BALTICSEAH2

CROSS-BORDER HYDROGEN VALLEY AROUND THE BALTIC SEA

Project ID	101112047
PRR 2024	Pillar 6 – H_2 valleys
Call topic	HORIZON-JTI-CLEANH2-2022-06-01: Hydrogen valleys (large-scale)
Project total costs	EUR 33 235 406.25
Clean H_2 JU max. contribution	EUR 24 998 830.00
Project period	1.6.2023–31.5.2028
Coordinator	CLIC Innovation Oy, Finland
Beneficiaries	Aalto-korkeakoulusäätiö SR, ABB Oy, Ballard Power Systems Europe A/S, Baltic Innovation Agency OÜ, Borealis Polymers Oy, Convion Oy, Cybernetica AS, Elcogen Oy, Elomatic Consulting & Engineering Oy, Energiforsk AB, Energy Cluster Denmark, Energy Valley, Flexens Oy AB, Gasgrid Finland Oy, Green North Energy Oy, Helen Oy, Iwen Energy Institute gGmbH, Keemilise ja Bioloogilise Füüsika Instituut, Lhyfe, MTÜ Viru Vesinik, Neste Oyj, OÜ Hendrikson & Ko, P2X Solutions Oy, PowerUP Fuel Cells OÜ, Research Institutes of Sweden AB, Rīgas brīvostas pārvalde, Rønne Havn A/S, Skyborn Renewables Sweden AB, Solarstone Infra OÜ, Stowarzyszenie Dolnośląska Dolina Wodorowa, Sustainable Business and Technology Development Sihtasutus, Tallinna Linn, Teknologian tutkimuskeskus VTT Oy, Uppsala Universitet, Vandenilio energetikos asociacija, Vantaan Energia Oy, Viking Line Abp, Wärtsilä Finland Oy, Yara Suomi Oy, Zaļo un Viedo Tehnoloģiju Klasteris

https://balticseah2valley.eu/

PROJECT AND GENERAL OBJECTIVES

BalticSeaH2 aims to build the first significant, cross-border hydrogen valley in Europe. The goal is to create an integrated hydrogen economy around the Baltic Sea to enable energy self-sufficiency and minimise carbon emissions from various industries. Combining local areas into a broader valley will help create a genuinely integrated, interregional hydrogen economy.

The area between Estonia and Finland is an optimal location for a cross-border hydrogen market. The necessary infrastructure – natural gas pipelines, electricity grids and active marine traffic – already exists in the Gulf of Finland. Additional hydrogen infrastructure is already planned: the Nordic–Baltic Hydrogen Corridor, the Baltic Sea Hydrogen Collector and the Nordic Hydrogen Route will enable the strong growth of the hydrogen economy and hydrogen markets in the Baltic Sea region.

Over 20 demonstration cases and over 10 investment cases will showcase the diverse applications of hydrogen across multiple sectors. The production potential for hydrogen will reach 100 000 t annually by the end of the project. The hydrogen and its derivatives can be utilised or sold by the industries brought together by the project.

NON-QUANTITATIVE OBJECTIVES

BalticSeaH2 will pioneer a large-scale interregional hydrogen valley, as there is no established framework to guide the process for developing a cross-border hydrogen economy including the necessary financial, legal, environmental and technical pre-requisites to develop such a market. BalticSeaH2 will plan, design and implement hydrogen technologies along the entire hydrogen value chain (production, distribution, and consumption), support the scale-up of the project results to countries in the Baltic Sea region, optimise the cost and energy efficiency of the established technical solutions, increase societal awareness and acceptance of hydrogen technologies and the hydrogen economy, and develop an integrated market model that maximises system efficiency and enables the establishment of an interregional hydrogen economy in the region.

PROGRESS AND MAIN ACHIEVEMENTS

The project started in June 2023. The project structures, online presence and communication channels have been set up and most tasks have begun. The consortium has participated in events aiming to raise awareness of the valley. The development of the use cases and investment cases has started, but some of the cases are still confidential because the final investment decisions (FIDs) have not been published yet. Use cases, investment cases and other results will be actively communicated with all quadruple helix stakeholders as progress is made.

FUTURE STEPS AND PLANS

BalticSeaH2 intends to create a large-scale hydrogen valley between Estonia and Finland. In addition, there are replication valleys in Denmark, Germany, Latvia, Lithuania, Norway, Poland and Sweden. Replication valleys are closely involved in the BalticSeaH2 project activities already, but the project will create a replication toolkit and best-practice handbook to disseminate knowledge and lessons learnt regarding building a hydrogen economy involving the whole hydrogen value chain.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?
Project's own objectives	Number of end-use opportunities served by the use cases with FIDs	number	20	4	
	Tonnes of new renewable H_2 produced in use cases with FIDs	t H_2/year	60 000	0	
	Number of sector couplings in the use cases with FIDs	number	15	6	
	Additional funding raised for boosting use cases	M€	2 500	90	
	Number of new H_2 valleys boosted	number	10	4	
	Number of interregional strategic cooperation actions	number	15	3	

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GREEN HYSLAND

GREEN HYSLAND – DEPLOYMENT OF A H_2 ECOSYSTEM ON THE ISLAND OF MALLORCA

Project ID	101007201
PRR 2024	Pillar 6 – H_2 valleys
Call topic	FCH-03-2-2020: Decarbonising islands using renewable energies and hydrogen – H_2 islands
Project total costs	EUR 23 717 171.38
Clean H_2 JU max. contribution	EUR 9 999 999.50
Project period	1.1.2021–31.12.2025
Coordinator	Enagás Renovable SL, Spain
Beneficiaries	Acciona Generación Renovable SA, Agência Regional da Energia e Ambiente da Região Autónoma da Madeira, Ajuntament de Lloseta, Asociación Chilena de Hidrógeno, Asociación Española del Hidrógeno, Asociación Ibérica de Gas Natural, Hidrógeno y Gas Renovable para la Movilidad, Association Marocaine pour l'Hydrogène et le Développement Durable, Autoridad Portuaria de Baleares, Baleària Eurolíneas Marítimas SA, Calvera Hydrogen SA, Centro Nacional de Experimentación de Tecnologías de Hidrógeno y Pilas de Combustible Consorcio, Commissariat à l'énergie atomique et aux énergies alternatives, Consultoria Tecnica Naval Valenciana SL, Diktyo Aeiforikon Nison Toy Aigaiouae, Empresa Municipal de Transports Urbans de Palma de Mallorca SA, Enagás SA, Enercy BV, Energy Co-operatives Ireland Ltd, European Marine Energy Centre Ltd, Fédération européenne des agences et des régions pour l'énergie et l'environnement, Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragón, Gemeente Ameland, HyCologne GmbH, HyEnergy Consultancy Limited, HyEnergy TransStore BV, Instituto Balear de la Energía, Power to Green Hydrogen Mallorca SL, Redexis Gas Servicios SL, Redexis Infraestructuras SL, Redexis SA, Stichting New Energy Coalition, Universidad de La Laguna, Universitat de les Illes Balears, University of Galway

