Interreg
Atlantic Area

Co-funded by
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H2YDEA

Boosting the hydrogen transition
in the Atlantic Area ports

1st Call for applicants

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DOCUMENT INFORMATION

GRANT AGREEMENT NUMBER	EAPA_0057/2022
PROJECT ACRONYM	HYDEA
WORK PACKAGE	WP6
RELATED ACTIVITY	ACT 6.5
DELIVERABLE REFERENCE	-
TITLE	Call for applicants
STATUS	Final
AUTHOR(S)	Victoria León Carpintero
DELIVERY LEAD	ENERGYLAB
FILE NAME	HYDEA_D651

DOCUMENT HISTORY

VERSION	DATE	DESCRIPTION	REVIEWER
0.0	13/01/2024	Initial outline	Elisa Romero
1.0	27/1/2025	Final	Victoria León

EXECUTIVE SUMMARY

While there are already proven hydrogen-based technologies that primarily require adaptation to specific installation site conditions, new concepts are continually being developed by academic researchers, industry professionals, and entrepreneurs. However, many of these innovators lack the resources to advance their ideas.

The aim of this call is to provide access to the experimental facilities and expertise of the project partners to support the development and testing of pre-commercial, innovative technologies. This process will involve a thorough review and evaluation by an Independent Selection Panel (ISP) comprising experts in the project’s core focus areas as well as a board of the Hydea project representatives. The selection criteria will include scientific merit, technological feasibility, and market potential, with priority given to solutions that can be integrated into port environments.

At the beginning of the project, all partners will provide a list of the facilities they are making available, whether from R&D entities or port authorities. Additionally, they will outline the support services offered to participants under the HYDEA project, encompassing both technical and market-oriented assistance.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

ISP – Independent Selection Panel

AA – Atlantic Area

NDA - Non-Disclosure Agreement

ELAB - Centro Tecnolóxico de Eficiencia e Sostenibilidade Energylab

APVIGO - Autoridad Portuaria de Vigo

UPorto - Universidade do Porto

APDL - Administração dos Portos do Douro, Leixões e Viana do Castelo

FEM - France Energies Marines

NUI - National University of Ireland, Galway

APS - Autoridad Portuaria de Sevilla

EVO - Évolution Synergetique Automotive

HIVE - HIVE Hydrogen

SYMBOLS

H_2 - Hydrogen

1 INTRODUCTION

Seaports are energy-intensive hubs, traditionally reliant on fossil fuels, which contribute significantly to air pollution. These environmental challenges can be mitigated through the adoption of alternative fuels and renewable energy sources. The HYDEA project seeks to evaluate, develop, and promote the use of hydrogen (H_2)-based technologies in ports across the Atlantic Area, aiming to enhance energy efficiency and foster a more competitive and sustainable maritime sector.

While H_2-based technologies have been proven and primarily require adaptation to specific installation conditions, innovative concepts continue to emerge from academic, non-academic, and industrial inventors. Many of these innovators lack the resources or expertise to further develop their ideas. To bridge this gap, the HYDEA project invites applicants to submit their H_2-based technologies or projects for testing and evaluation. The call particularly welcomes solutions that demonstrate potential for integration into port operations.

This call considers two possibilities for the applicants, whether they are applying for testing facilities or for services.

Successful applicants will gain access to one of the following facilities / services for up to one month:

- Centro Tecnolóxico de Eficiencia e Sostenibilidade Energylab (ELAB)
- Autoridad Portuaria de Vigo (APV)
- Universidade do Porto (UPorto)
- Administração dos Portos do Douro, Leixões e Viana do Castelo (APDL)
- France Energies Marines (FEM)
- National University of Ireland, Galway (NUI)
- Autoridad Portuaria de Sevilla (APS)
- Évolution Synergetique Automotive (EVO)
- HIVE Hydrogen (HIVE)

To ensure compatibility with the selected facility, applicants are required to contact their chosen institution prior to applying.

For detailed information on the application process, please continue reading these Application Guidelines.

2 Application guidelines

2.1 Interreg Atlantic Area Access to HYDEA Project Facilities

The Interreg Atlantic Area program offers users free access to the research and testing facilities of the HYDEA consortium Project, as well as additional technical and market support services. Detailed descriptions of the available infrastructure and services can be found on Annex 2 Facilities specifications document.

Over the lifespan of the HYDEA Project, up to three (3) calls for access to these facilities will be issued. Applicants are required to download and complete the HYDEA Application Form, providing the following information:

- Applicant affiliation(s)
- Preferred facility and proposed period of access (maximum one month)

- Detailed description of the proposed work, test plan, technical requirements, and anticipated outcomes

Applicants must engage in discussions with the main contact of the chosen Hydea partner of interest during the application phase. This ensures that the chosen facility is suitable for the proposed testing and allows for the fine tuning of the application.

Candidates are invited to submit their complete application to hydea@energylab.es by **31st of July 2025** as part of this first Call for Applicants.

2.2 Evaluation and Selection Process

Applications will be assessed by an Independent Selection Panel (IPS) and a board of Hydea representatives, who will evaluate proposals based on their eligibility and technical feasibility. Successful applicants will be notified and subsequently contacted by the partner's main contact to coordinate the test campaign.

2.2.1 Scoring procedure

All applications will be reviewed by an Independent Selection Panel (ISP) and a board of Hydea representatives, with the process managed by Energylab. The evaluation is divided into two key areas: Quality of Scientific Content and Relevance of the Outcome. Marks are awarded on a scale of 0–9 within each category as follows:

- Quality of Scientific Content
  - Global content of the proposal: Overall quality and clarity of the submission.
  - Technical feasibility: Practicality and robustness of the proposed testing/development plan.
  - Scientific context: Alignment with current research and technological advancements.
  - Project delivery: Capacity of the team to deliver a high-quality project.
  - User competence: Expertise and experience of the applicant team.
- Relevance of the Outcome
  - Immediate impact: Tangibility and significance of the expected outcome.
  - Mid/long-term impact: Contribution to the HYDEA Project's objectives and broader relevance.
  - Utilization and sharing: Extent to which project outputs can be used or shared effectively.
- Marking scale:
  - 0: Not considered.
  - 1–3: Poor; reason for rejection.
  - 4–7: Acceptable but needs improvement.
  - 8–9: Good; meets or exceeds expectations.

