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Focus on Hydrogen: Spain's Bid to Play a Leading Role in New Energy

*By Jaime Almenar and Clara Alcaraz**

The authors of this article explain Spain's Hydrogen Roadmap, which contains 60 measures designed to develop the nation's capacity to become one of the leading European countries in the production and exportation of renewable hydrogen.

In late 2020, the Spanish government approved the “Hydrogen Roadmap: a commitment to renewable hydrogen.” The Roadmap, which contains a total of 60 measures designed to develop Spain's capacity to become one of the main European powers in the production and exportation of renewable hydrogen, was proposed by the Ministry for the Ecological Transition and the Demographic Challenge (“MITECO”) and, as its name suggests, has a focus on hydrogen produced from renewable sources (“clean” or “green” hydrogen). The Roadmap provides a Vision 2030 and 2050, establishing ambitious country targets.

Clean hydrogen has huge potential to contribute to the target of climate neutrality set for 2050 and presents a clear opportunity to develop new industrial value chains. Spain can be a key player in this space if an appropriate regulatory framework is implemented and the operators involved received the necessary signals and incentives.

The main uses of hydrogen are:

- In the industrial sector, clean hydrogen can be used as a raw material in industrial processes (Spain currently consumes around 500,000 tons of hydrogen in chemical installations and refineries), and as a source of clean energy for processes requiring a major heat capacity and where electrification is not effective (such as metallurgy).
- In the transport sector, it is used for fuel cells, and has advantages over electrical batteries, as in addition to weighing less, charging times are shorter and it is possible to travel further without refueling. Hydrogen engines, due to their characteristics, also have lower maintenance costs.
- In the residential and service sector, clean hydrogen can, in the long

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term, be a cleaner alternative to natural gas.

REGULATORY AND ECONOMIC BARRIERS

At present, the main administrative obstacle for the development of clean hydrogen is environmental regulation. Industrial facilities devoted to the production of hydrogen are required, except in cases of projects experimenting with new products and processes, to obtain an integrated environmental authorization (“AAI”). This requires the provision of a financial guarantee (as of October 16, 2021) to cover potential environmental liability.

In the case of small electrolyzers, current legislation means they perform an industrial activity, for the purposes of the requirement of the AAI, and must provide the mandatory guarantee. Storage facilities may also have to obtain an environmental impact statement and comply with the regulations on monitoring measures for the risks inherent in serious accidents where hazardous substances are involved.

From an energy regulatory standpoint, the production of hydrogen and the storage and transport are currently subject to a significant number of administrative procedures for obtaining the required authorizations or permits.

Permits are required for production, storage, and distribution of hydrogen by pipeline, and if an associated renewable facility is used to generate the electricity used by the electrolyzers, it will also be necessary to obtain permits for the production of electricity and for access and connection to the electricity grid.

Economic components can also act as a barrier to the implementation of clean hydrogen. Factors such as the current price of renewable electricity (with its tolls and charges), the need to write off plant and operations and maintenance, together with the current low cost of natural gas and the high cost of hydrogen transport, could—in the absence of proper incentives—slow down the development of clean hydrogen.

A clean hydrogen certification system will contribute to the development of this technology, and the possible imposition of minimum renewable hydrogen consumption quotas would also contribute to this objective.

In addition, the development of a network of hydrogen pipelines would at least require recognition of the public utility of the deployment of such infrastructure.

ROADMAP TARGETS FOR 2030

2030 Targets

With an estimated investment of EUR 8.9 billion, the following targets have been set for 2030:

