France Hydrogène

Engagée pour la transition écologique

The Hydrogen sector's proposals for the development of a renewable and low-carbon hydrogen industry in France

This document is issued from France Hydrogène's Manifesto published in July 2020 updated with elements of the "National Strategy to develop renewable and low-carbon hydrogen in France" launched in September 2020 by the French government.

Achieving a successful energy transition is a crucial goal. Hydrogen enables us to turn this into an opportunity.

This particular energy carrier simultaneously facilitates decarbonization and reindustrialization. The first actors to invest significantly in this field stand to gain the most in a global race that has only just begun.

It is now abundantly clear hydrogen will play a key part in driving the energy transition. It enables the decarbonization of swathes of the economy, especially areas where electrification is not feasible, such as parts of the manufacturing and transportation sectors and fields where gas is currently used. It also has a part to play in increasing renewable energy capacity.

The European Union published an ambitious hydrogen strategy on 8th July 2020, indicating the future direction of travel of public policy – within the framework of the Green Deal - and setting out the funding mechanisms that will be used to develop a sector seen as having long-term significance.
If we look at the bigger picture, on a global level, many countries are investing massively in the growth of the hydrogen energy sector.
The general shift towards carbon-neutral societies is a game-changer in energy geopolitics as it redistributes the economic value generated by energy carriers. The renewable and low-carbon hydrogen produced creates value locally, given the large capital investments required for the production facilities and plant (electrolyzers, reformer units fitted with CO_2 capture and storage technology). The value created is more significant since these technologies will be French-designed and manufactured in France or potentially in partnership with European or near-European partners (Morocco or Spain for example) as part of a larger commercial, technological and economic collaboration.

Against this backdrop, France is well-positioned to take a leading role in this market by making the most of its existing strengths – as long as it embarks on a rapid and very large-scale programme of investment in this field.

Few nations are currently in a position to efficiently decarbonize hydrogen production. However, French industry's expertise and experience in producing CO_2 through electrolysis and biomass technology and CO_2 capture and storage gives France a competitive edge in the renewable and low-carbon hydrogen production sector.

It possesses:

- A world-beating scientific community that is already actively working on R&D into high value-added hydrogen production systems and technology;
- A large number of industrial players present at every stage of the value chain: world-leading large companies (electricity suppliers, construction firms and components manufacturers), industrial standard-bearers capable of working on key technologies, innovative start-ups etc;
- A captive local market which could potentially act as a launchpad for the sector's expansion into the export market;
- An electricity generation mix that is already low-carbon;
- Substantial renewable energy resources: hydro-electricity, off- and on-shore wind, solar power and biomass;
- High-quality energy and transportation infrastructure;
- An advantageous geographical location on major European trade routes, enabling it to make the most of the opportunities presented by cross-border trade in hydrogen, not to mention a large seaboard which, in the areas near to energy hubs, could lend itself to the creation of new businesses, for instance, in port areas.

The leveraging of these assets, together with a European context that is increasingly favourable to hydrogen production will enable France to benefit greatly from growing its hydrogen sector: environmental benefits, greater energy independence and gains in terms of re-industrialization and job creation. The development of a French hydrogen sector encompassing a large part of the value chain, together with the emergence and expansion of new hydrogen markets will all help create manufacturing and service sector jobs on French soil.

Success depends upon the implementation of an ambitious strategy that is capable of rapidly mobilizing both public and private sector actors in a coordinated fashion.

To invest in France, the manufacturing sector needs a domestic market, meaning that users of hydrogen need to be brought onboard (rolling out hydrogen in the transportation sector and using hydrogen as a raw material in industry). In 2030, the demand in France for renewable and low-carbon hydrogen may potentially be over 1 Mt (one million tonnes) spread over industry, transportation and the natural gas distribution network. To stimulate the growth of these markets, state aid will be needed in the early years. This aid must be directed at several areas at once and should be swiftly put in place if we are to achieve our national decarbonization goals and seize the chance to place French industrial actors and technologies in pole position in this field.