An average mark is calculated for each application before a group review and final selection.

Tips for Applicants

Addressing the evaluation criteria thoroughly in your application will significantly improve the likelihood of your technology being selected for testing. Focus on the quality, feasibility, and potential impact of your proposal to achieve a higher score.

2.2.2 Eligibility and Priority

Interreg Atlantic Area supports transnational cooperation across four countries: France, Ireland, Portugal and Spain. Consequently, only applications from organizations or individuals based in these regions will be considered. Priority will be given to:

- Proposals involving transnational access
- Applicants who have not previously tested their technology

2.3 Application preparation

In this application preparation there are two paths that can be followed, depending on if the applicant is interested in testing facilities or technical/market service.
Before applying, applicants are encouraged to familiarize themselves with standard testing procedures in case of applying for a testing facility, and the partners background, in the case of applying for a service. A thorough understanding of these two will help align their proposal with the expectations and capabilities of the facilities.
The preparation of a detailed, well-structured, and carefully considered proposal is crucial for a successful application. This section outlines key recommendations to enhance the quality of applications and increase the likelihood of approval.

2.3.1.1 Facility manager consultation

As part of the initial application phase, applicants are required to engage in discussions with the Hydea partner of interest before submitting their application. This communication is essential to ensure the following:

- Availability: Confirm that the chosen facility has the capacity to accommodate the proposed testing/service during the desired timeframe.
- Suitability: Verify that the facility is equipped to support the specific requirements of the proposed test program/service.
- Guidance: Receive expert advice on refining the test program/service request to maximize its feasibility and impact.

Depending on their expertise, Hydea partners can provide valuable insights, either by sharing their testing experience or by offering guidance on the use of the space or service allocated to applicants. This is particularly beneficial for those planning a project of these characteristics for the first time.
Proposals must be technically feasible to be considered for approval. A detailed consultation with the partner's main contact is therefore critical to ensure that the proposal aligns with the facility's capabilities and operational parameters.

2.3.1.2 Testing infrastructure application

2.3.1.2.1 Application Supporting Materials

In the case of applying for testing facilities, to enhance the quality of the proposal and increase the likelihood of approval, applicants are strongly encouraged to include photographs or figures illustrating the concept to be tested. These visual aids might help the evaluation committee better understand and evaluate the proposal. They also assist the facility manager in identifying potential challenges related to deploying or testing the device at the chosen facility. If available, photographs of the device should be included to demonstrate the applicant's level of preparedness.

Additionally, applicants should provide a comprehensive proposed test plan as part of their submission. Evidence of a well-planned and thoroughly considered testing campaign is critical to securing a positive decision. This plan can be refined in collaboration with the facility manager during the application process.

Applicants are encouraged to include:

- Documentation from previous studies, including results from numerical or physical testing, if applicable.
- Detailed information about specific requirements for the facility, such as testing conditions, data acquisition needs, sensors, tools, and other resources.

The inclusion of these materials demonstrates a high level of preparation and ensures that both the ISP and the facility manager have the necessary information to evaluate the feasibility and readiness of the proposed testing campaign.

2.3.1.2.2 Testing plan

In the case of applying for testing facilities, a comprehensive test schedule must be agreed upon with the facility manager prior to the commencement of testing. The schedule should outline:

- The specific conditions required for each individual test
- The duration of each test
- The total number of tests planned

Since the testing process may not always proceed as anticipated, a robust contingency plan should also be developed:

- Prioritize Critical Tests: Identify and schedule the most critical tests early in the campaign to ensure key objectives are met, even if delays occur.
- Include Contingency Tests: Prepare additional tests that can be conducted if testing progresses faster than expected.
- Allow Flexibility: Build buffer time into the schedule to accommodate unexpected challenges or delays.

During the consultation with the facility manager, it is also important to confirm whether setup and dismantling time are included in the access allocation. Users should be aware of any configuration changes that may be necessary during testing, as well as the time required to implement them.

In addition, users should prepare a list of preliminary checks to be performed before testing begins. This ensures that all necessary preparations are in place and that potential issues are addressed prior to starting the testing campaign.

2.3.1.2.3 Set up and instrumentation

In the case of applying for testing facilities, the specific data to be collected during testing must be agreed upon in consultation with the facility manager. When planning instrumentation, focus on collecting only the data that is truly necessary. Excessive instrumentation can introduce delays, complications, and potential interference between sensors. Additionally, proper sensor sizing is critical.

2.3.1.3 Services application

When applying for technical or market services, it is essential to submit a detailed plan outlining the requested services. The applicant must provide a comprehensive overview of their project, highlighting its current stage of development and the core ideas or concepts to be explored. This overview should also address the project's unique value proposition, the target market or audience, and any preliminary research or validation efforts undertaken.

The submission should include a clearly articulated service plan, specifying the type of assistance required (e.g., technical expertise, market analysis, product development) and the expected role of the service provider. This plan should align with the overall objectives of the project and include milestones to ensure progress is trackable and measurable.

In addition, the applicant should outline a timeline for the collaboration, detailing key phases and objectives. Including a risk assessment, along with strategies for mitigating potential challenges, can further strengthen the application.

Lastly, the applicant should define the expected outcomes of the collaboration, and how these align with the broader goals of their project. Providing supporting documentation, such as prototypes, prior achievements, or endorsements, can help demonstrate the project's potential and credibility.

2.4 Application submission

Upon completion of the proposal preparation phase, applicants may proceed with the submission process. The application package should include a completed application form (Annex 1) along with all supporting documentation outlined in section 2.3. It is essential that all materials are submitted in full to ensure a smooth evaluation process and to avoid unnecessary delays.

