BEST4HY

SUSTAINABLE SOLUTIONS FOR RECYCLING OF END OF LIFE HYDROGEN TECHNOLOGIES

Project ID	101007216
PRR 2024	Pillar 5 – Cross-cutting
Call topic	FCH-04-4-2020: Development and validation of existing and novel recycling technologies for key FCH products
Project total costs	EUR 1 586 015.00
Clean H_2 JU max. contribution	EUR 1 586 015.00
Project period	1.1.2021–31.12.2023
Coordinator	Parco Scientifico Tecnologico per l'Ambiente SpA, Italy
Beneficiaries	Aktsiaselts Elcogen, Commissariat à l'énergie atomique et aux énergies alternatives, EKPO Fuel Cell Technologies GmbH (from March 2021), ElringKlinger AG (up to February 2021), Hensel Recycling GmbH, IDO-Lab GmbH, Politecnico di Torino, RINA Consulting SpA, Univerza v Ljubljani

https://best4hy-project.eu/

PROJECT AND GENERAL OBJECTIVES

The overall objective of Best4hy was to identify and develop viable recycling strategies, supported by innovative technologies, that will provide the best solution for material recovery from fuel cell and hydrogen (FCH) products (i.e. proton-exchange membrane fuel cells (PEMFCs) and solid oxide fuel cells (SOFCs)) and proof of concept for the recovery of iridium and palladium from proton-exchange membrane water electrolysis with novel technologies. The following specific objectives were set, according to the call challenges.

- Complete the adaptation and validation (in a relevant environment) of processes already used in conventional recycling and recovery centres to make them suitable for use in FCH commercial systems, including those involving key materials such as the platinum group metals.
- Complete the selection and validation (in a relevant environment) of at least two novel recycling techniques for key materials contained in FCH commercial products, such as PEMFCs / proton-exchange membrane water electrolysis, alkaline water electrolysis and SOFCs; the focus should be on recovering the precious metals used in the stacks as catalysts, reducing pre-consumer scraps, etc.
- Validate the suitability of the material(s) recovered for reintroduction into the supply chain of different FCH systems and/or different industrial sectors.
- Ensure the quality standards of industry in open-loop and/or closed-loop recycling applications.
- Undertake comprehensive environmental–economic analysis of the considered strategy.
- Overcome the main barriers of existing regulations.

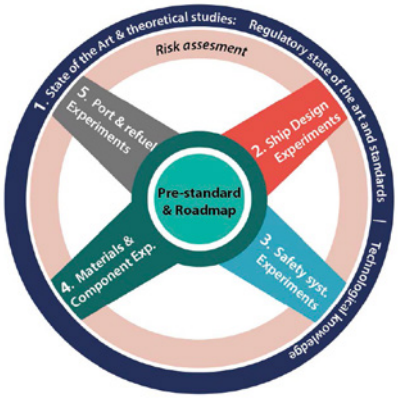
PROGRESS AND MAIN ACHIEVEMENTS

The Best4hy project developed a new gaseous-phase dismantling process for end-of-life (EOL) PEMFC processing, aiming to maximise the recovery of CCMs and achieve high recovery percentages of materials and components. Two patent applications were filed for the gaseous-phase dismantling process. The project also adapted a hydrometallurgical process and developed two novel processes for recovering Pt (as a salt precursor for PEMFCs), the ionomer and metallic Pt. High yields were achieved, with up to 95 % recovery for Pt and 80 % recovery for the ionomer. The recovered Pt salt was synthesised into a recycled catalyst for membrane electrode assembly production. CCMs were manufactured up to an industrial scale with 100 % recycled catalyst, showing good performance compared with that of commercial cells. A cradle-to-grave/gate-to-gate life-cycle assessment study was completed for both PEMFCs and SOFCs, adopting Best4hy recycling technologies and findings to support different EOL management scenarios and further research and development. All developed EOL processes, with their associated mass and energy balances, represent significant advances in SOFC manufacturing and EOL technologies.

FUTURE STEPS AND PLANS

The project has finished.

However, an exploitation strategy was developed for each of the 13 key exploitable results identified in the project. Partners are seeking opportunities to continue the development of the technology readiness level 5 technologies and to exploit the results commercially.



PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?	Year for reported SOA result
Project's own objectives	GHGs in the overall production	%	– 20	– 20	✓	N/A
	La and Co recovery	%	> 80	La: > 78 %; Co: > 87 %		2023
	Pt recovered	%	90	95		2023
	Membrane	%	100	100		2022
	Pt recovered	%	80	95		2023
	Ionomer recovered	%	80	80		2023
	Anode material recovered overall for SOFCs	%	80	> 80		2023

PRR 2024 PILLAR
Cross-cutting

Clean Hydrogen Partnership

Co-funded by the European Union

ELVHYS

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

Project ID	101101381
PRR 2024	Pillar 5 – Cross-cutting
Call topic	HORIZON-JTI-CLEANH2-2022-05-02: Safety of cryogenic hydrogen transfer technologies in public areas for mobile application
Project total costs	EUR 1 433 960.00
Clean H_2 JU max. contribution	EUR 1 433 960.00
Project period	1.1.2023–31.12.2025
Coordinator	Norges teknisk-naturvitenskapelige universitet, Norway
Beneficiaries	Alma Mater Studiorum – Università di Bologna, Deutsches Zentrum für Luft- und Raumfahrt EV, Health and Safety Executive, Karlsruher Institut für Technologie, L'Air Liquide SA, National Centre for Scientific Research 'Demokritos', University of Ulster

https://elvhys.eu/

PROJECT AND GENERAL OBJECTIVES

The Elvhys project addresses a critical gap in international standards related to liquid and cryogenic hydrogen transfer technologies for mobile applications, such as filling trucks, ships and stationary tanks. Currently, there is limited or no experience in this area, which poses significant challenges for safety and efficiency in hydrogen transfer operations.

