



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.