https://greenhysland.eu/

PROJECT AND GENERAL OBJECTIVES

Green Hysland is developing all the infrastructure the island of Mallorca (Spain) needs to produce and consume at least 330 t of green hydrogen from newly built photovoltaic plants per year. Green hydrogen will have multiple applications on the island: a fuel supply for a fleet of fuel cell buses and other vehicles, the generation of heat and power for commercial and public buildings, a new hydrogen refuelling station (HRS) and injection into the island's gas pipeline network. The project includes the development of a roadmap to 2050 in Mallorca and activities to replicate the experiments on other islands and at other locations, including Madeira (Portugal), Tenerife (Spain), the Aran Islands (Ireland), Greek islands, Ameland (Netherlands), Chiloé Island (Chile) and Morocco. The tools developed within the project are expected to be useful for other territories, especially isolated ones, interested in replicating the project model.

NON-QUANTITATIVE OBJECTIVES

Green Hysland has been diligent in its dissemination efforts, employing various channels to reach a wide array of stakeholders. The project has organised a conference and 10 workshops to facilitate direct engagement and knowledge sharing. In addition, Green Hysland has issued 25 press releases and produced 82 non-scientific and non-peer-reviewed publications, making its work accessible to a broader audience.

In the digital sphere, the project has leveraged social media platforms extensively, with 752 posts to date, alongside the establishment of a dedicated website. Furthermore, Green Hysland has conducted communication campaigns using radio and TV. Involvement in conferences, workshops and other events, totalling 87 participations, has facilitated direct interaction and networking opportunities.

In collaboration with other EU projects, the project has engaged in 11 joint activities to amplify its reach and impact. Dissemination efforts have been tailored to engage specific audiences, with a focus on the scientific community, industry stakeholders, civil society, policymakers, media representatives, investors, customers and other interested parties. This targeted approach has yielded significant traction, ensuring the project's objectives and outcomes are effectively communicated to and understood by diverse stakeholders.

PROGRESS AND MAIN ACHIEVEMENTS

- The green H_2 production plant located on Cemex land in Lloseta has been built, and site assembly testing has been carried out.
- The engineering tasks associated with the HRS have been finalised but some issues arose with the construction, which is therefore delayed.
- The H_2 pipeline and H_2 injection point for the island's natural gas network operated by Redexis are under construction.
- The 100 kWe fuel cell that will supply electricity to the maritime station of Ports de Balears is progressing and a procurement has been launched.
- The 50 kWe combined heat and power (CHP) system to be located in the Iberostar Bahía de Palma (four-star) hotel, which will cover part of the hotel's energy demand, is progressing.
- The five hydrogen buses for the Empresa Municipal de Transports de Palma (EMT) city bus fleet have been delivered and are on-site.
- The search for car rental companies willing to incorporate H_2 vehicles into their fleets is ongoing.

In addition, important progress has been made in terms of data collection, background research and scenario production in the former and the further development of the H_2 Territories Platform. Finally, great efforts were made to disseminate information about the project through online webinars and workshops organised by the project.

FUTURE STEPS AND PLANS

- The project aims to resolve the current situation with the HRS. The work associated with the engineering of the HRS has been finalised; however, it has been identified that all the design engineering was undertaken with the EMT yard in mind, which is not available at this time owing to space limitations, so construction is delayed. Solutions are being considered and the expectation is that a solution will be found in the coming months.
- Owing to Lloseta Council's formal announcement of its intention to leave the consortium, no associated activity has been executed in relation to the CHP application in the municipal building, and other municipalities are currently being analysed. The expectation is that a solution will be found in the coming months. In addition, the consortium expects to resolve the electrolyser issues and complete the site and factory acceptance tests for the two tube trailers in the coming months.
- The work of Sebastián Barceló Vidal as General Manager of Power to Green Hydrogen Mallorca will continue during 2024, focusing on centralising all aspects related to the exploitation of the H_2 production plant and the relationship with the H_2 consumers.
- An amendment will be launched in the coming months. In it, the consortium intends to include modifications of the overall costs and due dates of deliverables and milestones, make clear OK Mobility's final decision to enter the project, make official the exit of Lloseta Council from the project consortium and explain the situation with the EMT yard and the HRS.

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PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?
MAWP (2018–2020)	Commitment of public authorities	M€	-	6.25	
Project's own objectives	Commercial fuel-cell-based CHP system in a hotel	kWe	50	N/A	
	Fostering replication of hydrogen valley elsewhere	Replication studies on EU islands (Madeira (Portugal), Tenerife (Spain), the Aran Islands (Ireland), Greek islands and Ameland (Netherlands))	Studies on five EU islands and updated version of the Hydrogen Territories Platform	Replication tool development (from BIG-HIT) and replication studies ongoing	
	Long-term roadmap for a local and regional H_2-based economy on the island of Mallorca towards 2050	Studies	Roadmap drafted and endorsed	Studies ongoing	
	H_2 fuel cell for electricity supply for critical infrastructure at Ports de Balears	kWe	100	Call for tenders for the fuel cell launched	
	Electrolyser	MW	7.5 MW or + 300 t H_2 production per year	2.5 MW	
	Injection of H_2 into the local gas distribution grid	t H_2/year	190	Permits granted, H_2 pipeline and injection point under construction	
	10 light-duty vehicles	number	10	Discussions with potential end users ongoing	
	FC H_2 buses in Palma	number	5	5	✓