The overarching objective of Elvhys is 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.

NON-QUANTITATIVE OBJECTIVES

- The results of Elvhys will contribute to many objectives of the Clean Hydrogen Joint Undertaking strategic research and innovation agenda, such as increasing the level of safety and supporting the development of regulations, codes and standards (RCSs) for hydrogen technologies and applications.
- Increasing the level of safety of hydrogen technologies and applications is the cornerstone of the entire Elvhys project. It will be addressed by performing cutting-edge research, closing numerous knowledge gaps in the understanding of the underlying liquid hydrogen (LH_2) transfer physical phenomena of heat and mass transfer at cryogenic temperatures and under multiphase flow conditions, advancing the SOA through the generated knowledge, developing innovative prevention and mitigation strategies and proposing risk-informed recommendations and guidelines on cryogenic hydrogen transfer technologies.
- The objective of supporting the development of RCSs for hydrogen technologies and applications, with a focus on standards, will be addressed through the developed science-based recommendations for RCSs, beyond the SOA guidelines and fuelling/bunkering/transfer procedures.

PROGRESS AND MAIN ACHIEVEMENTS

The Elvhys project's progress regarding LH_2 transfer technologies is as follows.

- Operational data collection and best practices in LH_2 transfer. Extensive data collection efforts made to identify best practices in LH_2 transfer operations.
- LH_2 transfer ecosystem, infrastructures and applications. Comprehensive overview of the LH_2 transfer ecosystem provided.
- Piping and instrumentation diagrams of LH_2 transfer installations and list of existing safety devices. Detailed piping and instrumentation diagrams developed for LH_2 transfer installations.
- Refined research programme on the safety of LH_2 transfer systems. Refined research programme developed to focus on the safety aspects of LH_2 transfer systems.
- Review of methodologies, preliminary risk analysis and gap identification. Preliminary risk analysis of specific scenarios conducted to identify gaps and areas for further investigation.
- Compilation of relevant/existing RCSs and bodies. Comprehensive list of relevant RCSs and regulatory bodies compiled for LH_2 transfer operations.
- Support of LH_2 fire and explosion tests through modelling. Computational models selected to provide insights into potential hazards and mitigation strategies.
- Experiment set-up and test readiness review for fire tests and boiling liquid expanding vapour explosion tests on LH_2 hoses.
- Hazard identification for LH_2 transfer operations. Detailed identification of potential risks and proposed mitigation strategies completed.

FUTURE STEPS AND PLANS

The Elvhys project aims to provide a supportive regulatory and standardisation framework.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?	SOA result achieved to date (by others)	Year for reported SOA result
SRIA (2021–2027)	Impact on standards at scope	number/project	1	⚙	0.6	2020
	Safety, PNR/RCS workshops	number/year	2	✓	1	2020

Clean Hydrogen Partnership
Co-funded by the European Union

EGHOST

ESTABLISHING ECO-DESIGN GUIDELINES FOR HYDROGEN SYSTEMS AND TECHNOLOGIES

Project ID	101007166
PRR 2024	Pillar 5 – Cross-cutting
Call topic	FCH-04-3-2020: Development of eco-design guidelines for FCH products
Project total costs	EUR 1 133 541.25
Clean H_2 JU max. contribution	EUR 998 991.25
Project period	1.1.2021–31.5.2024
Coordinator	Fundación IMDEA Energía, Spain
Beneficiaries	Commissariat à l'énergie atomique et aux énergies alternatives, Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragón, Institute of Applied Energy, Symbio, Symbio France, Univerza v Ljubljani

https://eghost.eu/

PROJECT AND GENERAL OBJECTIVES

eGhost will reach the first milestone in the development of ecodesign criteria in the European hydrogen sector. Two guidelines for specific fuel cell and hydrogen (FCH) products are being prepared, and the lessons learnt will be integrated into the eGhost white book: a reference guidance book for any future ecodesign project on FCH systems. It addresses the eco(re) design of mature products (proton-exchange membrane fuel cell (PEMFC) stacks) and those emerging with low technology readiness levels (solid oxide electrolysers) in such a way that sustainable design criteria can be incorporated from the earliest stages of product development.

NON-QUANTITATIVE OBJECTIVES

- eGhost aims to contribute to FCH systems' sustainability. Ecodesigning products will improve their sustainability performance.
- The project aims to contribute to social acceptance. Sustainable products are better accepted by end users and stakeholders, including civil society.

PROGRESS AND MAIN ACHIEVEMENTS

- The preliminary life-cycle sustainability assessment of the PEMFC stack is complete.
- The preliminary life-cycle sustainability assessment of the solid oxide electrolysis cell stack is complete.
- The PEMFC stack has been evaluated in accordance with the EU ecodesign directive.
- Product concepts have been completed.
- Product concepts will be assessed and prioritised as a function of the reduction goals.

