



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

IPHE Country Update April 2022: FRANCE

Name	Laurent ANTONI
Contact Information	laurent.antoni@cea.fr
Covered Period	November 2021 – April 2022

1. New Initiatives, Programs, and Policies on Hydrogen and Fuel Cells

- [Becoming the leader in green hydrogen is our goal with France 2030!](#) On 16 November, President Emmanuel Macron confirmed that a budget of €1.9 billion will be dedicated to the objective of "making France the leader in green hydrogen" as part of the France 2030 investment plan, in addition to the €7.2 billion of the National Hydrogen Strategy. This will add to the €1.5 billion budget initially planned to finance the 15 French industrial projects selected for the Important Projects of Common European Interest (IPCEI) on hydrogen to support structuring industrial projects that meet three priority objectives: the production of electrolyzers (McPhy, John Cockerill, Elogen, Genvia), the development of key equipment for hydrogen mobility (Symbio, Alstom, Hyvia, Faurecia, Plastic Omnium, Arkema) and the production of hydrogen for the decarbonization of industrial sites (Air Liquide in Normandy and Dunkirk, Arcelor Mittal, Vicat and Hynamics for the Hynovi project; Total Energies and Engie for the Masshylia project).
- This new €1.9 billion budget will be dedicated to the component dedicated to gigafactories for manufacturing key equipment (electrolyzers, fuel cells, tanks). The projects in the IPCEI's industrial decarbonization component will be supported by the €5 billion envelope provided for in France 2030 in this area, a budget that is also open to other types of projects (heat or direct electrification). In addition to this investment aid, the Ministry of Economy is reportedly working on a tool to define a fixed price for CO₂ at a fixed time frame, which would function as a contract for difference.
- [Franco-German working groups on industry and energy](#). The French Presidency of the Council of the European Union (FPEU) invited the German Minister of the Economy and Climate Protection, Robert Habeck, to Paris on 7th of February to discuss strengthening European sovereignty in industrial and ecological matters. For Bruno Le Maire, sovereignty must be based on "common industrial projects", such as electric networks, electric batteries, or hydrogen. The working groups will enable France and Germany to reach agreement on hydrogen. One of the points of divergence between the two countries is the origin of the electricity used to produce hydrogen from the electrolysis of water. For France, the electricity comes from nuclear energy, while for Germany, it comes from renewable energy. "How can we combine our two strategies? This is a question that the working groups will be looking at, Bruno Le Maire said. Another topic that the two stakeholders will be able to address is the origin of hydrogen. France is looking to control the production chain, while Germany is considering importing green hydrogen. "How can we combine these two models rather than going our separate ways," said Bruno Le Maire. Working together and "putting our efforts together" will be "much more efficient" according to the minister. "These working groups will allow us to resolve many difficulties."



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

- [Presentation of the industry's decarbonisation strategy](#). Prime Minister Jean Castex, on February 4th announced the strategy for accelerating the decarbonisation of the industry and the State's support for the group's investment project in two electric arc furnaces and an iron ore reduction unit using renewable or low-carbon hydrogen in Dunkirk and Fos-sur-Mer (€1.7 billion). "We are going to devote €5.6bn within France 2030 to decarbonize our industry, in addition to what we are already doing for hydrogen."

[ADEME publishes its four Transitions 2050 scenarios](#). ADEME unveiled its "Transitions 2050" report on November the 30th, proposing four scenarios for achieving carbon neutrality, all of which involve a decrease in energy consumption by 2050. In all scenarios, hydrogen consumption is higher than today, although to different extents and for different uses. The "Frugal Generation" scenario (S1) projects a hydrogen requirement of 55 TWh (1.5Mt) by 2050, 78% of which will be used for the decentralized production of synthetic methane in combination with methanisation units (valorisation of biogenic CO₂). The "Territorial Cooperations" (S2) and "Green Technologies" (S3) scenarios imply the greatest need for hydrogen by 2050, with about 95 TWh (2.9 Mt), but for different uses. Finally, in the "Repairing Bet" scenario, hydrogen plays a lesser role (35 TWh in 2050) because it competes with other technologies, including the development of carbon capture, storage and reuse (CCUS) in industry and air carbon capture techniques, as well as with the battery, which is becoming the norm in mobility.