Candidates are invited to submit their complete application to hydea@energylab.es by **31st of July 2025** as part of this first Call for Applicants.

2.5 Intellectual property (IP) and Non-Disclosure Considerations

Upon approval of an application, a Non-Disclosure Agreement (NDA) should be established between the facility manager and the applicant. This is particularly important if the testing/service involves intellectual property (IP)-sensitive material. Applicants should discuss any specific IP-related provisions with the facility manager to ensure appropriate confidentiality measures are in place.

If the testing is not IP-sensitive or the design is already IP-protected, the local facility may seek permission to use the outcomes for publicity purposes, such as news stories or marketing initiatives. This can provide an excellent opportunity to promote the design and gain broader visibility.

It is generally advisable to have some form of IP protection in place prior to testing, particularly for innovative or proprietary designs. For guidance on IP issues related to EU-funded research projects, applicants can refer to the European IPR Helpdesk, which offers valuable resources and support.

2.6 Logistics, Health and Safety

2.6.1 Risk Assessments and Facility Policies

Users may be required to complete a Risk Assessment or Safety Statement before arriving at the facility. This requirement should be confirmed with the facility in advance. Additionally, some facilities may have restrictions on user involvement in on-site work. It is therefore essential to verify whether you will be permitted to work on your device during its time at the facility.

2.6.2 Transportation and Health & Safety Considerations

If transportation of a device to the partner facility is required, the following health and safety recommendations should be observed:

- Packaging for Transport: Devices should be securely loaded onto pallets to facilitate safe and efficient transport. Ensure the device is fully restrained with no potential for movement during transit. Use robust packaging and clearly label it as *fragile* with *this way up* arrows as appropriate.
- Component Details: Provide the facility with dimensions and the mass of individual components to allow for a proper assessment of lifting requirements.
- Lifting Equipment: Avoid manual handling wherever possible. Do not assume that on-site lifting equipment such as cranes or forklifts will be available. Confirm the availability and lifting capacity of such equipment with the facility manager in advance.

2.6.3 Delivery Timing and Inspections

Arrange for the delivery of the device to the facility approximately one week before the scheduled testing period. This allows time to address potential delays, complete preassembly tasks, and make necessary adjustments.

Upon delivery, the device should be inspected immediately for any damage sustained during transportation. Even minor damage can cause significant delays, so care should be taken during packaging to minimize risks.

2.6.4 Tools and Ancillary Equipment

Pack any specialized tools or ancillary devices required for assembly or testing with the device, as sourcing such items locally may prove challenging.

2.7 During testing

2.7.1 General recommendations

To ensure a productive and efficient experience at the test facility, users should bring the following items:

- Notebook: For note-taking and record-keeping.
- Large external hard drive: For saving and securely storing data, particularly large video files.
- Consumables: Items such as tape, cable ties, ropes, and other materials that may be required during testing.

Users should voice any concerns, particularly those related to testing procedures or health and safety, so they can be promptly discussed and resolved.

2.7.2 Record keeping

Maintaining a detailed log of the testing procedure is critical. Users should document daily activities, particularly noting any changes to the setup. Even minor adjustments can have unexpected impacts, which may only become evident during the post-processing of data.

A clear record of changes, including their timing and nature, is invaluable for tracing the root cause of any data abnormalities or inconsistencies observed later in the data.

2.7.3 Testing wrap up

After testing concludes, the device will need to be removed and dismantled, a process that is generally much quicker than the setup phase.

Users should:

- Retain all relevant documentation related to the testing process.
- Preserve any extra components used during testing, as these may prove useful for future campaigns or for interpreting data during post-processing.
- Ensure that all data obtained during testing is saved to a hard drive. Video files often require substantial storage space; plan accordingly to avoid data loss.

2.8 Report writing

After the completion of testing or service, users are required to submit a concise report summarizing the work carried out. The report should include the following:

- **Description of the Concept**: Provide a clear and detailed explanation of the concept or technology that was tested or assessed.
- **Campaign Overview**: Outline the testing/service campaign, including objectives, methodologies, and key activities undertaken during the process.
- **Results**: Present the results obtained during testing, including relevant data, observations, and analysis.
- **Key Learning Outcomes**: Highlight the main insights gained from the testing campaign, including any improvements, challenges, or potential next steps.
- **Figures and Photographs**: Incorporate visual aids such as figures, diagrams, and photographs to effectively describe the concept and illustrate the work carried out.

This report serves as a vital record of the testing/service process, providing valuable insights for future development and enabling the facility to evaluate the success of the campaign.

ANNEX 1 – APPLICATION FORM

APPLICATION FORM

Group Details	
Project Leader details (enclose a curriculum vitae also)	
Title	
Full name	
Gender	
Birth year	
Nationality	
Country where applicant works	
Contact phone	
Contact email	
Company name	
Company acronym	
Position in Company	
Company postal address	
Company country	
Company web address	
Please also **include details for all other members of the group** (if any) as above.	

Project Member details, if applicable (enclose a curriculum vitae also)	
Title	
Full name	
Gender	
Birth year	
Nationality	
Country where applicant orks	
Phone number	
Email	
Company name	
Company acronym	
Position in Company	
Company postal address	
Company country	
Company web address	
Please **include details for** <u>**all**</u> **other members of the group** (if any) as above.	

Access Details	
HYDEA partner facility for which you are applying:	
Is this your only HYDEA application in this call?	Yes / No
If No, please give details: **(approx. 100 words)**	

Length of time required for testing/service (maximum of one month)	
Suggested start date	
Details of any major timing constraints when you will be unable to test within the testing period (until September 2026) (100 words approx.)	

History	
Selection and eligibility	
New user: have you ever used (for research purposes) the proposed facility before?	Yes / No
If Yes, please give details: (approx. 100 words)	

Description for testing requests
Brief summary of the proposed work (approx. 100 words)
Do you have a device already fabricated or have the capacity to do so? Give details (approx. 100 words)
Please attach up to two images of the device being submitted for testing. Images must be in JPEG or PNG format only.