FUTURE STEPS AND PLANS

- Methodological and technical ecodesign guidelines for the PEMFC stack will be issued (month 39).
- Methodological and technical ecodesign guidelines for the solid oxide electrolysis cells will be issued (month 39).
- The eGhost white book will contain the main recommendations for FCH products' eco(re)design, drawing on the lessons learnt (month 41).

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?	SOA result achieved to date (by others)	Year for reported SOA result
AWP 2020	Ecodesign guidelines	number	2		N/A	N/A
	Cumulative environmental reduction	%	10		18–44 % carbon footprint reduction	2013
	Cumulative cost reduction	%	3		From 2.6 % reduction to 46 %	2013
	Eco-efficiency improvement	%	10		N/A	N/A

PRR 2024 PILLAR
Cross-cutting

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HYACADEMY.EU

THE EUROPEAN HYDROGEN ACADEMY

Project ID	101137988
PRR 2024	Pillar 5 – Cross-cutting
Call topic	HORIZON-JTI-CLEANH2-2023-05-02: European Hydrogen Academy
Project total costs	EUR 2 987 233.75
Clean H_2 JU max. contribution	EUR 2 987 233.75
Project period	1.1.2024–30.6.2028
Coordinator	Vysoká škola chemicko-technologická v Praze, Czechia
Beneficiaries	Bertz Associates Ltd, Deutscher Verein des Gas- und Wasserfaches – Technisch-wissenschaftlicher Verein EV, EUREC EESV, Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragón, Future. Solutions SÀRL, KIC InnoEnergy SE, Politecnico di Torino, Rijksuniversiteit Groningen, Technokrati Ltd, Trakiyski universitet, Università degli Studi di Modena e Reggio Emilia, Universitatea Politehnica din Bucureşti, Université de technologie de Belfort-Montbéliard, Université libre de Bruxelles, University of Birmingham, University of Ulster

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 establish a network of more than five joint training laboratories for hydrogen technologies.

Hyacademy.EU will capitalise on the European Commission's 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 'Network100') 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 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, thus 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 AND MAIN ACHIEVEMENTS

- Universities, technical schools, training institutions and schools are currently being contacted for information.
- Network membership is being offered.
- Full website went live at the end of June 2024.
- First version of the database went online at the end of June 2024.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?	Year for reported SOA result
Project's own objectives	Network of schools (Network500)	schools participating in network	500	50		2023
	Network of universities (Network100)	universities participating in network	105	30		2023
	Pupils trained	pupils trained	5 000	N/A		N/A
	Social media followers	followers	3 500	N/A		2023
	Training laboratory network	laboratories in network	5	3		2023
	Access to project website	access requests	100 000	50		2023
	Platform users	registered users	5 000	N/A		2023

HYPEF

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

Project ID	101137575
PRR 2024	Pillar 5 – Cross-cutting
Call topic	HORIZON-JTI-CLEANH2-2023-05-01: Product environmental footprint pilot for a set of FCH product categories
Project total costs	EUR 1 499 431.25
Clean H_2 JU max. contribution	EUR 1 499 431.25
Project period	1.1.2024–31.12.2026
Coordinator	Fundación IMDEA Energía, Spain
Beneficiaries	Advanced Energy Technologies AE Ereunas & Anaptyxis Ylikon & Proiontonananeosimon Pigon Energeias & Synafon Symvouleftikon y Piresion, Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile, Ecoinnovazione SRL, Engie, Europäisches Institut für Energieforschung EDF-KIT EWIV, Hexagon Purus GmbH, Istituto di Studi per l'Integrazione dei Sistemi SCRL

https://www.hypef.eu/

PROJECT AND GENERAL OBJECTIVES

Fuel cell 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. Therefore, 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 the running of similar PEF initiatives dealing with FCH product categories other than those addressed in HYPEF.

PROGRESS AND MAIN ACHIEVEMENTS

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

FUTURE STEPS AND PLANS

Current scientific efforts are focused on preparing the ground for FCH-PEFCRs by analysing relevant existing (PEF) category rules and exploring FCH systems for product categorisation. During the first year of the project, scientific efforts will also address the definition and selection of FCH product categories, the definition and screening PEF of the three representative products, and the set-up and management of the FCH-PEFCRs development process.

PROJECT TARGETS

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

HYPOP

HYDROGEN PUBLIC OPINION AND ACCEPTANCE

Project ID	101111933
PRR 2024	Pillar 5 – Cross-cutting
Call topic	HORIZON-JTI-CLEANH2-2022-05-01: Public understanding of hydrogen and fuel cell technologies
Project total costs	EUR 1 062 755.00
Clean H_2 JU max. contribution	EUR 1 062 754.50
Project period	1.6.2023–31.5.2025
Coordinator	Parco Scientifico Tecnologico per l'Ambiente SpA, Italy
Beneficiaries	Agenzia per la Promozione della Ricerca Europea, Balkanski Vodoroden Klaster, Centro Nacional de Experimentación de Tecnologías de Hidrógeno y Pilas de Combustible Consorcio, Cluster TWEED, Fundación IMDEA Energía, Institute for Methods Innovation, Regionalna Izba Gospodarcza Pomorza

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

PROJECT AND GENERAL OBJECTIVES

Project 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 H_2 technologies and (ii) the creation of a web platform collecting communication material (mainly videos) on new hydrogen technologies, developed based on the early findings of the public engagement activities. HYPOP will focus on two applications of hydrogen technologies that will enter people's daily lives: 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 citizens' abilities 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 AND MAIN ACHIEVEMENTS

- **Analysis of Member States' H_2 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 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 H_2 via social media across the EU.** This included the identification of the main individual-level determinants of public understanding and acceptance of fuel cell and hydrogen technologies.
- **Stakeholders' requirements for H_2 technology installation.** These are mainly permit-issuing, certification and safety requirements.