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HEAVENN

HYDROGEN ENERGY APPLICATIONS FOR VALLEY ENVIRONMENTS IN NORTHERN NETHERLANDS

Project ID	875090
PRR 2024	Pillar 6 – H_2 valleys
Call topic	FCH-03-1-2019: H_2 valley
Project total costs	EUR 99 720 599.49
Clean H_2 JU max. contribution	EUR 20 000 000.00
Project period	1.1.2020–31.12.2025
Coordinator	Stichting New Energy Coalition, Netherlands
Beneficiaries	Bytesnet Groningen BV, Cemtec Fonden, Emmtec Services BV, Enercy BV, Energie Beheer Nederland BV, Engie Energie Nederland NV, European Marine Energy Centre Ltd, European Research Institute for Gas and Energy Innovation, EWE GASSPEICHER GmbH, Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragón, Gemeente Emmen, Gemeente Groningen, Gemeente Hoogeveen, Green Planet Real Estate BV, Groningen Seaports NV, H2Tec BV, Hinicio, HyCC BV, Hydrogen Ireland Natural Resources Association Company LBG, HyEnergy Consultancy Limited, HyEnergy TransStore BV, Lenten Scheepvaart BV, Logan Energy Limited, Nederlandse Aardolie Maatschappij BV, Nederlandse Particuliere Rijnvaart-Centrale Cooperatie UA, Nobian Industrial Chemicals BV, NV Nederlandse Gasunie, PitPoint. Crew BV, PitPoint.Pro BV, Qbuzz BV, Rijksuniversiteit Groningen, Shell Nederland Verkoopmaatschappij BV, TotalEnergies Gas Mobility BV, TotalEnergies Marketing Nederland NV, UVO Vervoer BV

https://heavenn.org/

PROJECT AND GENERAL OBJECTIVES

Heavenn is a large-scale demonstration project bringing together core elements – production, distribution, storage and local end use of H_2 – into a fully integrated and functioning hydrogen valley that can serve as a blueprint for replication across Europe and beyond. The main goal is to make use of green H_2 across the entire value chain, while developing replicable business models for wide-scale commercial deployment of H_2 across the entire regional energy system.

NON-QUANTITATIVE OBJECTIVES

- Safety issues will be covered by permit-issuing procedures.

PROGRESS AND MAIN ACHIEVEMENTS

- The salt barge hull is actively sailing in the Netherlands. It uses a container swap solution to refuel on hydrogen. Salt cavern testing is ongoing and has been successful so far.
- A large proportion of the mobility applications (i.e. vehicles) have been ordered or purchased and will be delivered this year.
- Data collection is being taken over by a new partner, which will start collecting data as soon as they become available.
- Gasunie successfully conducted the first static tests and demonstrated that H_2 can be safely stored in salt caverns. The connection specification study was completed, covering various options. This study considered different market situations/developments and the scalability of the design, resulting in a plot plan and capacity range definition. The designs and site layout plans of subsequent H_2 caverns are in progress.
- The Eemshaven area is in the process of matchmaking for the pipeline, looking for customers and purchase agreements. The HyCC factory is on the way to a financial investment decision (FID). The Hydrogen Hub has requested a final co-financing subsidy and will then take its FID. The hydrogen refuelling station here is operational and used by the partner UVO.
- In Hoogeveen, the construction of houses powered by hydrogen has begun. Research is ongoing to find the right solution to fuel the data centre, and the size and type of fuel cell required.
- The Emmen EMMHY pipeline is in place. Emmtec is ready to start using hydrogen, but no contract is in place.

FUTURE STEPS AND PLANS

- The critical assessment of deliverables is planned. Since the grant agreement, a number of changes have occurred. The tasks and deliverables will be critically reassessed and updated if necessary.
- Partners are still waiting for co-funding. If co-funding is secured, they will accelerate all actions. The consortium is also waiting on a definitive project extension so that they can take a FID.
- Much effort will be put into connecting the various hydrogen valley projects, sharing experiences and lessons learnt, creating synergies and thus strengthening each other.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives and AWP 2019	Cluster 1: salt barge and refuelling	t H_2 per year	80	
	Cluster 2: salt cavern storage	t H_2 per year	–	
	Cluster 2: heating of buildings for Gemeente Hoogeveen, Bytesnet Groningen and others	t H_2 per year	155	
	Cluster 3: Emmen	t H_2 per year	–	
	Cluster 4: mobility	t H_2 per year	260	
	WP 5: impact analysis and business models	t H_2 per year	–	
	WP 6: research aiming towards future H_2 roll-out	t H_2 per year	80	

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HYSOUTHMARMARA

SOUTH MARMARA HYDROGEN SHORE

Project ID	101112054
PRR 2024	Pillar 6 – H_2 valleys
Call topic	HORIZON-JTI-CLEANH2-2022-06-02: Hydrogen valleys (small-scale)
Project total costs	EUR 37 798 575.00
Clean H_2 JU max. contribution	EUR 7 999 937.50
Project period	1.7.2023–30.6.2028
Coordinator	Güney Marmara Kalkınma Ajansı, Türkiye
Beneficiaries	Alma Mater Studiorum – Università di Bologna, Bandırma Onyedi Eylül University, Enerjisa Enerji Üretim A.Ş., Eti Maden İşletmeleri Genel Mudurlugu, Hidrojen Peroksit Sanayi ve Ticaret A.Ş., Kaleseramik Çanakkale Kalebodur Seramik Sanayi A.Ş., Linde Gaz A.Ş., Sabancı Üniversitesi, Software AG, Türk–Alman Üniversitesi, Türkiye Bilimsel ve Teknolojik Araştırma Kurumu, Türkiye Enerji, Nükleer ve Maden Araştırma Kurumu, Türkiye Şişe ve Cam Fabrikaları A.Ş., Université Mohammed VI Polytechnique

https://hysouthmarmara.org/

PROJECT AND GENERAL OBJECTIVES

Türkiye's south Marmara region, currently the world's 12th-largest region in terms of installed renewable capacity, is set to boost its hydrogen economy through the HySouthMarmara valley project. The project, with a budget of EUR 37.8 million and eight work packages, aims to increase the region's hydrogen market and boost the hydrogen economy. The project will focus on green hydrogen and green fuel production, with the goal of becoming Türkiye's first carbon-neutral region by 2053.

