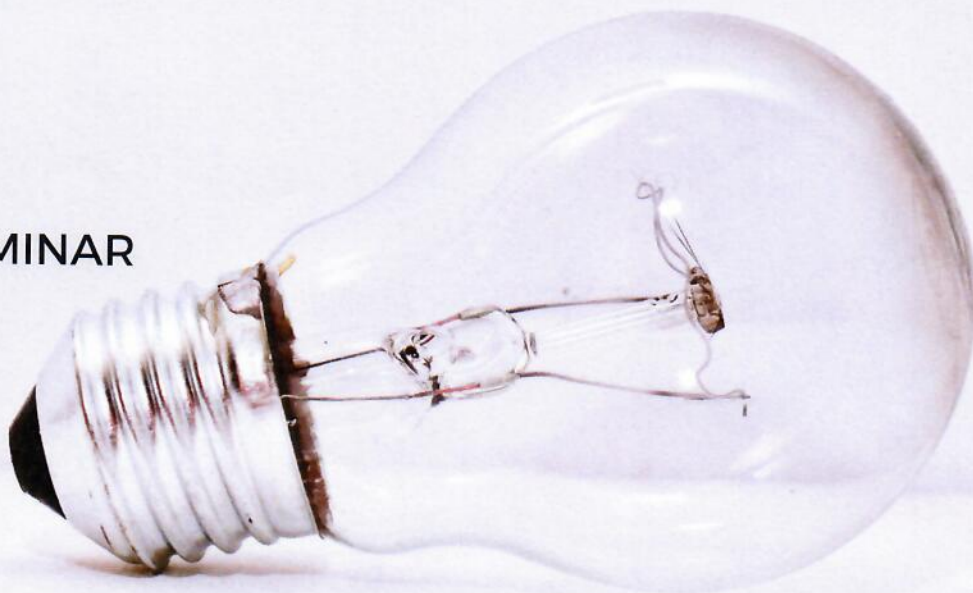


HIDROGEN

VERDE

SEMINAR



LIST OF ATTENDANTS

GREEN HYDROGEN SEMINAR

ALFA INTERNATIONAL SRL	Gheorghe Ciubotaru	President
ALFA INTERNATIONAL SRL	George Ciubotaru	Vice President
ASOCIAȚIA ROMÂNĂ A COMBUSTIBILILOR ALTERNATIVI (ARCA)	Cristian Anton	Strategy Consultant ACS
ASOCIAȚIA ROMÂNĂ A COMBUSTIBILILOR ALTERNATIVI (ARCA)	Vlad Stoicescu	President ACS
AUDIT IT&C SRL	Ing. Mihai Dovletiu	European Funds Consultant
CHIMCOMPLEX SA	Laurentiu Andrei	Production Manager
DEPOGAZ PLOIESTI SRL	Robert Vlasceanu	-
DEPOGAZ PLOIESTI SRL	Anastasios Glouftsios	-
DEPOGAZ PLOIESTI SRL	Cristian Nicolaescu	-
EON ROMANIA SRL	Madalina Nan	Public Affairs & EU Funds Expert
EON ROMANIA SRL	Cristian Calin	Tehnician Manager Gaz, Delgaz Grid
EON ROMANIA SRL	Georgian Albu	Public Affairs Expert
ELECTROTEL SA	V.Valeriu Velciu	President, General Director
ENGIE ROMANIA SA	Cristina Zaharia	Senior Manager Public Affairs
ENGIE ROMANIA SA	Stefan Popescu	Public Affairs Director
FRAMATOME SAS- REPREZENTANȚA PENTRU ROMÂNIA	Teodor Minca	Country Manager Romania
GOLDRING	Capcanaru Anton-Laurentiu	Broker
HENRO - ASOCIAȚIA PRODUCĂTORILOR DE ENERGIE ELECTRICĂ	Silvia Vlasceanu	Executive Director
HIDROELECTRICA SA	Bogdan Paun	Project Manager
HIDROELECTRICA SA	Emil Crisan	Project Development Manager
INSTITUTULUI NATIONAL DE CERCETARE SI DEZVOLTARE PENTRU ELECTROCHIMIE SI MATERIE CONDENSATA	Virgil Rotaru	ITT Manager
INSTITUTULUI NATIONAL DE CERCETARE SI DEZVOLTARE PENTRU TEHNOLOGII CRIOGENICE ȘI IZOTOPICE - ICSI	Elena Carcadea	Departament ICSI Energy Director
METAROM INDUSTRIES SRL	Ing. Paul Mirica	General Director
ROSERV GREEN ENERGY SRL	Doru Avramescu	CEO



