



**SMART HyAware | Action Plan
Aragon**



**General information**

Project	SMART-HY-AWARE
Partner organisation	Deployment Agency of Aragon
Other partner organisations involved (if relevant)	Foundation for the development of new hydrogen technologies in Aragon
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NUTS2 region	Aragon
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1. Introduction

SMART-HY-AWARE is an Interreg Europe programme with a budget of €1,359.626, --, running from the 1st of August 2019 to the 31st of July 2023. Its topic is low-carbon economy. The partners are: the Regional Development Agency of Aragon, Lazio Region, the province of Zuid-Holland, municipality of Delphi, Aberdeen City Council and Pannon Business Network Association.

SMART-HY-AWARE aims to promote hydrogen-electric mobility by tackling main infrastructural, technological (range anxiety related) and market uptake barriers related to hydrogen for electro-mobility through the improvement of PI linked to Structural Funds in Europe, addressing the transition to a low carbon economy, as clearly requested by objective 3.1 of the INTERREG EUROPE Programme.

Specific sub-objectives of the project, to reach the main goal, are:

- Exploiting the potential of hydrogen technologies for electro-mobility involving the whole supply chain;
- Improving regional and local strategies which focus on real needs for implementation such as giving impulses for new models of fuel cells integration;
- Increasing efficiency of green propulsion in transport;
- Improving renewable energy grids to cut down electrolysis costs and IT management applications to enable advanced planning of short-to-mid-term power productions and foster use of hydrogen power within distributed networks (Gopalakrishnan Kumar, Serhan Dermici, Chiu-Yue Lin, 2013);
- Increasing the deployment and the accessibility to refuelling infrastructure for both public and private sector in urban and rural areas;
- Supporting the deployment of alternative fuel vehicles in public transport by setting up regional financial support schemes;
- Promoting and assessing new measures favouring public-private partnership (PPP) in e-mobility sector, by designing suitable PPP business schemes to trigger hydrogen mobility;
- Enhancing the capability of public Authorities in developing effective policies for reducing the carbon footprint of transport activities.



2. Policy context

Aragon is one of the pioneering regions in Spain and Europe for the promotion of hydrogen technologies. This places the region in an extremely favourable position to continue developing technology and projects in this field while keeping its competitive edge and wealth of experience.

Since 2003, with the setup of the Foundation for the Development of the New Hydrogen Technologies in Aragon – created with the support of 28 Aragonese companies and organisations-, work on hydrogen projects has continued uninterrupted, with an increasing interest from companies that have joined FHa's board of trustees. Currently, this board is comprised of 89 trustees representing companies and organisations, as well as a nominative trustee and three other honorary members. This support has been directly translated into the main regional plans and strategies. Throughout 2020, the Regional Government of Aragon convened in June 2020 all political parties represented in the Regional Parliament of Aragon as well as social actors, the Federation of Municipalities, Counties and Provinces of Aragon (FAMCP) and the Aragonese Strategy for Social and Economic Recovery was thus defined. This strategy incorporates 273 recovery measures, with hydrogen present in several ones.

- Measure 43. Fostering alternative systems favouring sustainable mobility between municipalities with over 5000 inhabitants
- Measure 176. Fostering renewable energy projects, planning of the electric power transport grid for the 2021-2026 period, as well as the promotion of technologies related to power storage, renewable gas (biogas, hydrogen), sustainable and efficient mobility).
- Measure 177. Development of the industrial fabric linked to these renewable projects and new technologies.

Likewise, as in previous editions, the Energy Plan for Aragon (PLEAR 2013 - 2020) includes specific backing for hydrogen applications in transport, as well as its own heading inside the R&D&I section, designating hydrogen as a priority line in this field. PLEAR 2021-2030 is currently under review, and in line with previous plans, hydrogen technologies are to be supported.

In terms of climate change, in February 2019 the Regional Government of Aragon passed, in its Council of Government, the Aragonese Strategy on Climate Change Horizon 2030. This is the Aragonese reference framework for the development of public policy and the associated necessary measures, within Horizon 2030, for the mitigation of Greenhouse gases (GHG) and adaptation of the activities carried out in the region to climate change. Hydrogen and fuel cell technologies are found within, with the FHa being a member of the Climate Change

In the field of Research and Innovation, LAW17/2018, on Investigation and Innovation in Aragon, of December 4th was passed. It provides the legal framework of reference for the regulation, promotion and coordination of research, development, knowledge transfer and innovation within the Autonomous Region of Aragon, within the applicable State and EU legislation. FHa is one of the actors in the R&D&I system of Aragon.