- [RTE updates its "Future energies 2050" report](#). The 16th of February, RTE, the French electricity TSO, updated its report on the different scenarios of the French energy mix to achieve carbon neutrality by 2050. The update adds new analysis, as well as more details on the 6 scenarii, ranging from 100% RES to a 50% RES – 50% nuclear energy mix. A major difference compared to other studies, the RTE report does not integrate CCS/CCU and shows one scenario with no thermal power plants.
- [IEA report on French energy policy](#). The International Energy Agency (IEA) published its annual report on French energy policy on November the 30th. Among its main recommendations, the IEA warns against sending conflicting signals that could increase the risk and cost of investment in renewable energy, referring to the renegotiation of the pre-moratory solar contracts. The IEA notes that in order to align with a carbon neutrality trajectory, the new version of the SNBC will have to "revise upwards the expected contributions of biomass, CCS and CCUS, as well as decarbonized gases, and first and foremost hydrogen". Underlining the strong French potential for hydrogen production, the Agency invites the government to look beyond industrial uses and heavy mobility, and to conceive of hydrogen as a "new energy vector providing long-term storage in its energy system". This storage should be seen as a facilitator for the export of hydrogen to neighboring countries, a dynamic that the IEA supports by encouraging the French government to accelerate the retrofit of existing natural gas networks. Finally, the authors invite the government to deepen its efforts in international collaboration for decarbonization solutions, and cite hydrogen as an appropriate sector for this.
- [Annual report "Hydrogen in France", 2021 edition](#). France Hydrogen's annual report presents the highlights of 2021 for the hydrogen sector in France.



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

2. Hydrogen and Fuel Cell R&D Update

- [The maritime industry launches the Meet 2050 institute for the energy transition of the sector.](#) On the side-lines of the One Ocean Summit held in Brest from February 9 to 11, a coalition of maritime transport stakeholders announced the creation of the Meet 2050 Institute for the eco-energy transition of the maritime sector. This institute will "propose a shared vision, within the maritime sector, of the solutions that will enable the sector to collectively achieve its environmental objectives". The French Maritime Cluster (CMF) hopes that maritime transport "will find its place in the H2 plan, because hydrogen will serve many uses in the maritime sector, either as the main energy source or as auxiliary energy, at sea or in stationary technologies. "Following the work of France Hydrogène, the Institute's priority will be to remove "the barriers, which are primarily economic".
- [Helping the mechanical engineering industry in France to switch to hydrogen.](#) At the request of the French mechanical engineering sector, Cetim (*Centre technique des industries mécaniques*) is launching the HyMEET (Hydrogen Material and Equipment Engineering and Testing Center) project to help manufacturers in this sector master the technological changes required by the use of hydrogen. A first budget of €11m has already been approved to implement this project, and a second part of €14m should be voted in April.
- [The first class of students certified by Symbio has graduated.](#) Symbio is already training its employees. Its first class has just graduated. It involved a dozen students with eight graduates. "Two stopped during the training. All of them had started teaching at the beginning of 2021. They are people between 20 and 40 years old, coming from all walks of life. They were either in professional reintegration or in reorientation. *Pôle emploi* (national French employment agency) made the selection. The Region Auvergne Rhône-Alpes financed the project within the framework of the Contract for Assistance and Return to Sustainable Employment (Cared)". The teaching is the result of a partnership between the Industrial Research Institute (IRI), which provides the class lectures, and Symbio, which ensures the practical case studies. "We carry out this action within the framework of our Symbio hydrogen academy, whose mission is to create synergies with institutions, schools, training organizations and industrialists. In this way, we are creating training modules specific to the emergence of the skills and professions of the future of the hydrogen industry."
- [ANR launches the first call for projects of the PEPR for R&D in hydrogen technologies.](#) On November 30, the French National Research Agency (ANR) opened the first call for projects of the new Priority Research Program and Equipment (PEPR) on low-carbon hydrogen. The aim of this program is to support R&D activities at the highest world level, in support of the industry and in line with the priorities defined in the National Hydrogen Strategy. The call for projects targets five areas: low-temperature water electrolysis, hydrogen production by photo(electro)catalysis, hydrogen combustion, hydrogen storage in liquid and ammonia form, and the integration of PEMs into systems for application in heavy transport. The deadline for applications is December 31, 2022
- [Guide for the conformity assessment and certification of hydrogen systems.](#) This guide, written by Ineris with the financial and technical support of Ademe and France Hydrogène, aims to help the actors of the hydrogen sector, whether they are manufacturers or users, to identify the conformity assessment and certification procedures, relative to safety, that apply to hydrogen components and systems with a



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

view to their marketing. This guide presents the specificities of hydrogen systems and the associated risks and how these issues are covered in the current regulatory and normative framework.