TÜRKIYE'S HYDROGEN PROJECT OBJECTIVES ARE THE:

- creation of Türkiye's first regional hydrogen roadmap, aiming to provide recommendations for up to 2035;
- establishment of the first MW-scale green hydrogen plant, aiming to create the largest green hydrogen facility in Türkiye;
- development of a digital twin for the hydrogen production system, enabling renewable energy usage and efficient green hydrogen production;
- first use of green hydrogen in the production of hydrogen peroxide, glass, ceramic and boron chemicals;
- first investment opportunities for the green production of hydrogen derivatives such as ammonia and methanol;
- commercial production of sodium borohydride, a new boron chemical, and a new power system;
- development of Türkiye's first domestic hybrid ceramic tile kiln that can use hydrogen;
- establishment of Türkiye's first renewable energy park, Bandırma Energy Base;
- establishment of Türkiye's first hydrogen platform, the South Marmara Hydrogen Shore Platform;
- completion of Türkiye's first hydrogen training centre.

NON-QUANTITATIVE OBJECTIVES

The HySouthMarmara project aims to develop a hydrogen generation system using sodium borohydride hydrolysis, which will be used by the Disaster and Emergency Management Presidency in south Marmara. The first prototype will be installed in the presidency's logistics warehouse, demonstrating its usability in disasters such as earthquakes, landslides, major power plant failures, floods and

fires triggered by the climate crisis. This application will contribute to the social impact of hydrogen.

The project also focuses on education and skill development. By combining aspects of education, research and industry, the project will provide vocational skill training and educational programmes on hydrogen. The south Marmara region has set out a vision to become a green technologies training hub, and Güney Marmara Kalkınma Ajansı (GMKA) has increased its efforts regarding renewable-energy-related studies and projects. The renewable youth operation, financed under the EU Instrument for Pre-accession Assistance, is carried out with the partnership of GMKA and two out of three universities operating in the region. Renewable energy laboratories and applied education infrastructures are established at each university, with Bandırma Onyedi Eylül University focusing on offshore renewable technologies and green hydrogen.

The project's international dimension includes interactions, collaborations and impacts beyond national borders. Delegation visits and site visits will facilitate engagement with international partners, stakeholders and experts, allowing participants to exchange ideas, share best practices and explore opportunities for collaboration and mutual learning.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?
Project's own objectives	Annual green hydrogen production	t	500	N/A	
	Sodium borohydride production	t/year	10	N/A	
	Feasibility studies	number	4	1	
SRIA (2021–2027)	Installed capacity of green hydrogen plant	MW	4	N/A	

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IMAGHYNE

IMAGHYNE: INVESTMENT TO MAXIMISE THE AMBITION FOR GREEN HYDROGEN IN EUROPE

Project ID	101137586
PRR 2024	Pillar 6 – H_2 valleys
Call topic	HORIZON-JTI-CLEANH2-2023-06-01: Large-scale hydrogen valley
Project total costs	EUR 192 164 346.25
Clean H_2 JU max. contribution	EUR 19 996 911.75
Project period	1.1.2024–31.12.2029
Coordinator	Région Auvergne-Rhône-Alpes, France
Beneficiaries	Aéroports de Lyon, ANA Aeroportos de Portugal, SA, Arkema France SA, Association Cara, Atawey, Axelera – Association Chimie-Environnement Lyon et Rhône-Alpes, Bontaz Centre, Bouygues Energies & Services, Commissariat à l'énergie atomique et aux énergies alternatives, Communauté de Communes Faucigny-Glières, Commune de Bonneville, Compagnie Nationale du Rhône SA, Engie Energie Services, ERM France, Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragón, G. Jacquemmoz et Fils, GRDF SA, Green Corp Konnection, GRTgaz, Hyliko, Hympulsion SAS, Hynamics, Imagine..., Institut national de l'environnement industriel et des risques, Keolis, Lhyfe, Lhyfe Production 3, Manufacture Française des Pneumatiques Michelin, Nomads Foundation, Politecnico di Torino, PolyTechnyl SAS, SAS PUM, SATA Group, Societé Rhodanienne des cars Ginhoux, Storengy France, Storengy SAS, Symbio France, Syndicat Mixte des 4 Communautés de Communes, Technologies énergies nouvelles énergies renouvelables, Rhône-Alpes, Drôme, Isère, Savoie et Haute-Savoie, Transports LTR-Vialon, VINCI Airports, Watea, Zamenhof Exploitation

www.imaghyne.eu

PROJECT AND GENERAL OBJECTIVES

Imaghyne will dramatically accelerate the deployment of hydrogen technologies in Auvergne-Rhône-Alpes. The ambition is to activate a long-lasting hydrogen economy that is fully integrated into the wider energy system and addresses the needs of high-emitting sectors. Imaghyne will be deeply connected to European initiatives to further expand and accelerate synergies and enable quicker uptake of hydrogen innovations in Europe and beyond. In addition, Imaghyne will gather key public and private stakeholders, foster investments along the entire hydrogen value chain and create the conditions to achieve a pan-European hydrogen economy at scale. To achieve this main target, the project partners created the following list of objectives aligned with the call criteria.

- Deploy 57 MW of electrolysis capacity to produce 8 000 t/year of low-carbon and renewable hydrogen.
- Implement a flexible hydrogen supply chain securing local ecosystems by deploying 20 high-capacity tube trailers and a multitonne hydrogen storage system in an underground salt cavern.
- Deploy 13 multimodal hydrogen refuelling stations that will contribute to the cohesion, efficiency and sustainability of the trans-European transport network and ensure there is a clear pathway to decarbonising public transport fleets.
- Deploy 199 on-road fuel cell vehicles (of various types) from public and private fleets.
- Deploy 63 off-road fuel cell vehicles and stationary equipment to decarbonise agricultural, mountainous and airport hubs; this will include the replacement of three emergency diesel generators with a 4 MW hydrogen stationary fuel cell for power generation to secure airport operations.

To create a real ecosystem, the project gathers a multiplicity of partners, including the production side, storage side and end-use side.

NON-QUANTITATIVE OBJECTIVES

- Strengthen the robustness of the overall energy and hydrogen supply chain by integrating a flexible industrial player into the ecosystem.
- Design an efficient, pipeline-based, multiuser hydrogen system and provide evidence to help determine the optimum hydrogen transport and storage technology choice(s) for wider roll-outs.
- Prepare for additional large-scale deployment as part of the valley extension and its replication in Europe and beyond.