By the same token, the new Aragonese Research and Innovation Strategy for Smart Specialisation (RIS3 Aragon) is being developed, alongside the III Regional Plan for Research, Development and Knowledge



Transfer (III PAID) and the Aragonese Strategy for Research, Development and Innovation (Aragonese R&D&I Strategy). All of them have previously included specific support for hydrogen, and it is expected that this will continue to be the case. On the other hand, the proactivity of the Government of Aragon must be stressed, since as seen in the previous section, Aragon leads the S3 European Hydrogen Valleys.

2.1. Aim of the Action Plan

The Action Plan aims to impact in a regional development policy instrument, Hydrogen Master Plan of Aragon Region.

Given that the 2014-2020 programming period has come to an end, it is not considered possible to influence the policy instrument selected in the proposal (Aragon ERDF ESF regional operational programme 2014-2020. Thematic objective: 04 - Supporting the shift towards a low carbon economy in all sectors. IP 4 (c)).

Although the new operational programme for the period 2021-2027 is under preparation, as the region has a new Direct Hydrogen Plan for the period 2021-2025, it is considered that this Regional Government strategy focused exclusively on the development of Hydrogen is more suitable for the development and implementation of the proposed action.

Name of the policy instrument addressed:

Hydrogen Master Plan is a tool that defines the main lines of work regarding hydrogen technologies in Aragon in a 4-years period. It is an initiative promoted by Department of Industry, Competitiveness and Business Development of the Government of Aragon through the Aragon Hydrogen Foundation. Up to date, fourth editions of the Hydrogen Master Plan have been released. Currently, the Hydrogen Master Plan in Aragon is in its fourth edition, with a larger number of participating entities in each development process and, edition after edition, achieving greater compliance with development indicators and objectives.

One of the main objectives of this Plan is to identify the strategic lines for the region and establish the actions for the deployment of these lines in the period 2021-2025, analyzing the potential of the region in this area, the emerging markets and identifying specific opportunities adapted to the socioeconomic reality of the region. For this reason, several specific activities and indicators related to sustainable mobility have been considered to be included in different lines of work, addressing both the development of infrastructures and markets as well as the necessary training. The following are the lines of work on which the government of Aragon has decided to work and which have been reflected in the latest edition of the Master Plan:

- **Line of Action 2: Hydrogen Storage, Transport and Distribution**

Expanding refuelling infrastructure by means of hydrogen refuelling stations (HRS) for distribution to end-consumers in road mobility. Opportunities are centred on developing a HRS network linked to a large Aragonese project, logistic platforms and major and minor Trans-European Transport Networks (TENT-T). For the 2025 year the target of working HRS, public or private, is seven.



- **Line of Action 3: Hydrogen Applications**

The development of applications in the mobility sector takes into account land mobility in particular. The Aragon Master Plan envisages carrying out mobility demonstration projects in local captive fleets (taxis, buses, last mile vans, public cleaning, etc.) as well as in heavy transport, with a high priority, and with a target of 2 demonstration projects for the year 2025.

- **Cross-cutting Line of Action 1: Market Deployment and Cross-cutting Line of Action 2: Training**

Promoting the value chain and technology transfer. Facilitate technology transfer and stimulate those sectors that clearly need to start introducing hydrogen technologies, such as the automotive sector. Supporting this work with actions such as collaboration with training bodies, through pilot training schemes, helping launch new qualifications or at least by updating the competences and fitting qualifications present in other vocational training for vehicles – for instance, Vocational training++ on electric and hybrid vehicles.

The objective of our action plan described in this document, 1 hydrogen-based mobility demonstration project, is coherent and consistent with these Aragon Master Plan, helping to achieve their strategic indicators for our region, talking about infrastructure, vehicles, training and awareness.

In Aragon, the experience of drawing up 4 editions of the Hydrogen Master Plan has turned the region into a national benchmark, setting an example for other territories that wish to draw up their own Hydrogen Roadmaps. Its guidelines are reviewed in each edition to monitor progress and the level of development achieved on the basis of technical indicators. In fact, it is planned to maintain this character of support that this Master Plan has for a long time and that it remains as a document that witnesses the evolution of the Aragon region, being updated periodically and gathering and incorporating those initiatives that are detected as strategic, so that in following editions it could reflect the successes achieved with the RAP presented here.

2.2. Objectives

The objective will be to demonstrate the technical and economic feasibility of the implementation of a hydrogen fuel bus route with two vehicles to provide sustainable public transport and connect the center of the regional capital city of Huesca with its main technological and commercial hubs, as well as public education centers.