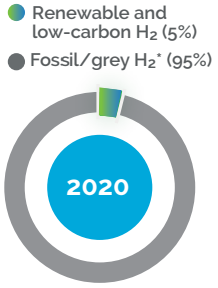
Aid to the sector must be focused on 4 areas:

- Aid to generate demand and create a market
- Aid targeted at hydrogen production
- Aid focused on infrastructure
- Aid aimed at developing French-designed and manufactured technology in this field

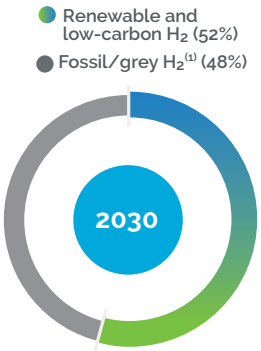
Lastly, an ambitious national Hydrogen plan for France cannot do without purpose-designed tools for governance which will bring stakeholders together and implement this long-term vision in a coordinated fashion.

The plan put forward by FRANCE HYDROGÈNE encompasses the vision of the full range of hydrogen sector actors in France. Drawing on experimental programmes run by the manufacturing sector and local authorities, as well as recent studies, it offers a wide-ranging collection of recommendations along with a figure for the total investment required to achieve the goals of the Energy and Climate law (loi Energie-climat). The benefits identified are commensurate with the financial investments needed and correspond perfectly with the challenges of the green transition.

Growth in hydrogen production
for industry and new uses



45,000 tonnes H_2
out of a total of 880,000 tonnes



700,000 tonnes H_2
out of a total of 1,345,000 tonnes

This plan sketches out a road-map for the rolling out of hydrogen-based solutions, with a 2030 target of almost 700,000 tonnes of renewable or low-carbon hydrogen being produced as part of a total hydrogen market forecast to be around 1.35 million tonnes by this time.

Producing this amount of hydrogen would require 7GW of installed electrolyzer capacity to become operational over the period 2020-2030 along with CCS units attached to the steam-methane reformers currently in use which produce 130,000 tonnes annually. Other solutions might also be used to produce low-carbon hydrogen such as biomass gasification.

In order to be in a position to achieve these goals in line with the Multi annual Energy plan (PPE), industry and research and development will need to invest almost 24 billion euros (€24bn) from 2020 to 2030. They will need State aid to the value of €6.7bn and further financial support worth €3.6bn targeting the production of renewable and low-carbon hydrogen.

This road-map would reduce emissions in all fields concerned (transportation, gas distribution networks, industry), reaching a figure of a reduction in CO_2 emissions of over 4 million tonnes in 2030 and achieving an emissions reduction of more than 20 million tonnes of CO_2 over the course of the decade.

On the basis of predicted turnover, this booming sector could create between 120,000 and 250,000 direct and indirect jobs in France**, either in the shape of net job creation or through the upskilling of existing jobs.

** Hydrogen produced from fossil fuels*
***According to EY, €1M of investment generates between 11 and 14 direct and indirect jobs (varies according to sector). According to manufacturers, for every direct job created, 4 indirect jobs are generated.*

The investment needed to develop a French hydrogen sector

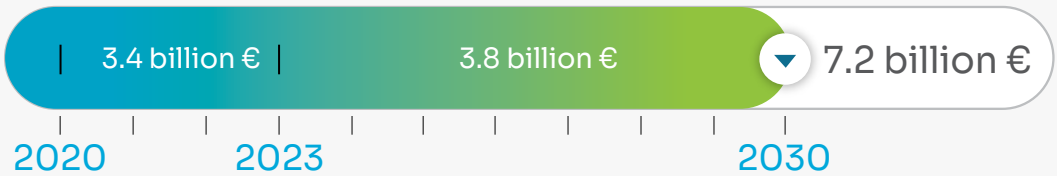
Investment required

According to the H_2 sector

State investment decided in the France's national strategy for the development of renewable and low-carbon hydrogen - September 2020