Agenda Evenimentului despre Hidrogen Verde

Marti, 30 mai 2023

- 10:15-11:00** - Înregistrarea participanților și micul dejun
- 11:00-11:05** - Introducerea și prezentarea evenimentului de către Biroul Comercial al Ambasadei Spaniei și ICEX (Institutul de Comerț Exterior)
- 11:05-11:35** - Hidrogenul verde în Spania
- Javier Brey (Președintele Asociației Spaniole a Hidrogenului Verde).
- 11:35: 12:15** - Situația Hidrogenului Verde în România
- Ioan Iordache, Asociația Română a Hidrogenului Verde
 - Dumitru Chisalita, Asociația Energia Inteligentă
- 12:15-12:30** - Întrebări și răspunsuri; Concluzii finale
- 12:30-13:30** - Întâlniri între companiile spaniole și române (format fizic sau online)
- 13:30** - Încheierea evenimentului



EXECUTIVE SUMMARY

Renewable hydrogen is a key sustainable solution for the decarbonisation of the economy. It is considered as part of the solution to achieve climate neutrality by 2050 and to develop innovative industrial value chains in Spain and the EU, as well as a high value-added green economy.

Renewable hydrogen is set to become a valuable energy vector for end uses where it is the most efficient solution in the process of its decarbonisation, such as hydrogen-intensive industry and high-temperature processes, long-distance heavy transport, maritime transport, rail transport or aviation. In addition, the energy vector quality gives it great potential as an instrument for energy storage and sector coupling.

Creating and promoting a favourable environment for the supply and demand of renewable hydrogen is crucial. Any new framework should prioritise, in the first phase of deployment, renewable hydrogen production projects linked to industrial end-use, as well as mobility projects over other options. In this regard, the creation of **hydrogen valleys or clusters** will play a very significant role, where production, transformation and consumption are specially concentrated, taking advantage of the application of economies of scale, as well as the development of pilot projects linked, among others, to the transport sector and isolated energy systems.

The industry that uses hydrogen as a raw material (oil refining, fertilizers and chemicals, among others) has a great potential to boost renewable hydrogen production in the short term:

- Ambitious but common targets at EU level for industrial uses of renewable hydrogen can be a key lever to ensure a level playing field at EU level.
- Dedicated projects to decarbonise part of the hydrogen-intensive industry can speed-up technological maturity and enable the deployment of other end uses.

Other hydrogen end-uses should be encouraged in those areas where electrification is not the most efficient solution or is not technically feasible in the medium term, such as public transport, urban services or various uses in intermodal transport nodes such as ports, airports or logistics platforms. The early support of this project profiles will allow to develop their competitiveness, in the same way that other nearby countries are developing.



Furthermore, given its high versatility as a vector, the potential of renewable hydrogen to store energy and/or decarbonise the heat sector in both industry and homes, must be assessed and prioritised in cases where electrification is not the most competitive solution. In the long term, hydrogen can play an essential role in energy storage from a 100% renewable electricity system, a goal that it is expected to be achieved by 2050.

Finally, solutions based on renewable hydrogen for islands and isolated energy systems, which depend largely on air and sea transport, must be enhanced so these regions can achieve climate neutrality by ensuring their sustainability as tourist destinations.

Any new regulatory framework must recognise the potential of renewable hydrogen. Establishing a market for hydrogen at EU level may be premature at this stage and distort competition in the short term, as non-renewable hydrogen would displace renewable hydrogen if its environmental impact were not properly internalised.

