

The Hydrogen Pathway: an alternative for a decarbonised energy sector

Overview

Hydrogen is enjoying a renewed and rapidly growing attention in Europe and around the world.

Hydrogen can be used as feedstock, fuel or as an energy carrier and for energy storage, and has many possible applications across the industry, transport, power and buildings sectors. **It does not emit CO2 and almost no air pollution when used.** According to the European Hydrogen Strategy, it thus offers a **solution to decarbonise industrial processes and economic sectors** where reducing carbon emissions is both urgent and hard to achieve.

Hydrogen is at the center of the political, energy and industrial debate as it represents a key **link for the sustainability and functionality of future decarbonised energy systems on a global scale.**

There are many reasons why hydrogen is a key priority to achieve the European Green Deal and Europe's clean energy transition. Renewable electricity is expected to decarbonise a large share of the EU energy consumption by 2050, but not all of it. Hydrogen has a strong potential to bridge some of this gap, as a vector for renewable energy storage, alongside batteries, and transport, ensuring back up for seasonal variations and connecting production locations to more distant demand centres. In its strategic vision for a climate-neutral EU published in November 2018, the share of hydrogen in Europe's energy mix is projected to grow from the current less than 2% to 13-14% by 2050.

The advantages derived from a greater penetration of hydrogen as a green energy vector lie in its intrinsic characteristics, first of all its versatility and integration with other clean technologies for the production and consumption of energy. Among other opportunities, hydrogen allows to:

- **Guarantee flexibility and resilience to the energy system**, offering a new balancing instrument and storage system during renewable electricity generation peaks and a link between the gas and electricity sectors (so-called sector coupling).
- **Leverage the natural gas network infrastructure** to accelerate the hydrogen penetration process and to connect production and consumption sites.

A condition for a widespread use of hydrogen as an energy carrier in the EU is the **availability of energy infrastructure for connecting supply and demand.** Hydrogen may be transported via pipelines, but also via trucks or ships docking at adapted LNG terminals. Transport can happen as pure gaseous or liquid hydrogen or bound in bigger molecules that are easier to transport (e.g. ammonia or liquid organic hydrogen carriers). Hydrogen can also provide cyclical or seasonal storage to produce electricity to cover peak demand, secure hydrogen supply, and allow electrolyzers to operate flexibly.

A Roadmap for EU and Spain

In July 2020, the European Commission published a **hydrogen strategy for a climate-neutral Europe** with a strategic road map for hydrogen. Some months later, the Spanish Government approved the "Hydrogen Roadmap: a commitment to renewable hydrogen". With this plan, the Government aims to guide the deployment of this sustainable energy vector as a key to achieving climate neutrality by 2050 at the latest.

Both the EU and Spanish roadmaps set specific targets (i.e. electrolyzers capacity) and investment objectives to be reached by 2030.

		Phase 1 2020 - 2024	Vision 2030
Electrolysers capacity	Spain	300 – 600 MW by 2024	4 GW
	EU	6 GW	40 GW
Investment Plan	Spain	<ul style="list-style-type: none"> 8.9 billion € will need to be mobilised. H2 production facilities + Industrial and transport sector adaptation to H2 usage. 	
	EU	<ul style="list-style-type: none"> 90 - 107 billion € will need to be mobilised. Electrolysers, H2 transport, distribution and storage facilities and refuelling stations. 	
Framework Strategy	Spain	Hydrogen Roadmap: a commitment to renewable hydrogen (October, 2020).	
	EU	A hydrogen strategy for a climate-neutral Europe (July, 2020).	

MRC Vision

We see the development of renewable hydrogen sector as great opportunity to:

1. Contribute to the **decarbonisation** of the energy and other economic sectors thanks to the switching from fossil natural gas and conventional hydrogen to renewable hydrogen.
2. Contribute to the economic prosperity through **investment mobilization and employment creation**.

Still, achieving a fully-fledged renewable hydrogen system by 2030 is not an easy task. It will require a multidimensional strategy with full engagement of key stakeholders:

➤ Governments and policy makers.

- Renewable hydrogen production is still far from achieving cost competitiveness; thus, **incentives and public support schemes** should be available during the next years to foster projects development.
- Policy makers must ensure that an **enabling legislation** is in place allowing for scaling up the renewable hydrogen sector.
- 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.