Introduction (approx. 300 words) - include background, scientific/technical context of the tests (if previously tested, please give brief details of the most recent test location/facility, dates and results achieved).

Project objectives - (approx. 100 words) including potential commercial benefits/progress.

Potential impacts of proposed testing (scientific, commercial, environmental) (approx. 100 words)

Outline test plan and timeline (approx. 300 words) - include proposed plan of work and timing. It is important that the scope of work be very well focused with clearly defined primary and secondary objectives. Include full timings (for setup, calibration, testing, removal etc.)

Specific requirements (approx. 300 words) - include details of **tentative equipment/instrumentation/materials required** (subject to what is offered by the infrastructure - see infrastructure description), **technical assistance** and **training** required etc.:

Description for service requests
Brief summary of the proposed work (approx. 100 words)

Introduction (approx. 300 words) - include **background, scientific/technical context of the project** (if previously assessed, please give brief details of it and its results).

Project objectives - (approx. 100 words) including potential commercial benefits/progress.

Potential impacts of proposed project (scientific, commercial, environmental) (approx. 100 words)

Outline service plan and timeline (approx. 300 words) - include **proposed plan of work and timing**. It is important that the scope of work be very well focused with clearly defined primary and secondary objectives. Include full timings.

Specific requirements (approx. 300 words) - include details of **technical assistance** and **training** required etc.:

ANNEX 2 – Facilities specification

FACILITIES SPECIFICATION

1 Puerto de Sevilla

1.1 Detail of facilities

- Microgrid for hybrid fast-recharging station (electric / hydrogen): the microgrid consists of the following equipment:
    - Photovoltaic plant 5 kW peak power.
    - Electrolyser (AEM technology) for 1 N/m3 hydrogen production at 30 bar, 2.4 kW nominal power.
    - Hydrogen Storage tank (4.34 kg of H2 at 30 bar).
    - Hydrogen dispenser.
    - PEM Fuel cell 6.8 kW for H2 to power conversion.
    - Battery pack of 5kWh.
    - 2 chargers for electric vehicles.
    - Electronic converters.
    - Programmable electronic load to emulate different demand profiles
- Laboratory of 60 m^2 open space for equipment testing
- Real port open space to test as long as there are no risks and/or interferences with port operations.

1.2 Availability of facilities

May 2025 to September 2026.

1.3 Support services

General guidance regarding the facility and equipment included in the installation, as well as guidance for the operation.