Renewable hydrogen should have common standards in the EU (targets, labelling, guarantees of origin), as these could facilitate its deployment and ensure a level playing field. Furthermore, taxation and the CO₂ market can help to provide the right signals to stakeholders and consumers to properly assess the renewable label.

This Hydrogen Roadmap aims to identify the challenges and opportunities for the full development of renewable hydrogen in Spain, providing a series of measures aimed at boosting investment action, taking advantage of the European consensus on the role that this energy vector should play in the context of green recovery. This Roadmap is therefore aligned with the 2021 Annual Sustainable Growth Strategy published by the European Commission, which identifies the future Recovery and Resilience Mechanism as an opportunity to create emblematic areas of action at European level, making two of these areas of action (*Power up* and *Recharge and Refuel*) an explicit mention of the development of renewable hydrogen in the European Union.

Spain has the opportunity to position itself as a technological benchmark in the production and use of renewable hydrogen, leading a *country project* towards a decarbonised economy, by boosting the hydrogen value chain through the



creation of technology clusters and pilot projects on a regional scale, promoting industrial innovation, supporting just transition areas and making renewable energy available at competitive prices.

Because of this exercise, this Roadmap provides a **Vision 2030 and 2050, establishing ambitious country targets in 2030** whose achievement will ensure the industrial and technological positioning of our economy in the European context, the decarbonisation of a relevant volume of hydrogen consumed today and the full introduction of hydrogen in sustainable mobility. All this with the ultimate aim of contributing to the achievement of the objectives set out in the National Integrated Energy and Climate Plan. In particular, **Vision 2030 foresees an installed capacity of 4 GW electrolyzers** and a series of milestones in the industrial, mobility and electricity sectors, for which it will be necessary to **mobilize investments estimated at 8,900 million euros during the period 2020-2030**. However, as an intermediate milestone to reach the 4GW objective, it is estimated that by 2024 it would be possible to have an installed power of electrolyzers of between 300 and 600 MW.



Illustration 1. Main HR objectives

Updating every three years of this Roadmap, based on the evaluation of progress towards the achievement of the Vision 2030 objectives, the degree of implementation of the measures and the quantification of their impact, will allow its permanent adaptation to technological development and market evolution.



Finally, the Roadmap is the result of the **participation of various economic agents, administrations and citizens** who have provided their contributions during the prior public consultation process, in particular by proposing numerous innovative projects in the different stages of the renewable hydrogen value chain. That fact is the best guarantee to ensure that this energy vector will play a relevant role in cross-cutting challenges such as economic recovery after the COVID-19 health crisis, fair transition, the demographic challenge and circular economy.



PROIECTE DE HIDROGEN REGENERABIL DEZVOLTATE ÎN SPANIA

Proiecte în curs

Au fost compilate proiecte în derulare în domeniul hidrogenului a căror relevanță a fost recunoscută prin acordarea de finanțări publice din fonduri publice spaniole sau europene. Sub rezerva celor de mai sus, acestea reprezintă o selecție dinamică cu posibilitatea de a încorpora noi proiecte, care se concretizează după publicarea acestei foi de parcurs.

H2PORTS	
Scopul proiectului	Realizarea de studii de fezabilitate pentru dezvoltarea unui lanț durabil de aprovizionare cu hidrogen în port pentru a reduce impactul asupra mediului al operațiunilor sale.
Descriere	Proiect pilot la scară europeană situat în Portul din Valencia care dezvoltă și validează transformarea în H2 pentru două utilaje (macara telescopică și cap de camion) în condiții reale de funcționare. Proiectul include generarea de hidrogen de 350 de bari, precum și studiul și dezvoltarea logisticii de aprovizionare cu H2 în port.
Companii afiliate	Autoritatea portuară din Valencia, Fundația Valenciaport (coordonator), Centrul Național de Hidrogen și companiile private MSC Terminal Valencia, Grimaldi Group, Hyster-Yale, Atena, Ballard Power Systems Europe și Enagás.
Perioadă	2019-2023
Locație	Portul din Valencia
Buget	4 milioane de euro
Finanțare	3.999.947,5 EUR de la Fuel Cells and Hydrogen Joint undertaking (FCH JU).