3. Demonstration, Deployments, and Workforce Developments Update

- [White paper "What prospects for hydrogen-powered heavy goods vehicles for freight transport?"](#). France Hydrogène Mobilité, the France Hydrogène working group dedicated to road mobility, has published its white paper on the prospects for the deployment of hydrogen-powered heavy goods vehicles for freight transport. The report identifies the segments of road freight transport for which hydrogen solutions appear to be the most relevant.
- [A hydrogen car tested as a world premiere in Val Thorens](#) (Savoie, altitude 2300m). On the ice of the Val Thorens circuit, the Hyundai Nexu was tested and proven. For six hours, the car was driven in the cold with adapted tires. "The vehicle that succeeds in demonstrating that it can run continuously for six hours in these conditions proves that, on a daily basis, we can use this hydrogen solution with complete peace of mind," says Olivier Pignon, director of the Val Thorens ice circuit.
- [Citroën launches its first E-Jumpy Hydrogen](#). The first hydrogen-powered Citroën Jumpy has just rolled off the production line. Assembled at the Stellantis plant in Sevelnord near Valenciennes (F), it has been converted at Opel's Rüsselsheim plant (D). With this solution, Citroën is further enhancing its range of electrified commercial vehicles.
- [Port ecosystems and hydrogen: a common ambition to build](#). Published by France Hydrogène, this study was carried out in collaboration with seven partner ports, to evaluate the consumption potential of the different uses of hydrogen by 2030. Due to the density of their activities, port areas are privileged places to accelerate the massive deployment of the hydrogen sector. In return, hydrogen will enable ports to meet their decarbonization challenges, diversify their economy and reinforce their attractiveness. Identified in national roadmaps for the sector such as the National Port Strategy, several river and sea ports are now committed to developing pioneering hydrogen projects.
- France Hydrogène has published its updated [panorama of hydrogen solutions](#) for the month of November. It offers an overview of the hydrogen offers available in France and in Europe
- [Alstom to supply hydrogen trains to the UK](#). Alstom is to design, manufacture (in the UK), commission and maintain a fleet of ten hydrogen trains. Final contracts for the train fleet are expected to be signed in early 2022.
- [ALSTOM and EDF join forces to optimise hydrogen train refuelling](#). Alstom (one of the main suppliers of hydrogen trains in Europe) and Hynamics, a subsidiary of EDF, have signed a partnership to "define an international refuelling standard that will limit the immobilization of hydrogen trains during refuelling". Alstom and Hynamics teams are already working together on modelling, calculation and simulation
- [Alstom increases Helion's hydrogen fuel cell production tenfold](#). A few months after the acquisition of Helion Hydrogen Power, Alstom inaugurated on December the 10th a



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

hydrogen fuel cell manufacturing unit in Aix-En-Provence, with a capacity of 30 MW per year. R&D for Helion's sixth generation of fuel cells to be launched.

- [Hydrogen transport: 98% of French gas distribution pipelines ready for conversion](#). The Ready4H2 project brings together 90 gas infrastructure operators - such as France's GRDF - who support the establishment of an integrated hydrogen market in the EU, and are working to create "a common vision for the transformation" of their business towards climate neutrality. According to the report, most of the existing pipelines (98% of the French network of 210,000km) could be converted to carry hydrogen, which the EU intends to promote. The networks studied currently supply gas to 67 million homes, businesses and industrial sites.
- [Experimentation of renewable hydrogen storage in a saline cavity at Etrez](#). The HypSTER project will be a new step towards the "flexible and large-scale" supply of low-carbon hydrogen. Launched in 2021 in Etrez, the demonstrator focuses on the underground storage of green hydrogen with a view to paving the way for the creation of a green hydrogen industry on an industrial scale. This project is now entering the construction phase of the 1MW electrolysis unit for the production of green hydrogen on site. "This production will enable the storage of renewable hydrogen to be tested, initially at a level of 2 to 3 tonnes, until the total capacity of the identified salt cavity, i.e. 44 tonnes, is used," says Storengy in a release.