FUTURE STEPS AND PLANS

- Citizens' engagement workshops in each of the HYPOP countries (Belgium, Bulgaria, Ireland, Spain, Italy, Poland) and two international events to inform citizens about the project and increase public trust in H_2 implementation.
- Stakeholders' engagement workshops in each of the HYPOP countries 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 body).
- 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	Trained professionals in tier 2 countries (Austria, Belgium, Finland, Italy, Latvia, the Netherlands, Norway, Spain and Sweden)	number	> 50	
	Trained professionals in tier 3 countries (rest of the Member States and associated countries)	number	> 30	
	Number and type of target groups engaged	number	> 3/country across the six HYPOP countries (including one industrial group)	

PRR 2024 PILLAR
Cross-cutting

Clean Hydrogen Partnership
Co-funded by the European Union

HYRESPONDER

EUROPEAN HYDROGEN TRAIN THE TRAINER PROGRAMME FOR RESPONDERS

Project ID	875089
PRR 2024	Pillar 5 – Cross-cutting
Call topic	FCH-04-1-2019: Training of responders
Project total costs	EUR 1 000 000.00
Clean H_2 JU max. contribution	EUR 1 000 000.00
Project period	1.1.2020–31.5.2023
Coordinator	University of Ulster, United Kingdom
Beneficiaries	Association Comité National Français du Comité Technique International de Prévention et d'Extinction du Feu, Ayuntamiento de Zaragoza, Commissariat à l'énergie atomique et aux énergies alternatives, Crisis Simulation Engineering SARL, Deutsches Zentrum für Luft- und Raumfahrt EV, DLR-Institut für Vernetzte Energiesysteme EV, École nationale supérieure des officiers de sapeurs-pompiers, Fire Service College Limited, International Fire Academy, L'Air Liquide SA, Landes-Feuerwehrverband Tirol, Ministry of the Interior of the Czech Republic, Persee, Service Public Fédéral Intérieur, Università degli Studi di Roma 'La Sapienza', Universitetet i Sørøst-Norge

https://hyresponder.eu/

PROJECT AND GENERAL OBJECTIVES

The aim of Hyresponder was to develop and implement a sustainable trainers' programme on hydrogen safety for responders throughout Europe. The updated operational, virtual reality and educational training reflects state-of-the-art hydrogen safety. The *European Emergency Response Guide* has been revised. Translated materials for responders are available in eight languages via a purpose-built e-platform. The translated materials will be utilised by trainers to deliver workshops and impact training nationally in 10 European countries, enhancing the reach of the programme.

NON-QUANTITATIVE OBJECTIVES

- Hyresponder aimed to embed elements of the training at the national level. Each country has a short- to medium-term plan to maximise the impact during and beyond Hyresponder.
- The project aimed to develop a formal module/certificate. A draft document has been prepared with the key learning outcomes, content, etc., which will be trialled by some partners during national training.
- It aimed to develop training packages at different levels. Stratified educational materials are now available.

PROGRESS AND MAIN ACHIEVEMENTS

- A beta version of the Hyresponder e-platform with stratified training materials and tools is available online.
- Responder trainers from 10 partner countries have been trained in hydrogen safety.
- Novel online training sequences have been developed to support the remote training of responders.
- Three activities have been evaluated by the Innovation Radar: the e-platform to support training of responders in hydrogen safety (https://www.innoradar.eu/innovation/44458), stratified training materials for responders spanning four learning levels (https://www.innoradar.eu/innovation/44457) and the novel training sequences to support online training of responders (https://www.innoradar.eu/innovation/44454). In addition, translated material is now available on the e-platform under 'Training materials'.
- Hyresponder delivered regional workshops.
- The project completed the translation of training materials.
- Hyresponder demonstrated the project's impact within each country. Each partner had a plan to ensure that the Hyresponder training had an impact within and beyond the project.
- Within Hyresponder, trainers from across Europe have undertaken online (June 2021) and operational (June 2022) training. In turn, the trainers have used this training to deliver training in their regions, as part of Hyresponder, but also to ensure a plan is in place beyond the project.

FUTURE STEPS AND PLANS

The project has finished.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?
Project's own objectives	Materials translated into eight languages	number	8	8, but not all elements	✓
	Threefold training materials (lectures, operational training, VR)	number	3	3	
	e-Platform for responders	number	1	1	
	Train-the-trainer activities for all trainers and 10 national training events	number	12	12	
	Revised *European Emergency Response Guide*	number	1	1	

JUST-GREEN AFRH2ICA

PROMOTING A JUST TRANSITION TO GREEN HYDROGEN IN AFRICA

Project ID	101101469
PRR 2024	Pillar 5 – Cross-cutting
Call topic	HORIZON-JTI-CLEANH2-2022-05-05: Research & innovation co-operation with Africa on hydrogen
Project total costs	EUR 999 995.00
Clean H_2 JU max. contribution	EUR 999 995.00
Project period	1.2.2023–31.1.2025
Coordinator	Università degli Studi di Genova, Italy
Beneficiaries	African Hydrogen Partnership, Artelys, BluEnergy Revolution SCRL, Commissariat à l'énergie atomique et aux énergies alternatives, Forschungszentrum Jülich GmbH, Fundación IMDEA Energía, Impact Hydrogen BV, Institut de Recherches en Énergie Solaire et Énergies Nouvelles, Noordwes-Universiteit, STAM SRL, Strathmore University, Teknologie Solutions Limited

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 H_2 synergic and 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 the EU and African Union (AU) sides at the association (African Hydrogen Partnership and Hydrogen Europe), academia, research and technology organisation and policymaking levels. JUST GREEN AFRH2ICA aims to be a stepping stone to a collaborative hydrogen roadmap that, based on the analysis of different AU green H_2 scenarios at the socioeconomic-technical level via partners' tools (also assessing local resources – renewable energy sources and water are the key ones for green hydrogen production), will also drive future investments and policies and the set-up 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 on 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 export to Europe.