HIGGS (Hydrogen In Gas GridS: o abordare sistematică de validare la diferite niveluri de amestecuri în rețele de gaz de înaltă presiune)	
Scopul proiectului	Analizarea potențialului existent și cerințele privind infrastructura, componentele acesteia și managementul implicat în injectarea hidrogenului în rețelele actuale de transport de gaze naturale de înaltă presiune.
Descriere	<p>Studiu pentru decarbonizarea rețelei de gaze și utilizarea acesteia, acoperind lacunele în cunoașterea impactului pe care nivelurile mari de hidrogen le-ar putea avea asupra infrastructurii de gaze, a componentelor și a managementului acesteia.</p> <p>Proiectul include diverse activități, printre ele: cartografierea obstacolelor tehnice, a facilitatorilor juridici și tehnici- normativi, testarea și validarea sistemelor și inovarea, modelarea și pregătirea tehnico-economică a unui set de concluzii ca modalitate de a permite injectarea hidrogenului în rețelele de gaze de înaltă presiune.</p>
Companii afiliate	Coordonator Fundación Hidrógeno de Aragón (FHa) cu participarea Redexis, TecNALIA, DVGW (Asociația Germană de gaz și apă), HSR (Universitatea de Științe Aplicate Rapperswil, Elveția) și ERIG (Institutul European de Cercetare pentru Gaze și Inovație Energetică, Belgia).
Perioadă	2020-2022
Locație	Distribuit în centrele de cercetare ale participanților.
Buget	2 milioane de euro.
Finanțare	100% din Fuel Cells and Hydrogen Joint undertaking (FCHJU).



GH2 Country Portal – Spain

Green hydrogen vision

Hydrogen production using renewable sources has been recognized in Spain's National Energy and Climate Plan ("NECP") as having a key role in the country's energy transition. It is considered an important and flexible energy vector that allows the integration of surplus variable renewable electricity and therefore a higher penetration of renewables in the electricity system. The development of hydrogen as a renewable fuel is considered a priority to decarbonize the industrial and mobility sectors of Spain (National Hydrogen Roadmap, October 2020).

Spain has an abundance of sunshine and windy hillsides, making it a well-suited location for green hydrogen plants. The government plans for Spain are therefore to position the country as a renewable hydrogen exporting nation of Europe in the medium-long term. According to the Ministry for Ecological Transition and the Demographic Challenge, green hydrogen is a "*country project*" for Spain.

"Each kilogram of green hydrogen that replaces a fossil fuel will prevent nine kilograms of CO2 being emitted into the atmosphere"- Pedro Sanchez, Prime Minister of Spain