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PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives	CO_2 emissions avoided resulting in the off-road mobility and energy-related actions	kt	6.5	
	Amount of hydrogen injected into and extracted from the salt cavern during the project	t	300	
	Off-road vehicles deployed during the project	number	Three farm tractors, five snow groomers, 61 GSE engines	
	CO_2 emissions avoided resulting in the industry-related actions developed	kt CO_2eq	150	
	Stationary fuel cells deployed	number	1	
	Monitored operational period for each type of vehicle	months	> 24	
	Tonnes of low-carbon and renewable hydrogen used in Arkema's process	t H_2	16 000	
	Average hours of operation per off-road vehicle per year	h/year	Farm tractors: 600 h/year; snow groomers: 1 300 h/year; average GSE: 540 h/year	
	Monitored operational period for off-road vehicles	months	> 24	
	CO_2 emissions avoided resulting in the mobility-related actions	kt	14.2	
	Electrolysis capacity deployed	MW	57	
	Underground storage capacity of hydrogen in salt cavern available for commercial exploitation	t	44	
	Average availability rate of the electrolyser	%	80–90	
	Evaluation of H_2 deployment scenario (technical, economic, environmental, societal and safety/risk criteria)	number of scenarios analysed	2	
	40-ft tube trailers deployed	number	20	
	Total hours of operation across the entire off-road fleet	hours, days	Farm tractors: 7 200 hours, 1 000 days; snow groomers: 25 000 hours, 1 000 days; total GSE: 130 000 hours, 5 500 days	
	Regions/organisations targeted by replicability actions	number	5	
	Length of additional pipeline to be deployed secured by feasibility studies	km	40	
	Years of operation of the electrolysers	year	2	
	Amount of renewable hydrogen produced	t/year	4 000	
	Hydrogen distribution capacity available	t/day	10	
	Average distance driven per vehicle per year	km/year	Coaches/buses: > 40 000 km/year: light-duty vehicles > 35 000 km/year; trucks 100 000 km/year	
	Distance driven across the entire fleet	km	Buses/coaches: > 3 000 000 km: light-duty vehicles: 28 000 000 km; trucks: 7 000 000 km	
	Vehicles deployed	number	17 coaches/buses; 164 light-duty vehicles; 18 heavy-duty vehicles	
	Hydrogen refuelling stations deployed	number	13	
	Amount of low-carbon plus renewable hydrogen produced	t/year	8 000	
	Length of small-scale pipeline deployed	km	0.8–2.3	
	Amount of hydrogen delivered by tube trailers within the project	t	2 500	

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LUXHYVAL

LUXEMBOURG HYDROGEN VALLEY DELIVERING INTEGRATED FULL-CHAIN SUSTAINABLE HYDROGEN ECOSYSTEM WITH TECHNICAL, ECONOMIC, SOCIAL AND ENVIRONMENTAL BENEFITS AND SUPERIOR REPLICABILITY

Project ID	101111984
PRR 2024	Pillar 6 – H_2 valleys
Call topic	HORIZON-JTI-CLEANH2-2022-06-02: Hydrogen valleys (small-scale)
Project total costs	EUR 39 108 677.50
Clean H_2 JU max. contribution	EUR 7 999 998.64
Project period	1.11.2023–31.1.2029
Coordinator	Université du Luxembourg, Luxembourg
Beneficiaries	Autocars Sales-Lentz SA, Centre national de la recherche scientifique, CERATIZIT Luxembourg SARL, Encevo SA, Enovos Luxembourg SA, Green Power Storage Solutions SA, Institute of Higher Education King Danylo University, IZES gGmbH, Luxembourg Institute of Science and Technology, LuxEnergie SA, LuxMobility SARL, Paul Wurth SA, R2M Solution Spain SL, S.L.A. SA, SLG SA, Syndicat des tramways intercommunaux dans le canton d'Esch, Université de Bordeaux, University of New South Wales, Vysoká škola chemicko-technologická v Praze

https://www.luxhyval.eu/

PROJECT AND GENERAL OBJECTIVES

Luxhyval is launching a flagship hydrogen valley to boost the penetration of hydrogen ecosystems in Luxembourg by deploying green hydrogen initiatives across the entire value chain from local production to utilisation, including storage and distribution for a range of applications targeting industry and mobility, while also aiming to connect with existing/planned infrastructures. Several end-use applications in the mobility (i.e. private and public buses, light-duty industrial vehicles) and industry (i.e. metal and glass) are included, with the support of key commercial actors along the entire value chain and political support in line with the Luxembourg hydrogen strategy, which aims to fully decarbonise the industrial sector before 2030. Digital twinning for optimal planning and operation is delivered to support upscaling and replication, while public perception and professional upskilling deliver social benefits and equip the workforce with the competences needed. Finally, the lessons learnt and solutions are replicated in two follower valleys in central (Czechia) and eastern (Ukraine) Europe.

Luxhyval aligns its work with the vision that hydrogen is a key piece of any decarbonisation strategy, especially for energy-intensive industrial and mobility applications, enabling energy sector integration and sector coupling. Specifically, Luxhyval underpins the Luxembourg hydrogen strategy to locally generate and supply hydrogen to fulfil Luxembourg's hydrogen needs – which are currently covered by imported grey (i.e. from fossil origin) hydrogen – including a plan to replace fossil fuels with green hydrogen. This is achieved using comprehensive planning and a progressive approach to get the roadmap in motion, while providing evidence and confidence to local users, citizens and stakeholders for progressive upscaling. To achieve these overarching objectives, Luxhyval's specific objectives, with corresponding key performance indicators and targets, are defined. Specific objectives are measured quantitatively using the targeted key performance indicator metrics.

NON-QUANTITATIVE OBJECTIVES

- Social impact.
  - Increase public understanding of H_2 technologies.
  - Upskill professionals and students in terms of H_2 and provide associated jobs.
- Technological impact.
  - Fully integrate the H_2 technology ecosystem.
  - Establish a functioning green H_2 market in Luxembourg.
  - Validate the multistakeholder business model and governance.
- Economic impact.
- Environmental impact.
  - Enhance the environmental profile with zero-emission and low-noise buses.
- National impact.
  - Provide a local supply of green H_2 and energy independency.
  - Reduce dependence on imported fuels.
  - Boost the economic resources remaining in Luxembourg.
- Policy and regulatory impact.
  - Overcome bottlenecks delaying rapid H_2 market expansion.
  - Contribute to policy and regulation instruments.
  - Explore potential synergies with international markets.