4. Events and Solicitations

- 11-12 May 2022 [HyVolution 2022](#) Paris Event Center
- 28-30 June 2022 Connection Europe Days (formerly TEN-T days), Lyon

5. Investments: Government and Collaborative Hydrogen and Fuel Cell Funding

Two call for projects have been published in October 2020

1. "[demonstration and technology bricks](#)" with a budget of €350 M for the next three years
It has enabled three projects to be contracted for a total of €19 million in aid, out of a total investment of €153 M.
2. "[territorial hydrogen ecosystems](#)" with a budget of €275 M for the next three years.
23 applications were shortlisted for a net amount of €164 M and cumulative investments of €490 M. The third call is very rich, since the ADEME and State services are currently examining some 60 new projects.

6. Regulations, Codes & Standards, and Safety Update

- [Publication of a decree on the certification of bioenergy and renewable fuels of non-biological origin](#). Published on December the 31st, Decree No. 2021-1903, issued in application of an ordinance of March 2021, transposes part of the European Directive 2018/2011 on renewable energy (RED II). The decree mainly targets bioenergy chains, but part of the measures also concerns non-biological renewable liquid and gaseous fuels for the transport sector (RFNBO), including renewable hydrogen, and recycled carbon-based fuels. Producers and suppliers of RFNBO are required to demonstrate compliance with greenhouse gas emission reduction criteria (art. R 283-17 to R. 283-22 of the Energy Code), defined by RED II as a 70% reduction



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

compared to a fossil comparator, i.e. a threshold of 3.38 kgCO_{2eq}/kgH₂. Thanks to a certification system, established by the State or on the basis of national or international voluntary schemes, economic operators will have to provide information on the inputs used for their RFNBO production and thus provide their customers with a certificate of greenhouse gas emission reduction which contains all the useful information relating to the threshold of greenhouse gas emission reduction, for each batch delivered. These certificates are required in order to benefit from public aid and tax advantages associated with these fuels (such as TIRUERT). A joint order of the ministers responsible for the environment, energy and customs will define the methods for calculating reductions in greenhouse gas emissions resulting from the production, transport and use of renewable liquid and gaseous fuels of non-biological origin intended for the transport sector, and fuels based on recycled carbon.

- **Publication of a decree on the interoperability obligation of the public or refuelling infrastructure open to the public.** The decree No. 2021-1561 of December 3, 2021 concerns the equipment of fixed refuelling points open to the public that deliver hydrogen to road vehicles. It specifies the conditions for the implementation of interoperability and roaming refuelling for hydrogen.
- **Publication of a Decree on various measures relating to the creation, configuration, installation and supply of alternative fuel refuelling points as well as their operation, the terms of access to services and their use.** The decree No. 2021-1562 of December 3, 2021 defines a "refuelling point open to the public" as "a refuelling point distributing an alternative fuel operated by a public or private operator, to which users have non-discriminatory access. Non-discriminatory access non-discriminatory access does not preclude the imposition of certain conditions in terms of authorization, authentication, use and payment". The following are excluded are points installed in a private dwelling and exclusively reserved for residents, a point exclusively dedicated to fleet of vehicles, and a point installed in a maintenance or repair workshop not accessible to the public. A ministerial order will provide for approved standards and their control for fuel cells (art. D641-6 of the Energy Code). The decree sets the requirements for hydrogen refuelling points open to the public, regardless of the vehicle (road, maritime and rail).
- **Publication of the two decrees governing hydrogen refuelling stations.** Decree No. 2021-1561 of 3rd of December 2021 specifies the conditions for implementing interoperability and roaming refuelling for equipment at fixed refuelling points open to the public that deliver hydrogen to road vehicles. Decree no. 2021-1562 of 3 December 2021 defines the rules for hydrogen refuelling points open to the public (excluding stations reserved for captive fleets or installed in a maintenance workshop), regardless of the vehicle (road, sea and rail).
- **Publication of the ordinance and decrees transposing the directive on clean road vehicles.** These texts transpose into French law the obligations regarding the renewal of public vehicle fleets. They are scheduled to come into force the day after their publication and are deferred to July 1, 2022 for local authorities, their groupings and public institutions. The second decree modifies the criteria defining low-emission buses and coaches (hydrogen is included in group 1 under the most advantageous conditions). The third decree updates the criteria for defining low-emission category N2 and N3 freight vehicles (electricity, hydrogen, CNG, biofuels).