National Strategy

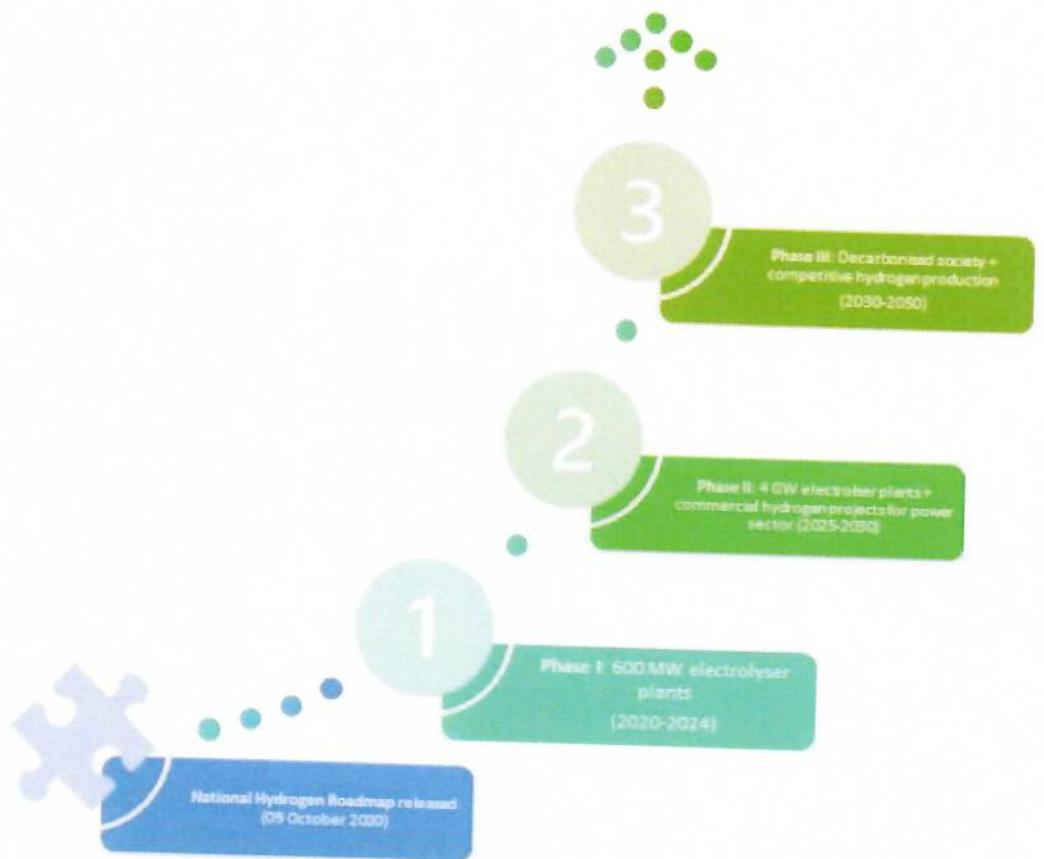
In October 2020, the Ministry for Ecological Transition, and the Demographic Challenge (MITECO) approved the "Hydrogen Roadmap: a commitment to renewable hydrogen". The strategy is a follow up of the EU Hydrogen Strategy for a climate-neutral Europe by 2050. The roadmap has a set of challenges, opportunities, and measures for robust development of hydrogen technologies and establish a market for the entire hydrogen value chain: production, storage/transport, and usage (whether as a fuel, energy vector or as raw material for industry).

The roadmap defines 60 specific measures which are divided into the following 4 blocks:

- a. **Regulatory:** At present, hydrogen production is considered an industrial activity, thus the roadmap suggests modifying the classification of on-site renewable hydrogen production and developing policies to facilitate the development of direct electricity lines dedicated to renewable hydrogen production. It also attaches a green tax to the positive externality of producing green hydrogen.

- b. **Sectoral:** These include measures for the different components of the hydrogen value chain. Establishing a statistical system for hydrogen data, development of particular financial instruments for green hydrogen industry and creation of hydrogen “valleys” are some of the key aspects. Furthermore, this block describes promoting the consumption of renewable hydrogen in the transport sector.
- c. **Cross-cutting:** Support for the cross-cutting instruments that establish suitable technical and technological framework for the fulfilment of the defined objectives. The Hydrogen Roadmap aims to be a dynamic instrument that is updated every three years in order to correctly evaluate the degree of success.
- d. **Promotion of R&D:** Exclusive lines of financing will be provided for projects in the renewable hydrogen value chain. The role of the National Hydrogen Centre (“CNH2”) as a leading public R&D centre will be strengthened.

A first nation-wide consortium (*Shyne* – Spanish Hydrogen Network) was launched in January 2022, which includes 33 of the most important players in the Spanish energy market, as well as industrial and transport companies. The consortium is led by operators such as Repsol, Enagás, Iberia and Navantia and plans to develop projects in a dozen autonomous regions with a combined investment of € 3,230 million.



Capacity and capacity targets

- Spain has a production capacity of 600 000 tonnes of green hydrogen in 2021.
- According to the National Hydrogen Roadmap, the total electrolyser capacity target of Spain is 600 MW by 2024, increasing to 4 GW by 2030 (10% of the EU total).
- According to estimates by the Spanish government, the current electrolyser capacity is 40 MW (2022).