PROGRESS AND MAIN ACHIEVEMENTS

- The extended feasibility study is actively progressing.
- Business models for hydrogen-integrated ecosystems, governance and agreements for operation are under investigation and evaluation; the business cases are currently being drafted.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives	Replication plans for hydrogen valleys in Czechia and Ukraine	-	Feasibility studies done	
	Define and execute a roadmap with upscaling and replication strategies both within Luxembourg and the Greater Region	-	Roadmap specifies share and scale of future industry and mobility use of green H_2 in Luxembourg for 2030–2050	
	Skill development	-	Three university courses and two professional training modules, with 60 professionals and 300 students trained	
	Clean hydrogen production with electrolysis	t/year	650	
	Hydrogen end use	t/year	650 (indicatively 70 % for industry and 30 % for transport)	

NAHV

NORTH ADRIATIC HYDROGEN VALLEY

Project ID	101111927
PRR 2024	Pillar 6 – H_2 valleys
Call topic	HORIZON-JTI-CLEANH2-2022-06-01: Hydrogen valleys (large-scale)
Project total costs	EUR 345 326 582.18
Clean H_2 JU max. contribution	EUR 24 996 826.69
Project period	1.9.2023–31.8.2029
Coordinator	Holding Slovenske elektrarne d.o.o., Slovenia
Beneficiaries	Acciaierie Bertoli Safau SpA, AcegasApsAmga SpA, ACTIVE SOLERA jednostavno društvo s ograničenom odgovornošću za usluge, Adriatic Croatia International Club, za djelatnost marina d.d., Alpacem Cement, d.d., Area di Ricerca Scientifica e Tecnologica di Trieste, Azienda Provinciale Trasporti SpA, CTS H2 SRL, Danieli Centro combustion SpA, Dilj industrija građevinskog materijala d.o.o., DOK-ING Indeloop d.o.o. za proizvodnju elektricne energije i gospodarenje otpadom, Ecubes Tehnologije d.o.o., Faber Industrie SpA, Ferriere Nord SpA, Fondazione Bruno Kessler, Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragón, Gitone Kvarner d.o.o., HSE Invest družba za inženiring in izgradnjo energetskih objektov d.o.o., Maritime Center of Excellence d.o.o., META, META circularity, svetovanje in inovacije d.o.o., META Group SRL, Ministarstvo gospodarstva i održivog razvoja, Ministrstvo za infrastrukturo, Regione Autonoma Friuli Venezia Giulia, Snam SpA, Steklarna Hrastnik, družba za proizvodnjo steklenih izdelkov d.o.o., Sveučilište u Rijeci, Sveučilište u Rijeci Tehnički Fakultet, Sveučiliste u Splitu Fakultet elektrotehnike, strojarstva i brodogradnje, Sveuciliste u Zagrebu Fakultet strojarstva i brodogradnje, termoelektrarna sostanj d.o.o., Trasporto Pubblico Locale Friuli Venexia Giulia SCARL, Trieste Trasporti SpA, Università degli Studi di Trieste, Univerza v Ljubljani

https://www.nahv.eu/

PROJECT AND GENERAL OBJECTIVES

The North Adriatic Hydrogen Valley (NAHV), a Horizon Europe project supported by the Clean Hydrogen Partnership, is a response to an initiative launched by key members of industry in the target region, who requested coordinated action to develop a cross-regional innovation ecosystem at the first Hydrogen Ecosystem North Adriatic Conference, held in Nova Gorica in the autumn of 2021. The initiative builds on the agreement signed in early 2022 by representatives of the Slovenian Ministry of Infrastructure, the Croatian Ministry of Economy and Sustainable Development, and the Friuli Venezia Giulia (FVG) autonomous region in Italy to jointly contribute to the European Green Deal and European hydrogen strategy goals. On 14 March 2022, the Slovenian State Secretary of the Ministry of Infrastructure, the Croatian State Secretary of the Ministry of Economy and Sustainable Development, and the President of the FVG autonomous region signed a joint letter of intent in which they recognised the importance of regional cooperation and a cross-border hydrogen valley in boosting the energy transition and promoting sectoral integration between transport, hard-to-abate industries and end users in an integrated ecosystem. With this letter of intent, the three signatories committed to implementing a common innovation agenda and cooperation projects to accelerate the deployment of hydrogen-based solutions, thus strengthening local hydrogen ecosystems and building interregional value chains. The European hydrogen backbone considers the three territories that are part of the NAHV project – Croatia, FVG (Italy) and Slovenia – as one part of the larger pan-European hydrogen supply and import corridors, which will connect industrial clusters, ports and hydrogen valleys to regions with abundant hydrogen supply.

To fulfil these objectives, the NAHV project involves a well-rooted partnership of 37 organisations (of which two are part of Hydrogen Europe and three are part of Hydrogen Europe Research), covering the transnational central European area of three territories – Croatia, Slovenia and the FVG region – demonstrating the cross-border integration of hydrogen production, distribution and consumption, and building capacities for annual hydrogen production of over 5 000 t, of which over 20 % is expected to be exchanged within the area of the NAHV project.

The project will activate 17 test bed applications in their ecosystems, clustered into three main pillars: hard-to-abate industries, the energy sector and the transport sector. These will act as real-life cases for piloting global hydrogen markets, moving from technology readiness level 6 at the beginning to level 8 by the end of the project.

Four fuel cell applications in the energy and transport sectors will be demonstrated. Test beds will then be scaled up to the industrial level as a replicable model, contributing to the decarbonisation of the three territories by harnessing renewables to improve system resilience, security of supply and energy independence.

NON-QUANTITATIVE OBJECTIVES

The NAHV project is the establishment of a NAHV association as an Association Internationale Sans but Lucratif (AISBL). Under the coordination of Area di Ricerca Scientifica e Tecnologica di Trieste, the first steps towards the AISBL constitution have been taken. Partners will work to (i) prepare all the formal documentation for the incorporation of the AISBL, (ii) define the business plan and organisational model and (iii) define the financial needs and source for covering those costs. The NAHV AISBL will be supported by the three countries involved, and it will become the governing body of the NAHV ecosystem, going far beyond the NAHV project.