1.4 Contact person

Elisa Oyonarte
Eoyonar@apsevilla.com

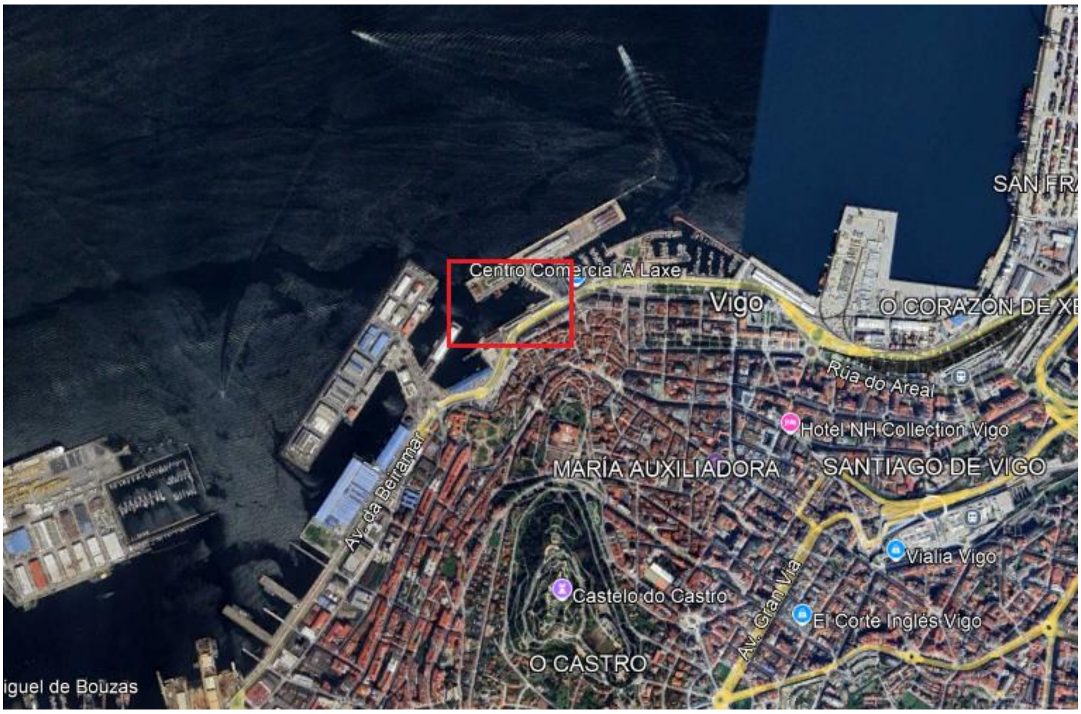
2 Puerto de Vigo

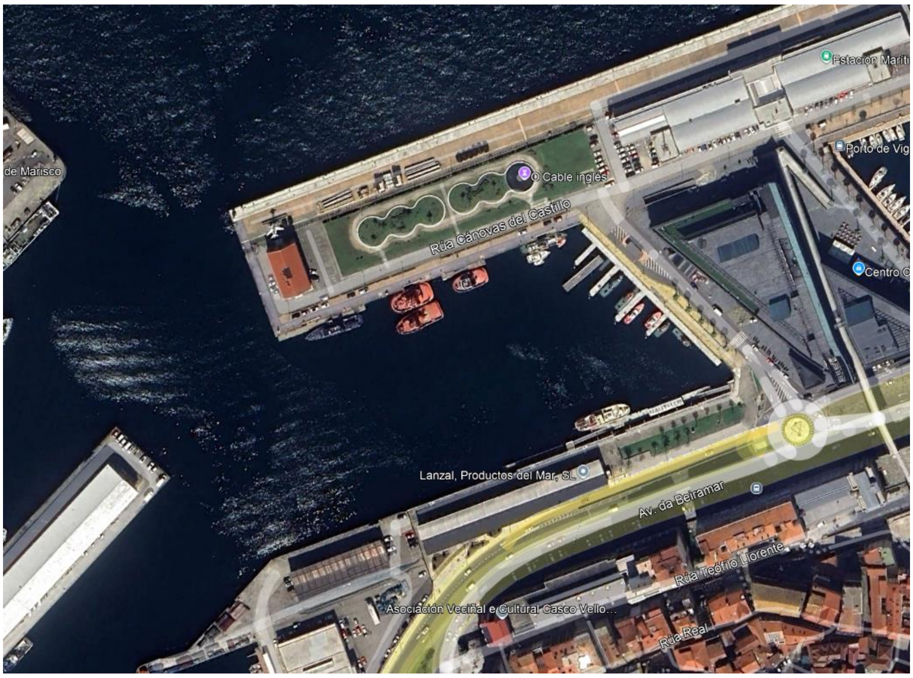
2.1 Detail of facilities

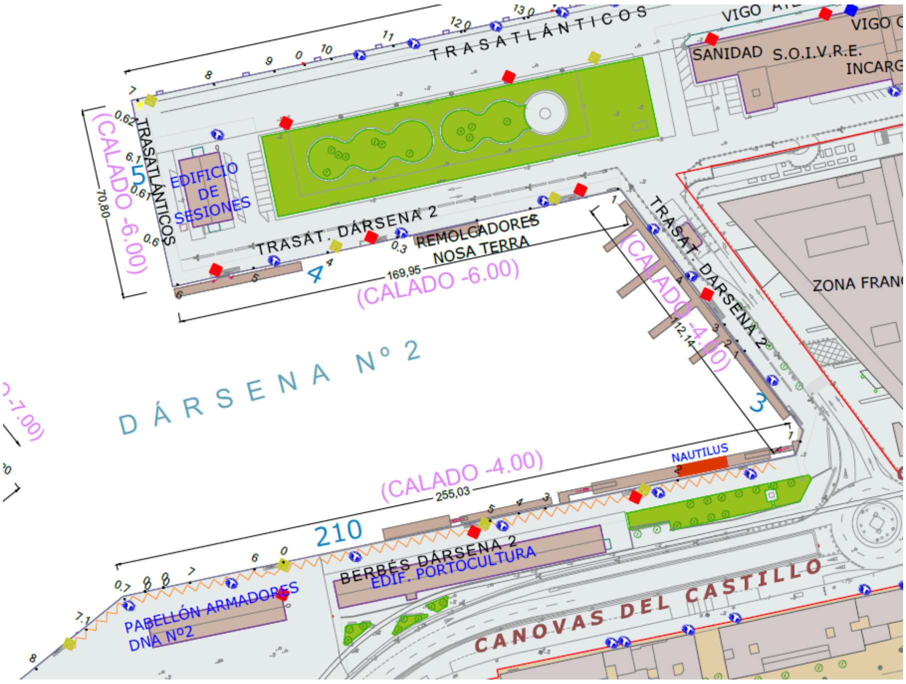
The space provided by the port for testing technologies under real conditions includes the water surface area of the A Laxe Dock and the docking lines that form it, with the following characteristics:

- 1 docking line of 169.95m in length and a draft of -6.00m, 3 accesses to the pier, 2 power connections (MAC), 3 water connections.
- 1 docking line of 112.40m in length and a draft of -6.00m, 1 access to the pier, and 3 water connections.

- 1 docking line of 255.03m in length and a draft of -4.00m, 3 accesses to the pier, 3 power connections (MAC), 6 water connections.







https://maps.app.goo.gl/qiBQk1XmSrBY3H6S7

2.2 Availability of facilities

May 2025 to September 2026.
The testing duration could to be modified based on the applicant's needs and possible area restrictions due to regular port operations.

2.3 Contact person

Elisa Romero
elisaromero@apvigo.es

3 Centro Tecnológico Energylab

3.1 Detail of facilities

- Permeability test bench:
  - Evaluation of the permeability of pipelines in hydrogen transport applications at different degrees of pressure and H_2 mixtures.
  - Working conditions can range between 0-40ºC and up to 16 bar.

- Synthesis and characterization of catalyst, membranes and electrodes for hydrogen production.
  - Development of catalysts and functionalised electrodes for H_2 production by both high and low temperature electrochemical routes and their direct application in fuel cells (PEM, AEM, SOEC/SOFC).
  - Synthesis of ceramic materials for SOEC/SOFC: conventional solid state methods, chemical synthesis (sol gel style) by assisted combustion and hydrothermal synthesis.

  - Synthesis of conventional polymeric membranes. Manufacture of membranes with specified chemical characteristics.
  - Synthesis of electrodes for electrolysers and low-temperature fuel cells (60-70ºC) by deposition on carbon cloth, nickel mesh and similar by drop casting.
  - Chemical synthesis, structural and microstructural modification of materials with applications in electrochemical catalysis.

- Characterisation of PEM electrolysers up to 1 kW.
  - Characterization of catalysts, electrodes, membranes and performance of LSV, CV, EIS, IV, CA, CP curves.

3.2 Availability of facilities

May 2025 to September 2026.

3.3 Support services

General guidance on the equipment operation.

3.4 Contact person

Victoria León
victoria.leon@energylab.es

4 EVO – Évolution Synergétique

4.1 Detail of facilities

- LV component validation set-up: LV Set-Ups for testing automotive components with the following tests
  - Electrical tests such as voltage and current feature measurement
  - Continuity tests
  - Security tests
  - Functional tests
  - Communication tests
- Terminal Tractor developed for testing: Prototype of a terminal tractor to use for testing in real environments.