The selection of this route and this city, on the one hand, responds to the ambition of using a demanding route on which it can be demonstrated that a fuel cell bus can achieve the operational performance of an equivalent diesel bus, while significantly exceeding its environmental performance. It would also make it possible to take advantage of existing resources as there is an existing hydrogen refueling station in operation at the facilities of the Aragon Hydrogen Foundation, which would be upgraded and allows to validate the operation of hydrogen refuelling for fuel cell buses.

On the other hand, with these main actions of the action plan, adequacy of the service station and demonstrative implementation of the operation of this line of fuel cell buses, other transversal but also necessary actions will be carried out such as:



- training in safety and maintenance of these new equipment and vehicles to operators and drivers who will use them directly,
- transferring to the citizenship the advantages that hydrogen can bring to our daily mobility.

2.3. Interregional exchange and learning approach

During the project, the following learning activities have been carried out:

- Exchange of good practices
- Mutual learning
- Peer assessment
- Transfer of know-how

3. Action 1: Hydrogen Bus City of Huesca

Commissioning of a demonstrative project based on fleet of fuel cell buses in the city of Huesca, which already has an operational hydrogen refuelling station in the facilities of the Foundation for the Development of New Hydrogen Technologies in Aragon. This action is based on the lesson learned provided by Aberdeen in its Aberdeen Hydrogen Bus Project.

3.1.1 Link with interregional learning and exchange of experiences

- Hydrogen Buses: <https://www.interregeurope.eu/policylearning/good-practices/item/5961/hydrogen-buses/>
- Hydrogen Refuelling Stations: <https://www.interregeurope.eu/policylearning/good-practices/item/5962/hydrogen-refuelling-stations/>
- Peer review about hydrogen bus and hydrogen refuelling stations led by Aberdeen and South Holland.

3.2. Action

- Study of the needs of adaptation of the existing hydrogen refuelling station for the supply of hydrogen to the two buses of the demonstration project.
- Adaptation of the existing hydrogen refuelling station to cover the demand of the two hydrogen buses demonstration project.
- Implement two hydrogen buses in a demonstration project covering a strategic route in the city of Huesca.
- The multi-disciplinary technical team of the FHa will study and optimise the operational parameters of the fleet, with the aim of carrying out a replication study of the project in other cities of Aragon.



- Addressing the associated cross-cutting issues, such as training for operators, outreach to the general public, and compliance with local rules and regulations for both the operation of a refueling station and the circulation of hydrogen vehicles for public use.

The action aims to improve the Hydrogen Masterplan of Aragon through new projects in the line of "Promotion of hydrogen mobility". Specifically within the section "Demonstrative mobility projects in local captive fleets".

Through the implementation of the "Hydrogen Bus City of Huesca" demonstration project, a contribution is being made to various objectives of the Plan, such as the deployment of hydrogen technologies in Aragon through specific opportunities adapted to the socio-economic reality of the region, in this case the city of Huesca.

Likewise, the project has an impact on increasing the involvement and participation of different regional agents including institutional bodies (Huesca City Council and Regional Government), research centres (Hydrogen Foundation), and companies (Avanza, Zoilo Rios).

In addition, it contributes to to meet the decarbonisation targets of the economy, as set by Masterplan, in line with and regional, national and European strategies..

3.2.1 Target Group

- General population: implementation of the bus fleet on routes traditionally covered by fossil fuel buses.
- Policy makers: demonstrative action to develop and implement hydrogen mobility and achievement of the objectives of the Hydrogen Master Plan (2021-2025).
- Industrial sector: The multidisciplinary team of the Fha will develop valuable know-how from which numerous third parties in the region can benefit through the dissemination of technical results.
- Academic sector: a more theoretical sector that can now make use of a real and demonstrative application, which could inspire new training vocations among students, and confirm the interest in these study and research paths among teachers and those responsible for the project definition and academic programs.

3.2.2 Content

Based on the knowledge exchanged during the project, and the key points to develop defined in the action, firstly, it is intended to evaluate the hydrogen refuelling facilities already available, with the aim of identifying potential adaptations as well as the assurance of hydrogen supply, key points identified by the Aberdeen region in the good practices during the project.

Secondly, the necessary adaptations will be made in order to adjust the refuelling station to the new demand required.



A demonstration project of two hydrogen buses will be implemented on a route connecting the city of Huesca with the Walqa technology park, home to more than 20 companies. In addition, the route includes a stop at an educational hub.

