMMER database.
- Evaluation of gas leakage monitoring and detection methods, concluding that current methods used by transmission system operators (TSOs) and distribution system operators (DSOs) are suitable for natural-hydrogen mixtures, though some calculation methods had to be adapted.
- Execution of a literature study on inspection methods for non-piggable pipes.

- Inspection of a high-pressure gas pipeline using the MFL tool method. The results will be used in 2025 as reference for three additional inspection methods (i) acoustic emission, (ii) metal magnetic memory and (iii) stress concentration tomography.
- Online workshops with all TSOs and DSOs in the project to establish realistic cases, test cases, and scenarios for modelling gas network infrastructures.
- Review of state-of-the-art modelling tools for gas networks simulations. In 2025 three modelling tools will be benchmarked to simulate the selected scenarios. Models will be used for infrastructure planning and predicting operational conditions and gas quality tracking along the network.
- Consortium meeting in San Sebastian in October 2024.
- Drafting of the communication and dissemination plan which is currently being updated.
- The SHIMMER project was showcased at the 1st CANDHy Cluster workshop in July 2024.
- Establishment of an advisory board and networking group.
- Organisation of an online workshop in 2025.

- Presentation of SHIMMER at two conferences in 2024 (IGRC and EGATEC).
- SHIMMER featured in an interview with H₂-Magazine (HZwei-Magazin).

Integrity management and safety:

- Gathering information about materials and components used in natural gas grid of participating TSOs and DSOs.
- Identifying critical material properties and component factors.
- Reviewing existing in-line inspection methods and involving technology providers in test campaigns.
- Gathering information on common leakage detection methods among operators.

Flow Assurance

- Definitions of network models and case studies.
- Organisation of workshops with TSOs and DSOs.
- A realistic case requirement document of needed components and data was achieved.

FUTURE STEPS AND PLANS

Continue working with the project activities as described in the workplan.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives	Capability to control hydrogen presence over a served area.	km ²	TSO < 100 DSO < 5	
	Capability to track hydrogen spreading through network structure.	[delta%H ₂ / hour] [delta%H ₂ / km ²]	< 1 < 2	

THOTH2

NOVEL METHODS OF TESTING FOR MEASUREMENT OF NATURAL GAS AND HYDROGEN MIXTURES



Project ID	101101540
PRR 2025	Pillar 5 - Cross-cutting
Call Topic	HORIZON-JTI-CLEANH ₂ -2022-05-04
Project Total Costs	1 997 361.25
Clean H ₂ JU Max. Contribution	1 997 360.50
Project Period	01-02-2023 - 31-07-2025
Coordinator Beneficiary	SNAM S.P.A., IT
Beneficiaries	CESAME-EXADEBIT SA, INRETE DISTRIBUZIONE ENERGIA S.P.A, GRTGAZ, ENAGAS TRANSPORTE SA, GERG LE GROUPE EUROPEEN DE RECHERCHES GAZIERES, OPERATOR GAZOCIAGOW PRZESYLOWYCH GAZ-SYSTEM SPOLKA AKCYJNA, EIDGENOSSISCHES INSTITUT FUR METROLOGIE METAS, INSTYTUT NAFTY I GAZU - PANSTWOWY INSTYTUT BADAWCZY, ISTITUTO NAZIONALE DI RICERCA METROLOGICA, COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION, FONDAZIONE BRUNO KESSLER, AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE, ALMA MATER STUDIORUM - UNIVERSITA DI BOLOGNA

<https://thoth2.eu/>

PROJECT AND GENERAL OBJECTIVES

THOTH2 aims to cover the normative and standards gaps related to methodologies and protocols for evaluating the performances and identifying the limits and tolerances of state-of-the-art (SOA) measuring devices in transmission and distribution systems when carrying mixtures of hydrogen and natural gas or pure hydrogen. THOTH2 will design dedicated methodologies to test different types of measuring devices (gas meters, gas volume conversion devices, pressure and temperature transducers, gas quality analysers, and gas leak detectors) under various operating conditions.

NON-QUANTITATIVE OBJECTIVES

THOTH2 will help the scientific and industrial communities understand the potential impact of different H₂/NG mixtures on the performances of SOA measuring devices installed in the transmission and distribution gas infrastructures. European transmission system operators (TSOs) and distribution system operators (DSOs) will benefit from the project results, as they will obtain important information about the limits and tolerances of the measuring instruments under various operating conditions. As THOTH2 is a pre-normative research project, recommendations will be sent to the normative bodies to support the development of new standards and the update of existing ones.

PROGRESS, MAIN ACHIEVEMENTS AND RESULTS

- Assessment of SOA, barriers and bias on metering devices for natural gas / hydrogen blends and pure hydrogen.
- Definition of the methodologies for testing the different measuring devices.
- Preparation of the test rigs and reporting procedure for experimental activities.
- Start of testing campaigns in December 2024, after the collection of the devices (gas meters, pressure transducers, water dew point analysers, leak detectors, flow computers) from manufacturers.
- Application of methodologies and testing protocols on selected devices to evaluate their performances under different operating conditions.

FUTURE STEPS AND PLANS

- Validation of the test methodologies to provide insights which will be included in recommendations, and subsequently be shared with relevant standardisation bodies and manufacturers through the THOTH2 Stakeholders Advisory Board.
- Development of a repurposing concept for an existing gas meters calibration facility for operation in the natural gas containing blended hydrogen.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?
Project's own objectives	Papers submitted to open access peer-reviewed journals during the project.	Number	4	3	✓
	Presentation of the project at at least 5 professional workshops/ exhibitions.	Number	5	3	
	Organisation of a closing workshop presenting the project results to all interested stakeholders.	Number	1	-	
	Presentation in international and other relevant conferences identified during the project.	Number	7	3	
	Safety, PNR/ RCS Workshops.	Number	2	1	
	Validation of new or modified test protocols and methods.	Number	5	-	⚙️
	Definition of preliminary guidelines and recommendations for new standards.	Number	1	-	
	Concept of repurposing of an existing gas meters calibration facility for operation in the natural gas containing blended hydrogen.	Number	1	-	
	Definition of SoA of measuring devices installed in NG transmission and distribution networks.	Number	1	1	
	Definition of methodologies and testing protocols for assessing the performances of measuring devices with H ₂ NG mixtures.	Number	5	5	
	Test rigs preparation and reporting procedure for experimental activities.	Number	1	1	
	Organisation of at least one Stakeholder Advisory Board workshop.	number	1	1	