State investment

France's national strategy for the development of renewable and low-carbon hydrogen

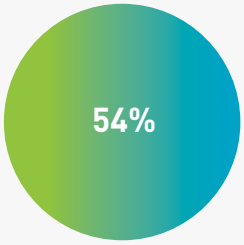


September 2020

2020 **2023**

How the 3.4 billion € will be allocated

Priority 1
Decarbonizing industry



Priority 2
Boosting the H_2-powered commercial-industrial transportation sector

Priority 3
Supporting research, innovation and skills acquisition

Environmental and societal benefits

2030 - Objectives of the French Government's Strategy

for the development of renewable and low-carbon hydrogen in France

6.5 GW* electrolysis capacity

* 5 MW electrolysis capacity in 2020

6,000,000 tonnes reduction in CO_2* emissions each year

* equivalent to the city of Paris' annual emissions

Job creation in the hydrogen sector

2020 — 2,000 jobs

2030 — over 100,000 jobs

France's national strategy for the development of renewable and low-carbon hydrogen - September 2020

The pre-requisites for success: 12 recommendations for an ambitious national Plan

There is widespread international recognition that hydrogen will play a crucial role in the transition towards a carbon-neutral economy. Numerous countries are implementing national strategies to gain a foothold on fast-growing markets. France also has a number of assets it can exploit: a wide range of local initiatives; industrial standard-bearers active in key technologies, large companies present at every stage of the value chain which would be able to act as a driver for a sector by creating value locally; world-beating, highly-innovative research and development capabilities. Its very low-carbon electricity generation mix is sure to add value, creating a competitive renewable or low-carbon hydrogen production sector, aimed initially principally at heavy industry that is difficult to decarbonize (chemicals, steel-making, large-scale/heavy methods of transportation etc.), before shifting increasingly to the production of renewable hydrogen to cater to a wide range of needs.

France has the potential to play a leading role in this field as long as it makes significant investments over the coming years. Together with private investors and manufacturers, state support would be required to give the necessary kick-start to transition to large-scale production. This support would focus on four different areas:

- Aid to generate demand and create a market
- Aid targeted at hydrogen production
- Aid focused on infrastructure

AID REQUIRED TO BOOST DEMAND AND CREATE A MARKET

Recommendation

1 Coordinating the creation of a mass market to enable major manufacturing sector actors to leverage economies of scale

Large-scale buying by both public and private sectors is a key way of quickly generating economies of scale in a way that will offer companies in the transportation and manufacturing sectors greater transparency and more predictable outcomes:

- Assisting public and private sector end clients' access to this market so that hydrogen fuel cells in various methods of transportation become cost-effective; achieving a critical mass with reference to hydrogen distribution/refuelling networks to lower the cost of hydrogen for road vehicles;
- Promoting the establishment of consortiums bringing together producers and consumers at local level;
- Promoting the adoption of renewable or low-carbon hydrogen solutions in industrial centres which already use hydrogen such as refineries, ammonia production plants and the steel-making industry (Fos-sur Mer, Le Havre, Dunkerque, Lyon/Vallée de la Chimie, Haut-Rhin, Nantes-Saint-Nazaire, etc.)
- Establishing new markets in sectors of industry which are responsible for significant CO_2 emissions
- Encouraging competitive dialogue to give rise to a large-volume, multi-buyer approach.