➤ National and EU Energy Regulatory Authorities.

- **EU energy regulatory framework** in force was not designed for the integration of power-to-gas solutions (P2G), sector coupling and large-scale renewable hydrogen production, transport and storage.
- The lack of adequate regulation is an important barrier hindering hydrogen sector development. For example, **the old roles and responsibilities of network operators** may need to be revised (e.g. gas TSOs may be allowed to operate P2G facilities injecting hydrogen into the gas network).
- The concept of **Regulatory Sandbox** shall be applied to address the need for regulatory innovation to facilitate investment framework for pilot projects allowing for flexibility from general rules.

➤ **Network Operators:**

- Gas System Operators. Increasing hydrogen usage allows to **leverage the natural gas network infrastructure** since hydrogen may be transported via pipelines. Existing gas infrastructure owned and operated by gas TSOs/DSOs can be gradually adapted to enable hydrogen transportation and storage.
- Electricity System Operators. **P2G solutions are a new source of flexibility** for the electricity system that can be used for balancing purposes. New unbundling regulation shall decide on, among other things, whether TSOs can operate P2G facilities.

➤ **Other existing private sector players:**

- **Electricity renewable producers** are crucial for scaling up renewable hydrogen sector since wind and PV installed capacity will need to surge to supply renewable power to electrolyzers.
- **Gas suppliers** may start offering **renewable hydrogen supply contracts** to end-users.
- **Oil and refinery companies** are the largest producers of conventional hydrogen and they are investing more and more in renewable hydrogen projects worldwide. These companies are likely to become key players in the future renewable hydrogen ecosystem.
- Fertilizers producers and the chemical industry are the largest hydrogen consumers nowadays.
- Large gas consumers. **Heavy industry** (e.g. steel mills) and **gas power plants** may switch gradually from natural gas to hydrogen blends and, ideally, pure hydrogen. The **installation of hydrogen-ready equipment** to scale up demand will be a crucial action to achieve full decarbonisation.

➤ **Specialised technical services and equipment providers.**

- The number of companies offering technical solutions for renewable hydrogen projects is still limited. As projects scale up from pilot phase to commercial and large-scale, the number of technical service providers will increase.

➤ **R&D Institutes, universities, technical advisors, etc.**

- The size and complexity of the challenge require that diverse agents contribute with their know-how and expertise to foster the development of the renewable hydrogen sector.

To **avoid bottlenecks**, all stakeholders must move forward and play their roles fully aligned with the overall renewable hydrogen strategy. It is useless to massively deploy electrolysis capacity with no adequate infrastructure and insufficient hydrogen demand. Private investment will not be mobilised if regulatory authorities and policy makers do not put in place an enabling regulatory framework.

MRC Capacities

A. What does MRC bring to the development and implementation of renewable hydrogen strategies?

1. **Knowledge and experience in the implementation of Energy Regulations and Market Development Strategies** (EU): Market Liberalization, Unbundling Models, Third-Party Access rules, Revenue and Tariff Methodologies, etc.
 - The update of some of the existing energy regulatory provisions is a must for achieving an enabling framework for renewable hydrogen projects.

2. Expertise in the **design of enabling Regulatory Frameworks and support incentives** for R&D activities and new technologies application in the energy sector.
 - Regulatory incentives and financial support will be crucial until renewable hydrogen technologies reach maturity.
3. **Strategic partnership** with key players in the electricity and gas sector: renewable projects developers, network operators, electricity and gas suppliers, etc.
 - The development of renewable hydrogen projects will be a joint effort of several companies and institutions.
4. Wide experience on **technical assistance** in the deployment of innovative technologies in the energy sector: electricity storage, e-mobility, LNG/CNG use for transport sector.
 - The pathway for a decarbonised energy sector must combine diverse innovative technologies.

B. What can MRC offer?

1. **Technical assistance and advisory services** to regulatory authorities and policy makers to design and implement enabling regulatory frameworks, policies, support schemes and strategies.
2. **Market advisory** for project developers including regulatory framework assessment, supply and demand studies, analysis of network capacities and constraints, business plan assessment.
3. Assistance to project developers regarding project financing and planning.
4. Modelling and forecast capabilities for electricity and gas markets.
5. Financial valuation of projects and companies.

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