PROGRESS AND MAIN ACHIEVEMENTS

- Assessment of the green hydrogen potential of African countries using a multisectoral approach.
- Identification of the use cases to be modelled as archetypes of potential African hydrogen offtakers.
- Definition (partly based on stakeholders' insights) of the hydrogen hub approach inspired by and in comparison with the European hydrogen valley approach.
- Detailed assessment of AU–EU green hydrogen policies and points of interaction.
- Analysis of existing natural gas infrastructure's potential to be enriched by hydrogen to transport it to the EU.
- Development and enhancement of partners' models to be adapted to the African context and data availability (e.g. innovative water modelling/assessment approaches).
- Interaction with stakeholders through surveys and at events to collect inputs to project actions in work packages 1–3.
- Launch of the e-learning platform and of the first package of training materials.
- Organisation of a training workshop in Nairobi in concomitance with a large EU–AU workshop.
- Participation in > 10 events, delivery of three speeches at international conferences, organisation of five stakeholders' workshops, running of a robust social media campaign and release of the first project videos.

FUTURE STEPS AND PLANS

- Modelling of the project use cases to collect information and results to drive the drafting of the project's joint EU–AU roadmaps (research and development, financing, manufacturing and electrolyser installation).
- Set-up of the second e-learning package.
- Organisation of further stakeholders' workshops and trainings.
- Organisation of a final event to present the project roadmaps and findings.

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	N/A	
	Number of trainees	number	> 200	60	
	Approval of the project roadmaps	%	> 70 %	N/A	⚙
	Modelling AU green H_2 scenarios using unique consortium tools	number of use cases	4	N/A	
	Number of users of the JUST GREEN AFRH2ICA matchmaking/stakeholder platform	number of registered users	> 150	N/A	
	Number of AU countries' policies analysed	number	10	25	✓
	Stakeholders' interaction – number of stakeholders engaged in activities	number	At least 25 stakeholders always present and active in planned stakeholder-driven activities	> 25	

PRR 2024 PILLAR
Cross-cutting

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MULTHYFUEL

MULTI-FUEL HYDROGEN REFUELLING STATIONS (HRS): A CO-CREATION STUDY AND EXPERIMENTATION TO OVERCOME TECHNICAL AND ADMINISTRATIVE BARRIERS

Project ID	101006794
PRR 2024	Pillar 5 – Cross-cutting
Call topic	FCH-04-1-2020: Overcoming technical and administrative barriers to deployment of multi-fuel hydrogen refuelling stations (HRS)
Project total costs	EUR 2 121 906.25
Clean H_2 JU max. contribution	EUR 1 997 406.25
Project period	1.1.2021–30.09.2024
Coordinator	Hydrogen Europe, Belgium
Beneficiaries	Engie, Health and Safety Executive, Institut national de l'environnement industriel et des risques, ITM Power (Trading) Limited, Kiwa Nederland BV, L'Air Liquide SA, Shell Nederland Verkoopmaatschappij BV, Snam SpA, Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg

https://multhyfuel.eu/

PROJECT AND GENERAL OBJECTIVES

Multhyfuel's ultimate goal is the amendment of best-practice guidelines for the design, construction and development of multifuel refuelling stations. An analysis of the current legal framework regarding permitting requirements throughout Europe has been carried out. A risk assessment analysis and the experimental data acquisition on the leakage characteristics and consequences in the station's forecourt will take place shortly.

NON-QUANTITATIVE OBJECTIVES

The project aims to contribute to the harmonisation of permitting and risk assessment requirements by developing best-practice guidelines based on new data acquired during project implementation.

PROGRESS AND MAIN ACHIEVEMENTS

Deliverable 1.2 – Permitting requirements and risk assessment methodologies for HRS in the EU (first version) was submitted and presented to the stakeholders, with a summary of the main commonalities and differences found in permitting requirements from 14 European countries.

Feedback from public authorities was received, as was feedback from experts during the interim review meeting. In work package (WP) 3, three case study models with different configurations were identified and designed, and a preliminary risk assessment was performed on them to identify the most critical scenarios to study in WP 2. In WP 2, *Deliverable 2.2 – Assessment of dispersion for high-pressure H_2* was submitted, with results from computational fluid dynamics modelling simulations performed to evaluate the size of clouds expected considering different scenarios of leakage in H_2 dispensers. Testing was performed to acquire data concerning leakage characteristics and consequences, and results were presented to targeted stakeholders.

FUTURE STEPS AND PLANS

Considering new data acquired during experimental testing, the consortium will review the risk assessment performed at the beginning of the project and develop a set of best-practice guidelines, which will be presented to hydrogen refuelling station operators, public authorities and standardisation bodies.