- Spain is part of the EU collective price target of green hydrogen at \$1.4 per kg by 2030.

Impact targets

- With the green hydrogen strategy, Spain aims to replace 25% of the current 500,000 tonnes of fossil-based hydrogen consumed by the Spanish industry annually, with green hydrogen.
- The aim is that the CO2 emissions will annually be reduced with 4.6 million tonnes by 2030.
- The strategy sets out the aim of adding a fleet of at least 150-200 fuel cell buses and between 5,000-7,500 light/heavy-duty hydrogen fuel cell vehicles for freight transport throughout the country by 2030.

Policy and Project Spotlight

- a) Guarantee of Origin System:** In collaboration with other European countries for renewable hydrogen, this system allows the production method of hydrogen to be traced and to provide appropriate price signals to consumers.
- b) Sun2Hy project:** Led by Enagás and Repsol, the project focuses on the development of a new photoelectrochemical technology that allows the production of green hydrogen, 100% renewable, at a competitive cost, from solar energy through a direct process without external electrical input. This new technique can achieve a 90% carbon footprint reduction with respect to existing green hydrogen production technologies.

c) Power to Green Hydrogen Mallorca Project [6]: Spain's first industrial renewable hydrogen plant set up in 2020, by an industrial consortium led by Enagás and Acciona Energía on the Balearic Island of Mallorca in Lloseta. It will produce 330 tonnes of green hydrogen a year powered by the nearby 8.5MW Lloseta and 5.9MW Petra solar arrays. Green hydrogen will be used to fuel bus fleets and provide heating and electric power generation for commercial and public buildings on Mallorca and the Iberostar hotel group. It is a part of European-funded project Green Hysland.

d) Green Hydrogen Buses: According to the president of Barcelona's public transport authority, Barcelona became the first city in Spain to introduce renewable hydrogen fuel cell buses. The city announced in 2020 that Portuguese manufacturer Caetano Bus won a tender to supply the eight busses for €6.4 million. The buses will use 20 kilograms of hydrogen per day and have a range of 300 kilometres on a single charge.

e) HyDeal España: As the first project of the 67GW HyDeal Ambition plan, HyDeal España announced in February 2021 that it will power 7.4 GW of electrolyzers from 9.5GW of solar power and create an industrial hub to decarbonise steel, fertiliser, and other products. It is expected to produce 330,000 tonnes of hydrogen each year that will be supplied to a new industrial hub in the Asturias region in northern Spain. The developers are steel maker ArcelorMittal and fertiliser producer Fertiberia.

Financing

- Out of the €7 billion announced towards renewables including green hydrogen and energy storage, €1.555 billion has been set out by the State for green hydrogen under its Strategic Project for Economic Recovery and Transformation plan (PERTE).
- Green hydrogen technology is expected to attract approximately €8.9 billion between now and 2030 from the public and private sector^[7].
- For the purposes of achieving such target, the Spanish Government has already approved the *Strategic Projects for the Recovery and Economic Transformation (Proyectos Estratégicos para la Recuperación y Transformación Económica - PERTE)* of Renewable Energies, Renewable Hydrogen. It will consist in the investment of € 1,555 million exclusively allocated to hydrogen developments during 2021-2023. By 2021, it was included (i) a credit of line of € 150 million for pioneering renewable hydrogen projects, with commercial viability, for local production and consumption in sectors that are difficult to decarbonise, such as heavy industry or heavy transport, and (ii) € 250 million credit line to promote the renewable hydrogen value chain, from components manufacturing to prototypes of new vehicles or electrolyser manufacturing projects to produce renewable hydrogen on a large scale.

Government green hydrogen lead

The Ministry for the Ecological Transition and the Demographic Challenge (MITECO)

Key Hydrogen Association and Foundations:

1. Spanish Fuel Cell Association (APPICE)
2. Spanish Hydrogen Association (AeH2)
3. National Hydrogen Centre (Centro Nacional del Hidrógeno, CNH2)