

# BIG HIT

## BUILDING INNOVATIVE GREEN HYDROGEN SYSTEMS IN AN ISOLATED TERRITORY: A PILOT FOR EUROPE



BIG HIT

<b>Project ID:</b>	<b>700092</b>
<b>PRD 2023:</b>	<b>Panel 6 – H2 valleys</b>
<b>Call topic:</b>	<b>FCH-03.2-2015: Hydrogen territories</b>
<b>Project total costs:</b>	<b>EUR 7 748 848.00</b>
<b>Clean H<sub>2</sub> JU max. contribution:</b>	<b>EUR 5 000 000.00</b>
<b>Project period:</b>	<b>1.5.2016–30.4.2022</b>
<b>Coordinator:</b>	<b>Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragón, Spain</b>
<b>Beneficiaries:</b>	Calvera Maquinaria e Instalaciones SL, Community Energy Scotland Limited, Danmarks Tekniske Universitet, Giacomini SpA, ITM Power (Trading) Limited, Ministry for Transport, Infrastructure and Capital Projects (Malta), Orkney Islands Council, Shapinsay Development Trust, Symbio, European Marine Energy Centre Limited, Scottish Hydrogen and Fuel Cell Association Ltd

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

### PROJECT AND OBJECTIVES

The BIG HIT project is a major first step towards creating a genuine hydrogen territory in the Orkney Islands. Orkney has over 50 MW of installed wind, wave and tidal capacity, generating over 46 GWh of renewable power per year, and it has been a net exporter of electricity since 2013. Hydrogen is proposed as a solution to minimise the curtailment problems in Orkney caused by the weak connection with the UK mainland. The hydrogen produced is used in thermal, power (co-generation) and transport applications locally.

### NON-QUANTITATIVE OBJECTIVES

- BIG HIT aimed to perform a life cycle assessment study; this is now complete. The first report was submitted during the second year of the project, and the final report, including operational data, was submitted at the end of the project.
- The project aimed to perform a business model study for integrated energy systems based on hydrogen technologies across the islands. The first report was submitted during the second year of the project, and the final report, including operational data, was submitted at the end of the project.
- It aimed to perform a social life cycle assessment. The first report was submitted during the second year of the project, and the final report, including operational data, was submitted at the end of the project.
- The project aimed to set up the Hydrogen Territories Platform; this platform was launched. Four webinars have been conducted to date. The platform will be used in the Hydrogen energy applications for valley environments

in northern Netherlands (HEAVENN) and Deployment of a H<sub>2</sub> ecosystem on the island of Mallorca (Green Hysland) projects as well, with a continuation of its activities and goals.

- BIG HIT aimed to perform a first analysis of lessons learned from the project about the connection of electrolysers in power grids with high penetration of renewable energy sources (optimal model), marination of electrolysers, etc. The outputs were included in the final report and in the deliverables related to project operation and maintenance.

### PROGRESS AND MAIN ACHIEVEMENTS

- The main project equipment has been built: five H<sub>2</sub> trailers (250 kg of H<sub>2</sub> storage), a H<sub>2</sub> catalytic boiler (30 kW), a 1 MW electrolyser, five H<sub>2</sub> fuel cell vans and a 75 kW fuel cell (co-generation).
- The project developed the logistics of moving hydrogen through an archipelago (a multielement gas container moving H<sub>2</sub> between the islands by ferry, and logistics optimisation).
- BIG HIT developed the Hydrogen Territories Platform.

### FUTURE STEPS AND PLANS

- The project finished in 2022. Some of the equipment and facilities remain operational in Orkney.
- BIG HIT performed an impact analysis. Final reports on the environmental and social impact and the business model analysis were published and made available to the public.
- The main project results, conclusions and lessons learned have been presented at the Hydrogen Territories Platform webinars.

### QUANTITATIVE TARGETS AND STATUS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?	SoA result achieved to date (by others)	Year for reported SoA result
Project's own objectives	Hydrogen catalytic boiler power	kW	40	30		30 kW commissioned; 10 kW FAT completed	N/A
	Availability of fuel cell light-duty vehicles (including cars)	%	98	98	✓	98	2017
	HRS durability	years	10	5		Other projects / HRSs have been running for longer periods	5 years SoA in 2020 according to the FCH 2 JU MAWP

# GREENHYSLAND

## DEPLOYMENT OF A H<sub>2</sub> ECOSYSTEM ON THE ISLAND OF MALLORCA

<b>Project ID:</b>	<b>101007201</b>
<b>PRD 2023:</b>	<b>Panel 6 – H2 valleys</b>
<b>Call topic:</b>	<b>FCH-03-2-2020: Decarbonising islands using renewable energies and hydrogen – H2 islands</b>
<b>Project total costs:</b>	<b>EUR 23 717 171.22</b>
<b>Clean H<sub>2</sub> JU max. contribution:</b>	<b>EUR 9 999 999.50</b>
<b>Project period:</b>	<b>1.1.2021–31.12.2025</b>
<b>Coordinator:</b>	<b>Enagás SA, Spain</b>
<b>Beneficiaries:</b>	Enagás Renewable, 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, Association marocaine pour l'Hydrogène et le Développement Durable, Autoridad Portuaria de Baleares, Baleària Eurolineas Marítimas SA, Calvera Maquinaria e Instalaciones SL, 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 Transportes Urbans de Palma de Mallorca SA, Energy BV, Energy Co-operatives Ireland Limited, 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, Gasnam – Asociación Ibérica de Gas Natural y Renovable para la Movilidad, Gemeente Ameland, HyCologne GmbH, HyEnergy Consultancy Limited, HyEnergy TransStore BV, Instituto Balear de la Energía, University of Galway, Redexis Gas Servicios SL, Redexis Infraestructuras SL, Redexis SA, Stichting New Energy Coalition, the European Marine Energy Centre Limited, Universidad de La Laguna, Universitat de les Illes Balears, Power to Green Hydrogen Mallorca, Enagás

<https://greenhysland.eu/>

### PROJECT AND 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, generation of heat and power for commercial and public buildings, a new hydrogen refuelling station 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 seven other islands.