PROJECT TARGETS

Target source	Parameter	Unit	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 refuelling distance	m	N/A		5–35, depending on the country	2021
	Guidelines for safety barriers	-	N/A		Depending on the country	N/A
	Number of stakeholders endorsing project's results	number of authorities	17		N/A	N/A

PRR 2024 PILLAR
Cross-cutting

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NHYRA

PRE-NORMATIVE RESEARCH ON HYDROGEN RELEASES ASSESSMENT

Project ID	101137770
PRD 2024	Pillar 5 – Cross-cutting
Call topic	HORIZON-JTI-CLEANH2-2023-05-03: Pre-normative research on the determination of hydrogen releases from the hydrogen value chain
Project total costs	EUR 2 086 683.75
Clean H_2 JU max. contribution	EUR 2 086 683.75
Project period	1.1.2024–31.12.2026
Coordinator	Snam SpA, Italy
Beneficiaries	Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile, Alma Mater Studiorum – Università di Bologna, Deutsches Zentrum für Luft- und Raumfahrt EV, Enagás Transporte SA, Engie, Equinor Energy As, Fondazione Bruno Kessler, Groupe Européen de Recherches Gazières, Instytut Nafty i Gazu – Państwowy Instytut Badawczy, Linde GmbH, NPL Management Limited, Nuovo Pignone Tecnologie SRL, Regents of the University of California, University of Surrey

https://cordis.europa.eu/project/id/101137770

PROJECT AND GENERAL OBJECTIVES

Several studies and analyses show that by 2050 hydrogen will become a pillar of the future energy system, representing up to 20 % of the future energy demand, and with this it is expected that anthropogenic H_2 emissions, which have an indirect impact on the greenhouse effect, will also 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 into the atmosphere.

The general objective of the project 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 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.

PROGRESS AND MAIN ACHIEVEMENTS

The NHYRA consortium organised a first workshop with the Hybrid power-energy electrodes for next generation lithium-ion batteries (HYDRA) project, during which the two projects presented their work and started discussions on how to cooperate, while considering each project's timeline, objectives and deliverables.

FUTURE STEPS AND PLANS

One of the central elements of the NHYRA project, and also one of the first activities that will take place, is the creation of a H_2 release inventory.

The first work package will involve an initial literature review and the collection of data and information from H_2 technologies, systems and infrastructure operators, which will lead to the identification of the most relevant H_2 supply chain and the most critical elements of the H_2 value chain in terms of H_2 emissions.

From these findings, dedicated methodologies will be developed with the initial aim of determining suitable techniques and instruments for the detection and measurement of hydrogen leakages. Then, measurement-based methods will be developed for detecting and quantifying H_2 emissions, considering both fugitive and vented emissions; calculation-based methods will also be developed to enable the estimation of hydrogen emissions when taking direct measurements is impossible or too complicated (as, for example, in the case of an accident or unburned fuel).

The methodologies developed will then be tested for validation, both in laboratories and in real cases, and the experimental data collected will feed the H_2 release inventory.

NHYRA will quantify the total potential H_2 releases along each H_2 supply chain and will develop mitigation strategies.

Finally, H_2 release scenarios that include all H_2 supply chains will be developed, considering various time horizons.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives	Workshop on H_2 production with overview of H_2 leakage in production	number	1	
	Workshop on H_2 transport and storage with overview of H_2 leakage	number	1	
	Workshop on H_2 end use with overview of H_2 leakage in end use	number	1	
	Engagement with EU/national associations	number	2	
	Invitation to join the Advisory Board sent to providers of H_2 detection technology and equipment manufacturers	number	1	
	Dissemination in Clean Hydrogen Mission countries and at universities in at least nine countries	number	9	
	Communication toolkit tailored to a non-technical audience	number	1	
	Workshop presenting results relevant to policymakers	number	1	
	Number of archetype technologies assessed in terms of H_2 releases and implemented in 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 from point or subarea sources	number/ project	2	
	H_2 release inventory	number/ project	1	
	Participation in one conference on energy markets/finance to engage with financial stakeholders	number	1	
	Presentation at suitable measurement-related conference (e.g. CEM)	number	1	
	At least two meetings with standardisation committees	number	2	

SH2E

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

Project ID	101007163
PRR 2024	Pillar 5 – Cross-cutting
Call topic	FCH-04-5-2020: Guidelines for life cycle sustainability assessment (LCSA) of fuel cell and hydrogen systems
Project total costs	EUR 2 142 778.75
Clean H_2 JU max. contribution	EUR 1 997 616.25
Project period	1.1.2021–30.6.2024
Coordinator	Fundación IMDEA Energía, Spain
Beneficiaries	Commissariat à l'énergie atomique et aux énergies alternatives, Forschungszentrum Jülich GmbH, Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragón, GreenDelta GmbH, Institute of Applied Energy, Symbio, Symbio France

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 cell 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 is for these guidelines to be globally accepted as the reference document for the 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 will contribute to assessing the sustainability of FCH systems.
- The project aims to contribute to social acceptance. Better knowledge of FCH systems' social and environmental impacts will contribute to their acceptance.
- It aims to contribute to standardisation. Harmonised guidelines will pave the way for a standard.

PROGRESS AND MAIN ACHIEVEMENTS

- SH2E reviewed the existing guidelines.
- The project reviewed case studies and projects.
- Environmental LCA guidelines were issued.
- Life-cycle cost assessment guidelines were issued.
- Social LCA guidelines were issued.
- LCSA guidelines were issued (interim version).
- The software tool for performing FCH life-cycle studies was issued (interim version).