4.2 Availability of facilities

- Validation set-up: availability during 2025 and 2026.
- Terminal Tractor: since September 2025, but it is encouraged to ask beforehand about its availability.

Both facilities require a four-week notice prior to the commencement of the testing.

4.3 Support services

- Support in the configuration of the set-up through the whole process.
- Support in data analysis results.

4.4 Contact person

Alejandro Rodríguez López
al.rodriguez@evo-syn.com

5 FEM – France Énergies Marines

5.1 Detail of services

FEM may provide expertise and technical support for the cost analysis of hydrogen production from Offshore Renewable Energy (offshore wind, tidal, wave power) using its in-house modelling tools.

5.2 Availability of facilities

May 2025 to September 2026.
Duration must be discussed depending on the hydrogen/e-fuel energy potential assessment to be performed. Generally, a duration of 2 month per study should be considered to ensure that the activity can fit in the planning of the research team.

5.3 Contact person

Jean Dubranna
Jean.dubranna@france-energies-marines.org

6 HIVE

6.1 Detail of facilities

Hive Hydrogen can provide market and business case development services based on their decades of experience in industrial gases, hydrogen and renewables. For businesses looking to commericalise their project or technology, HIVE can provide assistance in the form of market and industry expertise and their strong European-wide network.

6.2 Availability of facilities

May 2025 to September 2026.

6.3 Contact person

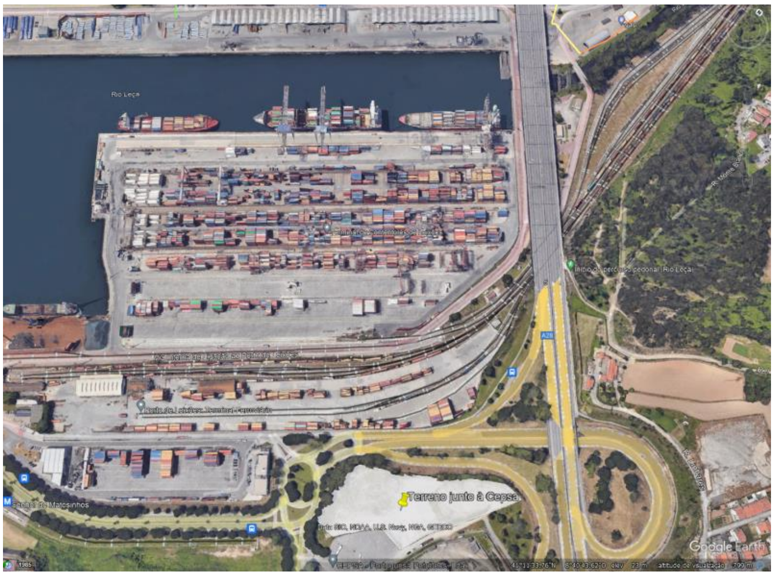
Cian Moran
cian.moran@hivehydrogen.co.uk

7 APDL – Administração dos Portos do Douro, Leixões e Viana do Castelo

7.1 Detail of facilities

- Port of Leixões

- Industrial area on port land – uses: installation of solar panels, electrolysers, hydrogen storage systems, others - 41°11'26.09"N - 8°40'50.94"W - 11,700 m²



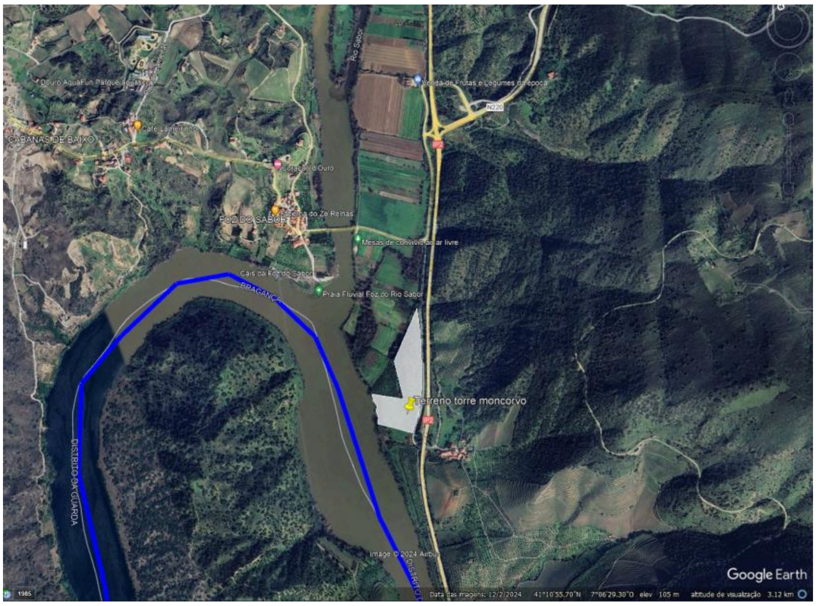
- Possible location for H2 refueling station for cargo Handling Vehicles: forklifts, trucks, and other cargo handling vehicles that can be powered by hydrogen fuel cells - 41°11'49.55"N , 8°40'56.68"W - 375 m²

- Land in the Logistics Hub of the Port of Leixões, access to the motorway and the port – uses: installation of solar panels, hydrogen storage systems, others - 41°41'1.34"N - 8°49'32.78"W - 7,200 m²

- Port of Viana
    - Land in the Port of Viana expansion area – uses: installation of solar panels, electrolysers, hydrogen storage systems, ship supply systems, others - 41°41'12.96"N - 8°49'17.35"W – 15,000 m^2

- Douro’s Inland Waterway
- Land within the Lamego commercial port, commercial ship pier and ship supply infrastructure – uses: installation of solar panels, electrolyzers, hydrogen storage systems, ship supply systems, others – 41° 9’32.47”N – 7°47’46.36”W 5.500 M^2 (or higher)

- Land with direct access to the Douro River and highway – uses: installation of solar panels, electrolysers, hydrogen storage systems, ship supply systems, others – 41°10'17.21"N – 7° 6'36.08" W – 52,000 m²



7.2 Availability of facilities

May 2025 to September 2026.