This process will be followed by the technical staff of the FHa, who will evaluate, implement and operate the hydrogen refuelling station. They will also collect data on the demonstration fleet of buses that will be used to replicate the project, both on other lines in the city and in other cities in Aragon.

3.3. Partners and players involved

The partners involved in the project will be the FHa, as installer and operator of the hydrogen refuelling installation, the local public transport company as well as local authorities such as municipalities and departments related to sustainable mobility.

On the other hand, the action will mobilise local companies in the adaptation of the hydrogen plant that can act either as suppliers or subcontractors for localised actions.

In addition, the hydrogen bus demonstration project, with a route that connects the city of Huesca with an educational centre and a technology park, involves the general population, as well as policy makers who, through this action, achieve innovative and pioneering objectives in the field of sustainable mobility.

3.4. Timeframe

The timeframe of the action plan, and the corresponding stages, are shown in the table below.

Month	2022					2023						
	8	9	10	11	12	1	2	3	4	5	6	7
Current situation assessment												
Technical-economic feasibility analysis												
Demonstration phase												
Results analysis												

Table 1. Aragon Regional Action Plan Timeframe.

3.5. Costs (if relevant)

The cost of the action is estimated at 120,000 euros, not including the price of the buses for which it is intended to establish a transfer agreement for a demonstration project.

The main items are associated with personnel hours for research, design and implementation of the new facilities and bus routes, as well as equipment to provide the line with the necessary and updated infrastructure.



3.6. Funding sources (if relevant):

The Master Plan does not have specific funds for its implementation, but uses different sources of funding available to the Region for its development.

Some of the sources of funding identified are the following:

- European funding:
 - o CONNECTING EUROPE FACILITY (CEF): The Connecting Europe Facility (CEF) for Transport is the funding instrument to realise European transport infrastructure policy. It aims at supporting investments in building new transport infrastructure in Europe or rehabilitating and upgrading the existing one.
 - o CLEAN HYDROGEN JU: The Clean Hydrogen JU is the continuation of the successful Fuel Cell and Hydrogen Joint Undertakings (FCH JU and FCH 2 JU), under FP7 and Horizon 2020 (H2020) respectively. Clean Hydrogen Joint Undertaking's main objective is to contribute to EU Green Deal and Hydrogen Strategy through optimised funding of R&I activities.
- National funding:
 - o MOVES SINGULARES II: MOVES Singular Projects II Programme, endowed with 100 million euros, and aimed at the selection and awarding, on a competitive basis, of aid corresponding to singular projects and projects relating to experimental and innovative developments, carried out in the national territory, related to the electric vehicle.
 - o PERTE "Renewable Energy, Renewable Hydrogen and Storage Infrastructure".
 - Incentives for Pioneering and Singular Renewable Hydrogen Projects (H2 PIONEERS Programme): The objective of the H2 PIONEERS Programme is to boost the deployment of commercial applications of integrated projects that include production, distribution, and consumption of renewable hydrogen in the same territorial location.
 - Innovative value chain and knowledge of renewable hydrogen (Programme 2: Design, demonstration and validation of new hydrogen-powered vehicles): Together with the incentive programme for pioneering and unique renewable hydrogen projects, this is one of the first two lines of aid for the promotion of renewable hydrogen approved by the Ministry for Ecological Transition and the Demographic Challenge (MITECO) within the Strategic Project for the Recovery and Economic Transformation of Renewable Energies, Renewable Hydrogen and Storage (PERTE ERHA).
- It will also have its own budget from the Huesca City Council and the Government of Aragon.



3.7. Expected impact

The main impacts expected in the region thanks to this action are based on the acquisition of knowledge in the operation of a hydrogen refuelling plant for buses in the technical field, this learning experience will allow:

- to the public transport company to evaluate fuel cell buses, both technical and economic aspects.
- to the town councils and public bodies involved in the project, to provide sustainable solutions to the growing demand for mobility while achieving the emission targets in the cities that are set from Europe, and that are known to be directly linked to the use of public transport based on conventional fuel.
- to the regional political entities, to use the results of this action as a basis for the replicability of the demonstration project in other lines or cities of the region.
- to educational centres, turn students and teachers into participants in a full-scale trial of new hydrogen-based technologies.
- to the general public, make new hydrogen technologies known in a natural and daily way, thus gaining knowledge and confidence in these new solutions.

This action will allow developing expertise in hydrogen bus fleet project management, including definition, deployment, and operation, which would directly improve structural and governance aspects related to the policy instrument. In addition, this experience will provide the basis on which to define new projects related to hydrogen mobility from a policy instrument perspective.