- *Production of renewable hydrogen:* the installation of at least 4GW of electrolyser capacity, with an estimated installed capacity of between 300MW and 600MW in 2024.
- *Industry:* 25 percent of total hydrogen consumed will be renewable.
- *Transport:* Directive (EU) 2018/2001 provides that the quota of renewable energy in the end consumption of energy in the transport sector will be at least 14 percent in 2030. Moreover, the IPCEI (Important Projects of Common European Interest) establishes a far more ambitious quota of 28 percent. In order to contribute to meeting these targets, the following milestones are envisaged by 2030:
 - A fleet of at least 150–200 buses with renewable hydrogen fuel cells.
 - At least 5,000–7,500 light and heavy hydrogen fuel cell vehicles for the transport of goods.
 - A network of at least 100–150 hydrogen stations situated in easily accessible locations distributed all over the country with a maximum distance of 250 km between them.
 - Use of hydrogen-powered trains on a continuous basis on at least two commercial medium- and long-distance routes on lines that are not currently electrified.
 - Introduction of handling machinery that uses renewable hydrogen fuel cells and supply points at the top five ports and airports by volume of goods and passengers.
- *Electricity sector/energy storage:* commercial hydrogen projects operational in 2030 are needed for the storage of electricity and/or use of the surplus renewable energy according to the guidelines established in the Storage Strategy.

KEY STEPS TO ACHIEVING THE TARGETS

The Roadmap sets out the following key steps to achieve the above goals:

- *Guarantees of Origin:* developing a system of guarantees of origin of renewable hydrogen will be key to providing appropriate signs on price.
- *Hydrogen valleys:* the creation of “hydrogen valleys” that concentrate the production, transformation and consumption of hydrogen is a priority objective.
- *Transport:* promoting the use of hydrogen in public transport, urban services and intermodal transport hubs at an early stage is seen as key for competitiveness.

Achieving the targets set for 2030 will make it possible to reduce emissions of 4.6 million tons of CO₂eq into the atmosphere in 2020–2030. Likewise, it is envisaged that it will avoid the emission of 1.125 million tons of CO₂eq into the atmosphere in 2030.

VISION 2050

The production of clean hydrogen is set to skyrocket from 2030, with technological developments and economies of scale facilitating a surge in clean hydrogen consumption in industries that are difficult to decarbonize and creating new uses for clean hydrogen in the aviation and maritime transport industries, among others.

Clean hydrogen is also expected to play a key role in power production management from 2030 onward. When demand spikes in Europe, while Spain's production capacity increases, it is set to become a clean hydrogen exporter to the rest of Europe. Consequently, the admissible hydrogen concentrations in the natural gas network should be standardized, and we should determine whether Spain's exports will be transported via hydrogen pipelines or by heavy goods vehicles / tankers.

PROJECTS UNDERWAY

The Roadmap identifies five projects that have earned public funding to date and 28 that have presented submissions to the call for expressions of interest to identify projects eligible to participate in the IPCEI mechanism.

The five that have already earned public funding are as follows:

- 1) *H2PORTS* (Port of Valencia): viability studies for the development of a clean hydrogen supply chain at the port to reduce the environmental impact of its operations (EUR 4 million).
- 2) *SUN2HY* (Móstoles): precommercial demonstration of hydrogen production by electrolysis.
- 3) *SEAFUEL* (Tenerife): viability demonstration of fueling local transport networks with fuel produced using renewable sources and fuel from seawater.
- 4) *HIGGS* (various locations): analysis of the existing potential and the requirements on infrastructure, its components and management entailed by injecting hydrogen into the current high-pressure natural gas networks.
- 5) *GREEN HYSLAND* (Mallorca): clean hydrogen production using electricity from the same source with multiple applications on the island.

The 28 other projects include the following noteworthy examples:

- *A Coruña*: project to produce clean hydrogen for various industrial applications.
- *Asturias*: production of clean hydrogen and subsequent use in producing iron ore, replacing coke gas.
- *Ciudad Real*: industrial-scale clean hydrogen production for use in the production processes of fertilizers that use hydrogen as a raw material.
- *Huesca*: industrial-scale clean hydrogen production for use in transport.
- *Vizcaya*: industrial-scale demonstration plant for producing synthetic fuels using clean hydrogen and CO₂ captured from industrial processes.

CONCLUSION

The 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 and taking advantage of the European consensus on the role hydrogen should play in the green recovery.

It is now up to the regulators to eliminate the existing barriers that may prevent the different actors from investing in this sector and provide the right signals to stakeholders and consumers who will in the long-term benefit from a decarbonized economy.