FUTURE STEPS AND PLANS

- LCSA guideline validation will be undertaken by an external party.
- The final version of the LCSA guidelines will be issued by the end of the project.
- The final version of the software tool will be issued by the end of the project.

PROJECT TARGETS

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

PRR 2024 PILLAR
Cross-cutting

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SHIMMER

SAFE HYDROGEN INJECTION MODELLING AND MANAGEMENT FOR EUROPEAN GAS NETWORK RESILIENCE

Project ID	101111888
PRD 2023	Pillar 5 – Cross-cutting
Call topic	HORIZON-JTI-CLEANH2-2022-05-03: Safe hydrogen injection management at network-wide level: towards European gas sector transition
Project total costs	EUR 3 037 265.00
Clean H_2 JU max. contribution	EUR 2 999 156.25
Project period	1.9.2023–31.8.2026
Coordinator	SINTEF AS, Norway
Beneficiaries	Bundesanstalt für Materialforschung und -prüfung, Enagás Transporte SA, Fundacion Tecnalia Research and Innovation, Gassco AS, Groupe Européen de Recherches Gazières, INRETE Distribuzione Energia SpA, Instytut Nafty i Gazu – Państwowy Instytut Badawczy, Nederlandse Organisatie voor toegepast natuurwetenschappelijk onderzoek, Operator Gazociągów Przesyłowych GAZ-SYSTEM S.A., Politecnico di Torino, Redexis Gas Servicios SL, Redexis SA, Snam SpA

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 multigas 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 impossible to set a common limiting value for hydrogen injected into the European gas infrastructure, instead recommending a case-by-case analysis. In addition to this, there are still uncertainties related to the material integrity of pipelines and network 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 & D) infrastructure components at the European level to provide stakeholders with decision support and risk reduction information to drive future investments and the development of regulations and standards.

The Shimmer project aims to enable higher levels of hydrogen integration and safer hydrogen injection management in multigas networks by contributing to the knowledge and better understanding of hydrogen projects and their risks and opportunities.

NON-QUANTITATIVE OBJECTIVES

- To map and address the European gas T & D infrastructure in relation to materials, components and technologies and their readiness for hydrogen blends.
- To define methods, tools and technologies for multigas 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 safely handling hydrogen in the natural gas infrastructure and managing the risks.

PROGRESS AND MAIN ACHIEVEMENTS

The technical work during the first month has started in two work packages.

WP3 - Integrity Management and Safety

- Gathering information about materials and components in natural gas grids 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.

WP4 - Flow Assurance

- Defines network models and case studies.
- Several workshops were held with TSOs and DSOs.
- A realistic case requirement document of needed components and data was achieved.
- Next phase focuses on collecting input data and finalizing case and model definitions.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives	Capability to control hydrogen presence over a served area	km^2	TSOs: > 100 DSOs: > 5	
	Trained professionals	number	Tier 1: 120 000 Tier 2: 40 000 Tier 3: 20 000	
	Capability to track hydrogen spreading through the network structure	$\Delta\%H_2/h$ $\Delta\%H_2/km^2$	< 1 % < 2 %	
SRIA (2021–2027)	Total capital investment	M€/km	0.8	
	Operational expenditure pipeline	€/kg	0.01	
	Projects with proactive safety management	number	100	
	H_2 leakage	%	0	
	Safety, PNR/RCS workshops	number/year	4	
AWP 2018	Impact on standards at scope	number/project	1	

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THOTH2

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

Project ID	101101540
PRR 2024	Pillar 5 – Cross-cutting
Call topic	HORIZON-JTI-CLEANH2-2022-05-04: Development of validated test methods and requirements for measuring devices intended for measuring NG/H_2 mixtures
Project total costs	EUR 1 997 361.25
Clean H_2 JU max. contribution	EUR 1 997 360.50
Project period	1.2.2023–31.7.2025
Coordinator	Snam SpA, Italy
Beneficiaries	Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile, Alma Mater Studiorum – Università di Bologna, Cesame-Exadébit SA, Commonwealth Scientific and Industrial Research Organisation, Eidgenössisches Institut für Metrologie METAS, Enagás Transporte SA, Fondazione Bruno Kessler, Groupe Européen de Recherches Gazières, GRTgaz, INRETE Distribuzione Energia SpA, Instytut Nafty i Gazu – Państwowy Instytut Badawczy, Istituto Nazionale di Ricerca Metrologica, Operator Gazociągów Przesyłowych GAZ-SYSTEM S.A.

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 H_2 and natural gas (NG) or pure H_2. Thoth2 will design dedicated methodologies to test types of measuring devices (gas metres, gas volume conversion devices, pressure and temperature transducers, gas quality analysers and gas leak detectors) under various operating conditions.

NON-QUANTITATIVE OBJECTIVES

The Thoth2 project will help the scientific and industrial communities understand the potential impact of different H_2NG mixtures on the performances of SOA measuring devices installed in the transmission and distribution gas infrastructure. 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 Shimmer is a pre-normative research project, recommendations will be sent to the normative bodies to support the development of new standards and the updating of existing ones.

PROGRESS AND MAIN ACHIEVEMENTS

Within work package (WP) 1, the SOA, barriers and bias of metering devices for NG blends and pure H_2 have been assessed. Three deliverables (public reports) describe the analysis performed.