Recommendation

2 Help boost the take-up of fuel cell electric vehicles (FCEV) and give potential users the tools with which to make informed decisions

Sector objectives by 2030 - 342,000 tonnes of renewable and low-carbon H2 powering:

300,000	5,000	250	1,000
Cars and vans [1]	Heavy vehicles [2]	Trains	Boats

1 - cumulative production over the course of the decade
2 - buses, bin lorries, HGVs and refrigerated semi-trailers

Objectives for 2028 of Multi annual Energy Plan (PPE) (French Strategy for Energy and Climate)

- *20,000 to 50,000 light commercial vehicles, company cars and vans*
- *800 to 2,000 heavy vehicles*

- Maintain or even increase existing grants for the purchase of hydrogen-fuelled vehicles, especially the schemes put in place in previous budgets in order to encourage low emissions motoring:
  - Maintain the special status of hydrogen-fuelled vehicles in the environmental bonus scheme
  - Extend the excess capital allowance scheme to vans over 2.6 tonnes and HGVs – and changing this tax incentive over time into a tax credit to help businesses deal with the economic impact of Covid-19
  - Extend these grants to buses or bin lorries, which do not currently qualify for any purchase grants
- Establish decarbonization goals by hydrogen-using market sector (refineries, ammonia production plants etc.), along with incentives to encourage the industrial sector to use renewable or low-carbon hydrogen.

Recommendation

3

Introduce changes to legislation

A number of implementing acts are expected following the passing of the loi d'Orientation des mobilités (the framework law for long-term transportation strategies) in December 2019

- Include a precise quota for very low-emissions vehicles in the upcoming decree regarding the numbers of green vehicles available for hire by members of the public (taxis and private hire vehicles);

- Set our sights higher in relation to the legislation being prepared by the government in order to incorporate into French law directive (EU) 2019/1161 of 20 June 2019 on the promotion of clean and energy-efficient road transport vehicles (relative à la promotion de véhicules de transport routier propres et économes en énergie): the quotas set out for low-emission vehicles offer genuine potential to ensure that a minimum (and sizeable) number of hydrogen-fuelled vehicles can be introduced into circulation by focusing on company cars and vehicles owned by local authorities;

- Continue the work begun with government agencies within the framework of Engagements pour la croissance verte (commitments for green growth), to create a regulatory framework that will encourage the development of hydrogen-related technologies;

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- Rapidly organize and offer ongoing support to the setting up of international testing and certification centres, for example, for the certification of high-pressure hydrogen components used in the field of road, air, sea, river and rail transportation;

- Support and facilitate the establishment of multi-fuel refuelling stations within the framework of the rules governing the configuration of refuelling stations that dispense alternative fuels.

AID TARGETED AT HYDROGEN PRODUCTION

Recommendation

4 Incorporate the RED II directive into French law as quickly as possible

This directive must be incorporated into French law by 2021 at the latest. It will play an important role in shaping the wider transportation field by laying down a binding target for fuel suppliers for at least 14% of the fuel they supply to be renewable fuels:

- Ensure that the renewable hydrogen used in the desulfurization process in refineries will be fully accepted as a RED II-compliant option;
- Apply a multiplying factor of 4 to renewable hydrogen produced via electrolysis used directly for transportation purposes, as is currently the case for electric vehicles;
- Highlight decarbonized ammonia, e-methanol, SNG (methane), synthetic fuels and biofuels incorporating renewable hydrogen in order to launch a new national industry centred on new uses and applications at a time when there is an emerging market in Europe for these new fuels in response to the RED II directive;

Recommendation

5 Ensure the traceability of the hydrogen being produced by means of a system of guarantees of origin

The National Hydrogen Plan, presented by the French government in June 2018, envisages 'the implementation of a hydrogen traceability scheme by 2020, in line with ongoing discussions at European level (revision of the Renewable Energy directive)' (measure 2). The actors in the sector are working alongside government agencies to design a renewable/low-carbon hydrogen traceability scheme, as well as deciding what shape a future system of guarantees of origin would take, as provided for in the French Energy and Climate law passed in November 2019.

- Adopt the existing Guarantees of Origin system supported by all major European industry players in the shape of the Certif'Hy project, funded by the FCH JU (Fuel Cell and Joint Hydrogen Undertaking), which offers European countries a ready-made management structure and an opening onto a more flexible European market.