### NON-QUANTITATIVE OBJECTIVES

- Green Hysland aims to develop public awareness and create a basis for skills development. The project has been presented at almost 120 events.
- Thirteen workshops have been conducted and 15 activities have been organised jointly with other EU projects.

### PROGRESS AND MAIN ACHIEVEMENTS

- Green Hysland has delivered and installed a 2.5 MW electrolyser.

### QUANTITATIVE TARGETS AND STATUS

Target source	Parameter	Unit	Target	Achieved to date by the project
MAWP addendum (2018–2020)	Commitment of public authorities	M€	–	6.25
Project's own objective	Electrolyser	MW	7.5	2.5

- The project has awarded the tender for the Empresa Municipal de Transportes (EMT) in Palma H<sub>2</sub> buses.
- It has completed the conceptual design of the six project sites.

### FUTURE STEPS AND PLANS

- The H<sub>2</sub> plant will go into operation. The electrolyser was delivered in December 2021 and the plant was expected to be operational in March 2023.
- The tender for H<sub>2</sub> buses was launched in December 2021 and was awarded in March 2022. They were expected to be delivered in the first quarter of 2023 (first bus available and in operation in March).
- During 2023, tenders are expected to be launched for the purchase of the fuel cells for the Puerto Deportivo Naviera Balear, Lloseta and hotel sites in Palma, and for a fleet of 10 vehicles (rental cars and vans). The project is working on defining the technical and administrative specifications of the tender documents.
- The sites are expected to receive the equipment at the end of 2023. Around 2 years of operation of the complete ecosystem is expected within the project period.

# HEAVENN

## HYDROGEN ENERGY APPLICATIONS FOR VALLEY ENVIRONMENTS IN NORTHERN NETHERLANDS



HEAVENN

<b>Project ID:</b>	<b>875090</b>
<b>PRD 2023:</b>	<b>Panel 6 – H2 valleys</b>
<b>Call topic:</b>	<b>FCH-03-1-2019: H2 valley</b>
<b>Project total costs:</b>	<b>EUR 96 191 883.00</b>
<b>Clean H<sub>2</sub> JU max. contribution:</b>	<b>EUR 20 000 000.00</b>
<b>Project period:</b>	<b>1.1.2020–31.12.2025</b>
<b>Coordinator:</b>	<b>Stichting New Energy Coalition, Netherlands</b>
<b>Beneficiaries:</b>	Shell Nederland Verkoopmaatschappij BV, TotalEnergies Marketing Nederland NV, TotalEnergies Gas Mobility BV, Gemeente Hoogeveen, Hydrogen Ireland Natural Resources Association Company LBG, Nederlandse Particuliere Rijnvaart-Centrale Cooperatie UA, U.V.O. Vervoer BV, Lenten Scheepvaart BV, Bytesnet Groningen BV, EWE Gasspeicher GmbH, Energy BV, Green Planet Real Estate BV, Emmtec Services BV, Gemeente Emmen, HyEnergy TransStore BV, H2Tec BV, Gemeente Groningen, Groningen Seaports NV, ENGIE Energie Nederland NV, EBN – Energie Beheer Nederland BV, HyEnergy Consultancy Limited, European Research Institute for Gas and Energy Innovation, PitPoint. Crew BV, PitPoint.Pro BV, Qbuzz BV, Nederlandse Aardolie Maatschappij BV, PitPoint.CNG BV, Cemtec Fonden, Gemeenschappelijke Regeling Samenwerkingsverband Noord-Nederland, Logan Energy Limited, Hincio, Nobian Industrial Chemicals BV, Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragón, NV Nederlandse Gasunie, the European Marine Energy Centre Limited, Rijksuniversiteit Groningen

<https://heavenn.org/>

### PROJECT AND OBJECTIVES

HEAVENN is a large-scale demonstration project bringing together core elements – production, distribution, storage and local end use of H<sub>2</sub> – 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<sub>2</sub> across the entire value chain, while developing replicable business models for wide-scale commercial deployment of H<sub>2</sub> across the entire regional energy system.

### NON-QUANTITATIVE OBJECTIVES

- HEAVENN aims to achieve certification of regulations, codes and standards. All relevant green H<sub>2</sub> value chains will be tested against the CertifyHy protocol.
- Safety issues will be covered by permitting procedures.

### PROGRESS AND MAIN ACHIEVEMENTS

- The salt barge hull has been delivered to the Netherlands and will be operational around June 2023. Salt cavern testing is ongoing and has been successful so far.
- Emmen hydrogen refuelling station was delivered in June 2022 and has been successfully used by Qbuzz and other companies to refuel at 350 bar. A large proportion of the mobility applications (i.e. vehicles) have been ordered or purchased and will be delivered this year.
- Work package 4 is currently on hold. Work packages 5, 6 and 7 are operating mostly on schedule.

### FUTURE STEPS AND PLANS

Securing co-funding is a prerequisite for the project to succeed. Talks with governments about State aid will continue, aiming to speed up the process and secure all co-funding.