FUTURE STEPS AND PLANS

In the coming months, the main activities of the project NAHV will be identifying co-funds at the European and national levels and preparing all spatial and technical documentation needed to start hydrogen production installation at various locations in the valley.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives	CO_2 savings	t/year CO_2eq	32 000	
	Cross-border hydrogen valley	-	17 renewable H_2 supply chain test beds in hard-to-abate, energy and transport sectors	
	Education and training	-	7 000 future professionals and experts trained, including through vocational training programmes and the creation of a macroregional competence centre for hydrogen research and education and the training and educational mentoring programme H2Student	
	Hydrogen production distributed in Croatia, Italy and Slovenia	t/year	6 000 (indicatively 50 % in industry, 30 % in the transport sector and 20 % in the energy sector)	

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SH2AMROCK

SOURCING HYDROGEN FOR ALTERNATIVE MOBILITY, REALISING OPPORTUNITIES AND CREATING KNOW HOW IN IRELAND

Project ID	101112039
PRR 2024	Pillar 6 – H_2 valleys
Call topic	HORIZON-JTI-CLEANH2-2022-06-02: Hydrogen valleys (small-scale)
Project total costs	EUR 54 806 601.01
Clean H_2 JU max. contribution	EUR 7 582 467.22
Project period	1.1.2024–31.12.2028
Coordinator	University of Galway, Ireland
Beneficiaries	Acondicionamiento Tarrasense Associacion, BOC Gases Ireland Limited, Bord Na Mòna Powergen Limited, Chesterfield Special Cylinders Ltd, Colas Teoranta, Córas Iompair Éireann, Dublin City University, E&E MEP Studio LLC, Energy and Hydrogen Alliance, Economic and Social Research Institute LBG, Energy Co-operatives Ireland Ltd, EPRI Europe DAC, European Marine Energy Centre Ltd, Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragón, Galway Aviation Services Ltd, Galway Harbour Company, Hive Hydrogen (Ireland) Limited, Hydrogen Ireland Natural Resources Association Company LBG, HyEnergy Consultancy (Europe) BV, Institute of Higher Education King Danylo University, IZES gGmbH, Kemijski inštitut, Noordwes-Universiteit, Politechnika Łódzka, Politecnico di Torino, Private Scientific Institution, Institute for Research in Environment, Civil Engineering and Energy, Skopje, Stichting New Energy Coalition

https://www.sh2amrock.eu/

PROJECT AND GENERAL OBJECTIVES

- Highlight hydrogen's role to enable deeper decarbonisation of the Irish economy through sector coupling.
- Establish Ireland's first multimodal hydrogen transport hub.
- Enable the creation of a domestic market for green hydrogen value chains.
- Ensure a fair and just transition for Ireland's isolated communities.
- Produce at least 500 t of green hydrogen per year by 2028.
- Use green hydrogen production to realise decarbonisation in multiple end-use applications.
- Create strong connections with existing European hydrogen valleys and associated initiatives to foster strong linkages in the European hydrogen sector.
- Instigate the sustainable economic growth and industrialisation of Ireland.
- Foster all-Ireland hydrogen knowledge sharing, replication activities and cross-border strategy development.
- Introduce hydrogen into the Irish energy mix to increase flexibility, security and resilience.
- Leverage lessons learnt from Sh2amrock to help develop hydrogen valley roadmaps in key replication regions in Ireland and Europe and globally.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives	Long-distance coaches	number	10	
	H_2 aircraft	number	1	
	H_2 injection (bitumen plant)	number	1	
	Double-decker city buses	number	3	
	Combined heat and fuel cell	number	1	
	Minibuses and vans	number	4	
	FC HGVs	number	5	
	Pipeline	bar	< 5	
	Mobile tube trailers	number	3	
	Electrolyser	MW	4	
	HRS	bar	350	

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TH2ICINO

TOWARDS H_2YDROGEN INTEGRATED ECONOMIES IN NORTHERN ITALY

Project ID	101112098
PRR 2024	Pillar 6 – H_2 valleys
Call topic	HORIZON-JTI-CLEANH2-2022-06-02: Hydrogen valleys (small-scale)
Project total costs	EUR 18 506 850.00
Clean H_2 JU max. contribution	EUR 7 446 920.00
Project period	1.9.2023–31.8.2027
Coordinator	RINA Consulting SpA, Italy
Beneficiaries	Air Pullmann SpA, Artelys, Centro de Investigación de Recursos y Consumos Enérgeticos, Comune di Busto Arsizio, Confindustria Varese, EMISIA SA – Anonimi Etairia Perivallontikon Kai Energiakon Meleton Kai Anaptixis Logismikou, Lhyfe, Società per azioni Esercizi Aeroportuali S.E.A.

http://th2icino.eu

PROJECT AND GENERAL OBJECTIVES

Th2icino spearheads the deployment of micro hydrogen economies by conceptualising and demonstrating an ecosystem. It comprises six replicable use cases:

- renewable hydrogen production,
- transport via pipelines,
- transport via tube trailers,
- hydrogen refuelling stations,
- direct refuelling from the tube,
- retrofitting of some airport ground units.

The implementation of the use cases will serve as a validation mechanism for a master planning tool, which will be designed to offer support in the techno-economic development of hydrogen valleys across the EU.

Th2icino will demonstrate a hydrogen ecosystem at the heart of Milan Malpensa Airport to foster sector coupling with the surrounding area, creating synergies between strategic pieces of the energy transition, such as airports, and hard-to-abate mobility and industries of Varese in the quest for net zero. The project's specific goals are the following:

- 500 t/year of renewable hydrogen,
- decarbonisation of at least two segments (mobility/energy),
- yearly savings equivalent to the CO_2 emissions of 1 500 cars.

NON-QUANTITATIVE OBJECTIVES

- Use a hydrogen airport as a test bed for an innovative solution.
- Establish governance of a hydrogen region.

PROGRESS AND MAIN ACHIEVEMENTS

- Preliminary hydrogen safety planning has taken place.
- Initial steps have been taken to outline the hydrogen safety-planning framework, ensuring adherence to stringent safety standards and protocols throughout the project life cycle. Safety protocols and risk assessment procedures have been developed to mitigate potential hazards associated with hydrogen production, storage and transportation.
- The modelling phase for the extended valley has begun, aiming to simulate and optimise various aspects of the hydrogen ecosystem, including production, distribution and utilisation.