Recommendation

6 Establish a support scheme aimed at encouraging the production of renewable and low-carbon hydrogen as quickly as possible

State aid is needed to make the roll-out of renewable and low-carbon hydrogen a reality given its production costs, which are still higher than those of grey (fossil fuel) hydrogen. Article 52 of the Energy and Climate law provides for the establishment of a support mechanism with a view to achieving the goals set out of decarbonizing 20 to 40% of hydrogen consumption by 2030. France Hydrogène suggests prioritizing a competitive bidding approach in the shape of annual invitations to tender assisted by support grants.

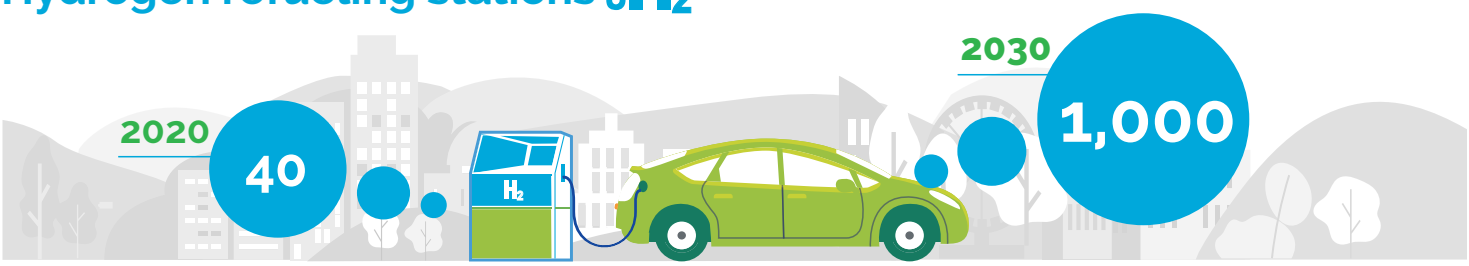
- Work with sector stakeholders to make progress as quickly as possible on the basis of proposals put forward by France Hydrogène in autumn 2019.

AID FOCUSED ON HYDROGEN INFRASTRUCTURE

Recommendation

7 Establish the refuelling infrastructure required for the large-scale rolling out of hydrogen-fuelled transportation solutions

Hydrogen refueling stations



PPE 2028 objectives: 400 to 1,000 stations.

As things currently stand, the goals for the number of hydrogen-fuelled vehicles and refuelling stations set out in the PPE for 2023 (5,000 light commercial vehicles, 200 cars and vans and 100 refuelling stations) should easily be reached and may even be exceeded. To speed up this process and move towards a large-scale roll-out of hydrogen vehicles and stations will require:

- Impetus from the revision of the Alternative Fuels Infrastructure Directive (AFID) and the regulation on the Trans-European Transport Network (TEN-T) in 2021 in order to bolster the case for a bold vision for the expansion of hydrogen-fuelled transportation solutions in France;
- Mitigation of risk for the hydrogen infrastructure business model through long-term take-or-pay contracts for hydrogen buying for clients when they purchase hydrogen vehicles, or through any other mechanism or approach that will reduce investment risk.

Recommendation

8

Create a framework whereby gas distribution networks can be used in the roll-out of hydrogen

The opening up of a dedicated, interconnected hydrogen distribution network that is accessible to both producers and consumers will allow the areas where hydrogen is produced to be linked to the areas where it is consumed. Re-using existing gas distribution assets will facilitate the distribution of hydrogen in a way that is cost-effective for all actors and which will reduce the emergence of stranded costs.
All this will facilitate the large-scale rolling out of hydrogen infrastructure at local and national level This vision of a hydrogen distribution network using natural gas pipelines depends upon the existence of numerous 'looped' gas pipelines which can be gradually converted to transport hydrogen as the demand for natural gas declines. From 2030 on, depending on how the natural gas market has changed and in tandem with other logistical solutions (transportation by road, river and rail), some sections of the gas distribution network could be converted to hydrogen to bolster initial efforts at creating local distribution networks.