7.3 Support services

Power grid connections.

7.4 Contact person

Filipe Martins
filipe.martins@apdl.pt

8 University of Galway

8.1 Detail of services

Consultancy related to the techno-economics of the hydrogen value chain.

Erin HyTEA model

The Erin HyTEA Tool is a spreadsheet-based techno-economic analysis (TEA) tool designed to calculate the levelized cost of hydrogen (LCOH) and manually size an electrolyser system to meet a given annual hydrogen demand. Additionally, the tool allows manual hydrogen storage sizing, a critical aspect often overlooked in LCOH studies, despite its importance in ensuring a reliable hydrogen supply given the variable nature of renewable energy sources. Moreover, the tool enables users to integrate up to two renewable electricity sources, which can be onshore wind, offshore wind, solar PV, or grid electricity.
A Python-based Erin HyTEA Online tool is currently in development and will be available by the end of this year.

8.2 Availability of facilities

May 2025 and September 2026.

8.3 Contact person

Haresankar Jayasankar
haresankar.jayasankar@universityofgalway.ie

9 University of Porto

9.1 Detail of facilities

University of Porto makes available the three following facilities:
Access to the laboratory set-up for catalysts characterization for direct CO_2 hydrogenation to methanol using a patented membrane reactor developed at FEUP, Portugal;
Access to the membrane characterization set-up at FEUP, Portugal, for conducting permeability tests on flat-sheet and hollow-fiber membranes for relevant gaseous separations.
Access to the wave basin or wave-current flume of the Faculty of Engineering of the University of Porto (FEUP), Portugal for the hydrodynamic testing of novel marine energy conversion technology at a small to intermediate scale.

Facility 1

The Chemical Engineering Laboratory of FEUP houses a catalyst testing set-up for the direct hydrogenation of CO_2 to methanol. The system incorporates a patented membrane reactor that enables *in situ* removal of water, thereby shifting the reaction equilibrium towards methanol production (higher conversion rates) while preventing catalyst deactivation caused by water-induced oxidation (enhanced stability). This system is designed to test catalysts at temperatures up to 280 °C and pressures up to 60 bar. The reactor can be fed with gas mixtures of H_2, CO_2, and N_2 at various ratios, with a total flow rate of up to 900 mL min^{-1} (maximum flow rates: 100 mL min^{-1} CO_2, 300 mL min^{-1} H_2, and 500 mL min^{-1} N_2). Precise control of the gas supply is ensured through mass flow controllers (MFCs). The reactor allows the catalyst to be accommodated in the lumen (4.25 cm^3) or in the annular space

(14.2 cm^3). All process parameters, including temperature, pressure, and gas flow rates, are digitally controlled by a programmable logic controller (PLC), ensuring high reproducibility and automated operation. At the reactor outlet, both permeate and retentate streams are analyzed online using a GC-MS equipped with an 8 port multiposition valve for composition analysis. Additional process monitoring includes pressure transducers and thermocouples, which provide real-time data on reaction conditions. This setup allows for characterizing the performance of catalysts under industrially relevant conditions, offering insights into conversion efficiency, selectivity, and long-term stability in methanol synthesis. A schematic representation of the setup is shown in Figure 1.

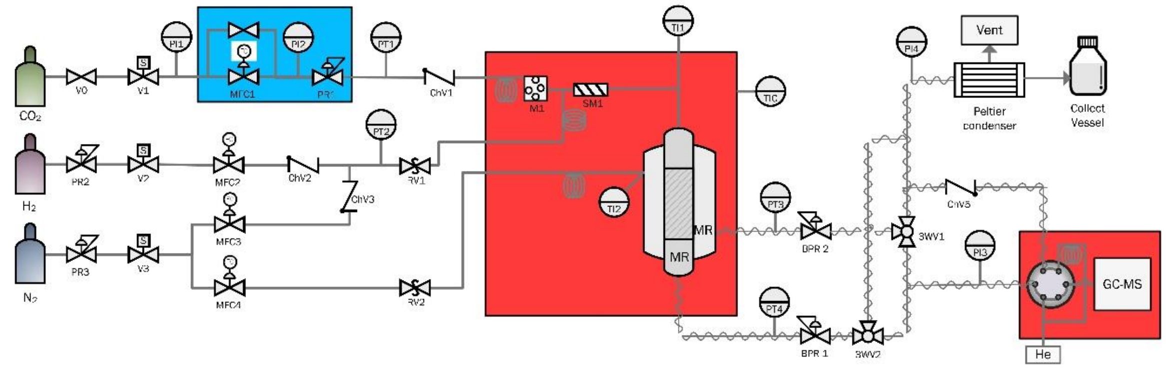


Figure 1. Direct CO_2 hydrogenation setup at the Faculty of Engineering of the University of Porto, Portugal.

Facility 2

The Chemical Engineering Laboratory of FEUP has a set-up for membrane characterization equipped with feed, permeate and retentate lines, gas tanks, pressure transducers, a vacuum pump, a thermostatic cabinet, a gas chromatographer and LabView software. This system is designed to perform characterization tests of membranes in either flat-sheet or hollow-fiber configurations. All relevant gases (H_2, CO_2, O_2, N_2, CH_4, He, Ar) are streamlined to the feed gas tank which has a capacity of 5 L. From this tank, the selected gas is supplied at constant pressure, normally at room pressure, to the testing module where the membrane is positioned. A pressure gradient across the membrane, essential for the separation process, is established using a vacuum pump applied to the permeate side. The permeate container of the membrane module is then closed for allowing the pressure to build up. The permeation rate is obtained from the buildup pressure rate in the permeate container which volume is known. During permeation, pressure data collected by the transducers is transmitted to LabVIEW, enabling the calculation of permeability values. The layout of this process is illustrated in Figure 2.