The definition of the methodologies for testing the measuring devices is in progress (under WP 2). They will then be applied in the validation of selected devices in order to evaluate the devices' performances under various operating conditions (WP 3).

FUTURE STEPS AND PLANS

Once the methodologies have been defined the next step will be to apply these methodologies/protocols to a list of selected measuring devices. These measuring devices have been selected based on the analysis performed in WP 1 in order to represent the most typical/common devices and systems installed in the gas infrastructure operated by the TSOs and DSOs involved in the project and in the analysis previously performed. The test activities will validate the methodologies and provide data that will be included in the recommendations. These recommendations will then be shared with standardisation bodies and manufacturers through the Stakeholder Advisory Board of the Thoth2 project.

PROJECT TA RGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?
Project's own objectives	Organisation of at least one Stakeholder Advisory Board workshop	number	1	1	✓
	Four papers submitted to gold open access peer-reviewed journals during the project	number	4	1	
	Presentation of the project at at least five professional workshops/exhibitions	number	5	3	
	Articles submitted to the popular press or trade journals to enable other stakeholders to understand and have access to the results of the project	number	3	0	
	Organisation of a closing workshop to present the project results to all interested stakeholders	number	1	N/A	⚙
	Presentation of at least seven papers at international conferences and other relevant conferences identified during the project	number	7	3	
	Impact on standards at scope	number	1	N/A	
	Safety, PNR/RCS workshops	number	2	1	

THYGA

TESTING HYDROGEN ADMIXTURE FOR GAS APPLICATIONS

Project ID	874983
PRR 2024	Pillar 5 – Cross-cutting
Call topic	FCH-04-3-2019: Hydrogen admixtures in natural gas domestic and commercial end uses
Project total costs	EUR 2 468 826.25
Clean H_2 JU max. contribution	EUR 2 468 826.25
Project period	1.1.2020–31.3.2023
Coordinator	Engie, France
Beneficiaries	BDR Thermea Group BV, Commissariat à l'énergie atomique et aux énergies alternatives, Dansk Gasteknisk Center A/S, Deutscher Verein des Gas- und Wasserfaches – Technisch-wissenschaftlicher Verein EV, Electrolux Italia SpA, Gas.be, Gaswärme-Institut Essen EV, Groupe Européen de Recherches Gazières

https://thyga-project.eu/

PROJECT AND GENERAL OBJECTIVES

The THYGA project investigated the amount of hydrogen that can be injected without compromising the safety, emissions and efficiency of existing and new applications. It focused on the end-user perspective, specifically domestic and commercial gas appliances (space heating, hot water, cooking and catering), which account for > 40 % of the EU's gas consumption. The objectives were to close knowledge gaps on the impact blends of H_2 and natural gas (NG), support standardisation activities and identify potential mitigation opportunities.

NON-QUANTITATIVE OBJECTIVES

- THYGA aimed to involve external partners in the project. Some laboratories and manufacturers expressed their wish to use the THYGA protocol to create their own tests and contribute to the analysis.
- The project aimed to have an international reach. THYGA's test protocol has been requested for use as a test reference by international partners (in Canada, Chile and the United States).

PROGRESS AND MAIN ACHIEVEMENTS

- THYGA tested around 100 appliances, including as part of the preparation of reports for work packages 4 (standardisation) and 5 (mitigation).
- Eighteen public deliverables/newsletters were created and distributed, and seven public workshops organised.
- The project completed its test campaign objectives, with more than 100 appliances (burners) tested, by March 2023.
- THYGA gained support regarding standardisation from stakeholders: European Committee for Standardization technical committees (CEN/TCs), manufacturer associations, notified bodies and national/European technical associations.
- The project identified technical issues linked to H_2 injection into natural gas at different rates and proposed several mitigation methodologies to improve the rate of H_2 injection with which appliances can deal (in terms of safety, efficiency, power, etc.).
- Results were disclosed during the final workshop on 24 March 2023. All results are published on the THYGA website, the results have been disseminated to CEN/TCs and the THYGA experts will be available for further enquiries on the topic.

FUTURE STEPS AND PLANS

The project has finished.

PROJECT TARGETS

Target source	Parameter	Achieved to date by the project	Target achieved?	SOA result achieved to date (by others)	Year for reported SOA result
Project's own objectives	Understanding of the actual, theoretical and experimental knowledge regarding the impact of H_2NG blends on combustion	12 public deliverables		Several studies and test reports	2020
	Understanding of the actual, theoretical and experimental knowledge regarding the impact of H_2NG blends on materials	Theoretical and practical reviews released		Several studies and test reports	2020
	Segmentation of the types of appliances	Segmentation validated with stakeholders (Advisory Panel Group)		Similar approaches on segmentation	2020
	Tests of appliances	100 % of tests done	✓	Similar evaluations for national projects (GRHYD, Hydeploy, Hydelta)	2020, 2021, 2022, 2023
	Establishing how the existing certification will be modified to allow higher concentrations, including the related additional costs and the required changes to common gas burners	SOA reports (deliverables 4.1 and 4.2)		CEN/TCs' activities and other projects (Hydelta)	2020, 2021, 2022
AWP 2018	Recommendations for revision of European or ISO standards or drafting of new standards based on PNR results and a review of the existing testing methods	Public deliverable 4.3 published, which includes recommendations, based on test gases, if the current framework is to be kept and provides insights on the risks to be assessed with H2NG blends		CEN/TCs' activities and other projects (Hydelta)	2022, 2023

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