Large-scale storage and injection of hydrogen into the natural gas distribution network

43,000 tonnes of renewable and low-carbon H_2

- Define and implement a framework that will facilitate an exploratory approach to developing and operating hydrogen energy infrastructure, including by means of converting gas distribution infrastructure;
- Extend the state's regulatory framework for business as it applies to gas suppliers to include in its remit preparatory work for and the actual carrying out of the conversion of some of their gas distribution infrastructure for the distribution of hydrogen;
- Prepare a framework for third party access to and economic regulation of this hydrogen energy infrastructure with a view to promoting the development of all forms of production and consumption likely to make use of this infrastructure;
- Lay down a target for all gas suppliers to supply a natural gas/hydrogen mix (90% natural gas, 10% hydrogen) by 2030, to enable network operators to adapt their equipment, facilities and operating models and systems to achieve this target;
- Encourage and help component makers and gas consumers to devise and roll out solutions to adapt to these changes.

AID AIMED AT DEVELOPING FRENCH-DESIGNED AND MANUFACTURED TECHNOLOGY IN THIS FIELD

Recommendation

9

Draw up and promote an ambitious strategy for the French industrial sector within the framework of the IPCEI on hydrogen

France's participation in the Important Project of Common European Interest (IPCEI) on hydrogen represents a framework in which to develop French-designed and manufactured technology in this field by supporting our manufacturing sector as they create production plant and facilities across France. This project will also ensure there is ongoing support for investment.

- Organize and strategize with actors at different points of the value chain to create a kind of 'French national team' in hydrogen.

Recommendation

10

Maintain our excellent record in R&D&I, improve training and skills acquisition

To compete on an international level, the French industrial sector needs to continue to innovate to underline their excellence – and their lead - in certain key technologies. To do this, they are assisted by well-organized, world-renowned, top-class research centres such as the CNRS and the French Research Network on Hydrogen (FRH2) and the CEA (the French Atomic Energy Commission) and LITEN, ensuring a steady flow of innovative developments in both the short and long-term.

- Support the IFHy and H2Lab initiatives that have been launched by researchers and manufacturers to strengthen the deeply intertwined, mutualistic relationship between research and industry. Pool tools for developing and assessing solutions;

- Support upstream R&D work, specifically through a large-scale, multi-annual ANR programme focusing on hydrogen and designed to shed new light on scientific and technological aspects of this field;
- Together with actors in the sector, identify the key technologies in which France is in a position to take a leading role;
- Support the development of new training courses in the field of hydrogen, from sub-baccalauréat to PhD level.

Recommendation

11

Help the French hydrogen sector export to emerging markets

France must make the most of its top-class expertise in this sector to seize the opportunities provided by new hydrogen markets, both in hydrogen-related technologies and the international trade in hydrogen and its by-products.
It must also combine this with a strategy of targeted international partnerships.
To achieve this, the French state needs to quickly acquire an in-depth understanding of this area so it is able to position itself for future international discussions:

- Help create, together with sector actors, a kind of 'French national team' combining large companies and SMEs, supported by export assistance schemes and programmes;
- Build strategic state-level partnerships with certain target countries.

GOVERNANCE

Recommendation

12 Implement a governance framework to organize the roll-out of hydrogen in France

Organizing and promoting a competitive French hydrogen sector at European and worldwide level will require the creation of a governance framework composed of government at national level and sector actors. The establishment of an inter-ministerial Task force has been a positive initial step which must now be built upon:

- Define a coherent, transparent framework driven by a national strategy;
- Coordinate the roll-out of hydrogen across the country through 'joined-up', coherent use of various existing planning tools and strategies.

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