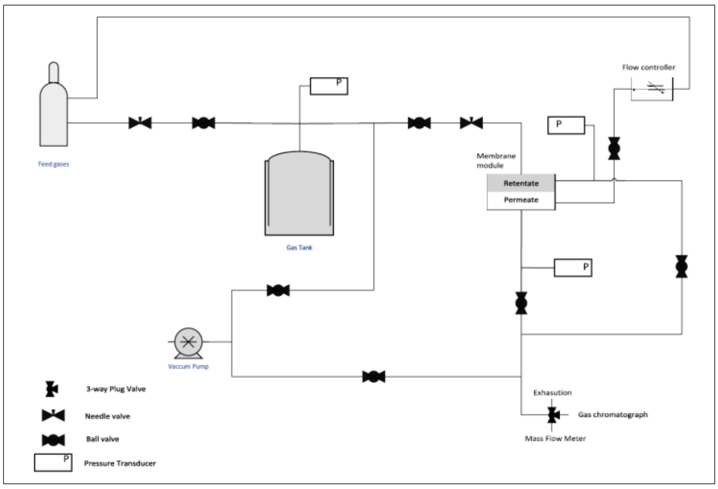


Figure 2. Membrane characterization set-up at the Faculty of Engineering of the University of Porto, Portugal.

This membrane characterization unit can also be used to determine the permeability to gas mixtures. In this case the gas mixture, prepared using the 5 L tank, is supplied to the membrane cell normally at room pressure. On the permeate side, a non-permeating gas such as sulfur hexafluoride is supplied as a swipe gas. From the swipe flowrate and the permeate stream composition, determined using the GC, the permeation rate of each gas is obtained.

Facility 3

The Hydraulics Laboratory of FEUP has a multidirectional wave basin that is 28.0 m long, 12.0 m wide and 1.2 m depth, and includes a central pit (4.5 x 2.0 x 1.4 m^3), Figure 3. This facility is prepared for a wide variety of studies in the domains of marine renewable energies, offshore and coastal engineering, allowing the simulation of regular and irregular waves, either long or short crested. The wave basin is equipped with a multi-element piston-type wave generation system, controlled by a HR Wallingford wave synthesiser, which integrates a dynamic wave absorption system. The following key equipment is available: resistive wave gauges, an infrared motion capture system composed of 3 cameras (Qualisys) to measure the motions of floating bodies in 6 DoF (Figure 2), pressure sensors, laser scanner, among others. The Hydraulics Laboratory also includes a 32.3 x 1.0 x 1.3 m^3 wave-current flume equipped with a wave piston-type paddle enabling the combined simulation of waves and currents, to study 2D physical models of coastal structures, sediment transport and offshore foundations under regular and irregular sea-states. This facility is also available as an alternative to the wave basin if, for the characteristics of the study to be performed, is found to be more suitable.

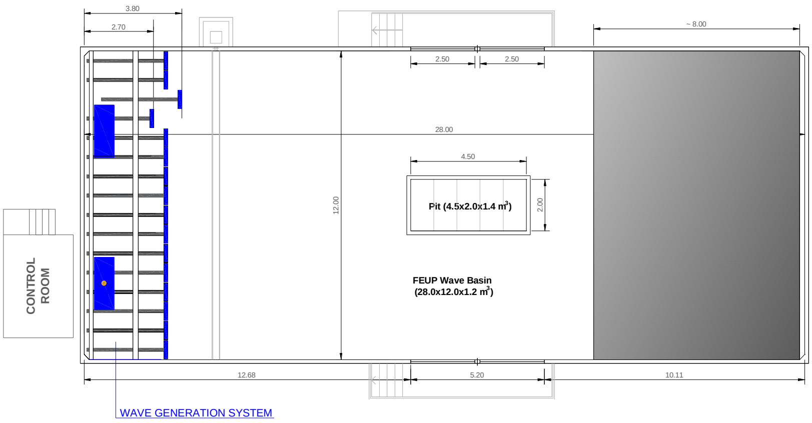


Figure 3. Wave basin of the Faculty of Engineering of the University of Porto, Portugal.

9.2 Availability of facilities

From the access granting notification until the end of HYDEA project in a schedule that fits the already booked occupation of UPORTO experimental facilities. The combined use of the three experimental facilities cannot exceed the total time allocated in the project for facility access within WP6.5 (1 month). The period of access should be agreed with UPORTO staff after the selection procedure. The use of the facilities from the Chemical Engineering Laboratory is only possible after September 2025.

9.3 Support services

Hydraulics Laboratory:

Support of one technician (general expertise) for small adjustments of the physical model to be tested and the preparation of the experimental setup in the wave basin. Support of technical staff from the laboratory to run the tests and use the equipment available. Basic data processing of experimental data measured during the testing campaign. Report covering the description of the technology tested, the experimental campaign carried out (characteristics of the model, set-ups, testing conditions, etc.) and some general conclusions of the proof of concept.

Chemical Engineering Laboratory:

The Chemical Engineering Laboratory provides comprehensive support for the characterization process. This includes assistance from a technician for minor adjustments to the set-up and the preparation of experimental parameters. Additionally, technical staff from the laboratory are available to operate the equipment and conduct the tests. The support also covers basic processing of the experimental data collected during the testing campaign. A detailed report will be prepared, encompassing a description of the technology tested, an overview of the experimental campaign (including permeability testing characteristics, set-up details, and testing conditions), as well as general conclusions derived from the proof-of-concept study.

9.4 Contact person

Hydraulics Laboratory - Paulo Rosa Santos pjrsantos@fe.up.pt

Chemical Engineering Laboratory - Tânia Lopes tlopes@fe.up.pt

CONTACT DETAILS

Victoria León Carpintero
Project Coordinator
EnergyLab
www.eu-hydea.eu