FUTURE STEPS AND PLANS

- Plans are in place to commence collaboration with offtakers in March 2024.
- The focus will be on modelling ground units at the airport and developing the master planning tool to support decision-making processes related to hydrogen production, distribution and utilisation.
- Engaging with offtakers will enable the refinement of project strategies, alignment of objectives and validation of technological solutions tailored to meet end users' needs.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives	Emission reduction	t CO_2/year	4 400	
	Levelised cost of H_2	€/kg H_2	< 4.5	
	H_2 produced	t H_2/year	500	

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TRIERES

TOWARDS THE DEVELOPMENT OF A HYDROGEN VALLEY DEMONSTRATING APPLICATIONS IN AN INTEGRATED ECOSYSTEM IN GREECE

Project ID	101112056
PRR 2024	Pillar 6 – H_2 valleys
Call topic	HORIZON-JTI-CLEANH2-2022-06-02: Hydrogen valleys (small-scale)
Project total costs	EUR 10 492 431.25
Clean H_2 JU max. contribution	EUR 7 995 825.63
Project period	1.7.2023–30.4.2028
Coordinator	Motor Oil (Hellas) Diilistiria Korinthou AE, Greece
Beneficiaries	Anónymos Etaireía Diórygas Korínthou AE, Avinoil Viomichaniki Emporiki Kai Naftiliaki Etaireia Petrelaion Monoprosopi Anonymi Etaireia, Dímos Loutrakíou – Perachóras – Agíon Theodóron, Dimosia Epicheirisi Ilektrismou Anonymi Etaireia, Dioryga Gas Monoprosopi Anonymi Etaireia Fysikou Aeriou, Ecoferry Naytiki Etaireia, Elliniki Etaireia Symmetochon Kai Periousias AE, Ethnicon Metsovion Polytechnion, FEN Research GmbH, Fulgor Monoprosopi Anonymi Eteria Elliniki Viomixania Kalodion, Hydrogen Egypt, Hydrus Anotati Synektiki Michaniki Etaireia Symvoulon Anonymi Etaireia, Idryma Technologias Kai Erevnas, Kition Ocean Port Ltd, LPC Monoprosopi Anonymi Etaireia Epexergasias Kai Emporias Lipantikon Kai Petrelaioeidon Proionton, National Centre for Scientific Research 'Demokritos', New Energy Environmental Solutions & Technologies E.E., Nova Telecommunications & Media Single Member SA, Odikes Sygkoinonies A.E., Olympia Odos Anonymi Etairia Parachorisis Gia Ton Autokinitodromo Eleusina Korinthos Patra Pyrgos Tsakona, Omospondia Ergodoton & Viomichanon Kyprou, Perifereia Peloponnisou, Piraeus Port Authority SA, Rijksuniversiteit Groningen, Stichting New Energy Coalition

https://www.trieres-h2.eu/

PROJECT AND GENERAL OBJECTIVES

Greece is focusing on sustainable innovation through the Trieres hydrogen valley, a renewable energy project based around the Motor Oil Hellas Corinth Refinery complex. The project aims to enhance local green renewable hydrogen production, transportation and end use in an integrated ecosystem. Initially small-scale, it aims to increase hydrogen production and consumption in the Balkans, south-eastern Europe and the eastern Mediterranean. The Trieres valley is a major hub of investment and talent, placing Greece on the hydrogen map for the first time thanks to its geopolitical and climate advantage.

The first Greek hydrogen valley will integrate the development, establishment and operation of the following projects.

- The first is green hydrogen production.
  - Hydrogen will be produced by an alkaline electrolyser (30 MW) with batteries for continuous operation.
  - Project will produce 2 410 t/year of green hydrogen through renewable energy systems.
- The second is green hydrogen logistics.
  - Project includes a trailer-filling terminal, a virtual pipeline and polymer pipelines connected to three consumption points.
  - Five hydrogen refuelling stations are to be in place for hydrogen distribution.
  - Hydrogen-bunkering facilities in Piraeus will service short-sea shipping vessels.
  - A compressor will be connected to the onshore natural gas pipeline of Dioriga Gas.
- The third is green hydrogen end-use applications.
  - **Maritime.** One short-sea ferry vessel will be retrofitted with a 200 kW fuel cell (FC) system.
  - **Road.** A group of FC electric vehicles will be created.
  - **Industry.** Motor Oil Hellas and LPC will consume green hydrogen to decarbonise their production processes.
  - **Energy.** Hydrogen will be injected up to 5 % volume into the national natural gas grid using the floating storage and regasification unit of Dioriga Gas.

NON-QUANTITATIVE OBJECTIVES

- Activate the hydrogen market in Greece by demonstrating the integration of various hydrogen pillars.
- Facilitate information sharing between valleys and elevate the energy market in the Balkans, south-eastern Europe and the eastern Mediterranean.
- Demonstrate the combination and integration of multiple hydrogen applications into an efficient ecosystem covering the full hydrogen value chain.
- Divide end users into three sectors: mobility, industry and energy.
- Strengthen visibility and improve public awareness of strategic actors in the hydrogen value chain and emerging hydrogen ecosystems.
- Increase public knowledge of hydrogen end uses, related technologies and applications.
- Create a replicable model so the hydrogen technologies can be reproduced and multiplied throughout small- and large-scale valleys and flagship hydrogen projects.
- Add value to the current hydrogen knowledge curve and support its take-off in the near future through state-of-the-art scientific and socioeconomic investment.

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PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives	Green hydrogen consumption in the energy sector	t/year	1 000	
	Developed digital twin blueprint	number	1	
	Green hydrogen consumption in the industry sector (lubricant production and oil refinery)	t/year	1 322	
	Green hydrogen consumption in the road transport sector	t/year	≥ 22	
	FC technology for light-duty vehicles	number	≥ 2	
	Hydrogen storage and transportation	t/year	1 105	
	Public awareness events	number	20	
	Hydrogen distribution (natural gas grid compression and injection capacities)	t/h	3	
	CO_2 emission reduction	t/year	9 880	
	Hydrogen distribution (compression capacity)	kg/h	180	
	PhD summer schools	number	20	
	FC technology for ships (capacity of FCs)	kW	200	
	Unified standards and specifications for hydrogen production, storage, distribution and use	number	2	
	Low-temperature PEMFC for onshore application (FC capacity)	kWe	100	
	Training programmes for reskilling	number	10	
	Hydrogen refuelling stations	number	5	
	FC technology for HD vehicles	number	≤ 3	
	Green hydrogen supply	t/year	2 410	
	Hydrogen purification system	number	1	
	Green hydrogen consumption in the maritime transport sector	t/year	66	
	New jobs created	number	92	
	Scientific publications	number	20	
	Valley safety management plans	number	1	

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