Summary Country Update April 2022: FRANCE

Transportation	Target Number	Current Status	Partnerships, Strategic Approach	Support Mechanism
Fuel Cell Vehicles ¹	5,000 by 2023 20 – 50,000 by 2028	382 (Oct 21)	National Implementation Plan based on a cluster model approach	• Subsidy for purchase (national government initiative on electrical vehicle, European projects)
Fuel Cell Bus	200 by 2023	28 (April 22)	28 buses in operation, 82 buses in deployment phase and 390 in plan	• Subsidy for purchase (European project + national and regional funds)
Fuel Cell Trucks ²	800 - 2,000 by 2028	1 (Oct 21)	1 BOM in operation	• Subsidy for purchase (national and regional funds)
Forklifts	No target	415 (April 22)	Within European and national projects	• Subsidy for purchase (European project)
H ₂ Refueling Stations	Target Number	Current Status	Partnerships, Strategic Approach	Support Mechanism
70 MPa On-Site Production	100 HRS by 2023 400 - 1,000 by 2028	As of April 2022: 6	National Implementation Plan based on a cluster model approach HRS are dual 350/700 bar	• Subsidy for installation and operation (European and national projects)
70 MPa Delivered		As of April 2022: 5	National Implementation Plan based on a cluster model approach HRS are dual 350/700 bar	• Subsidy for installation and operation (European and national projects)
35 MPa On-Site Production		As of April 2022: 14	National Implementation Plan based on a cluster model approach	• Subsidy for installation and operation (European and national projects)

¹ Includes Fuel Cell Electric Vehicles with Range Extenders

² As above



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

35 MPa Delivered		As of April 2022: 19	National Implementation Plan based on a cluster model approach	Subsidy for installation and operation (European and national projects)
20/30 MPa On-Site Production		As of April 2022: 6	HRS for bikes	
20/30 MPa Delivered		As of April 2022: 3	HRS for bikes	
Stationary	Target Number ³	Current Status	Partnerships, Strategic Approach	Support Mechanism
Small ⁴	No target	112 (April 20)	European (Ene.field 35, PACE 66) and national (ADEME & GRDF) funded projects for residential and small tertiary 1 system r-SOC in demonstration	• Subsidy for purchase (European and national projects)
Medium ⁵	No target	1	GRDF & Air Liquide	
Large ⁶	No target			
District Grid ⁷	No target			
Regional Grid ⁸	No target			
Telecom backup	No target			

³ Targets can be units installed and/or total installed capacity in the size range indicated

⁴ <5 kW (e.g., Residential Use)

⁵ 5kW – 400 kW (e.g., Distributed Residential Use)

⁶ 0.3MW – 10 MW (e.g., Industrial Use)

⁷ 1MW – 30 MW (e.g., Grid Stability, Ancillary Services)

⁸ 30MW plus (e.g., Grid Storage and Systems Management)



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

H ₂ Production	Target ⁹	Current Status	Partnerships, Strategic Approach	Support Mechanism
Fossil Fuels ¹⁰	No target		•	
Water Electrolysis ¹¹ (PEM, Alkaline, SOEC)	6.5 GW by 2030	5 MW (As of April 2022)	French national strategy	Subsidy for installation and operation (European and national projects)
By-product H ₂	No target			
Energy Storage from Renewables	Target ¹²	Current Status	Partnership, Strategic Approach	Support Mechanism
Inst. Electrolyser Capacity				
Power to Power ¹³ Capacity	No target	100 kW	Myrte platform in Corsica	Subsidy for installation and operation (European and national projects)
Power to Gas ¹⁴ Capacity	No target	1 MW	<ul style="list-style-type: none"> • Jupiter 1000 project (1 MWe of electrolysis) • GHRYD: 20% hydrogen in a local gas distribution network • MethyCentre 	Subsidy for installation and operation (European and national projects)

⁹ Target can be by quantity (Nm³, kg, t) and by percentage of total production; also, reference to efficiency capabilities can be a target

¹⁰ Hydrogen produced by reforming processes

¹¹ Please indicate if targets relate to a specific technology (PEM, Alkaline, SOEC)

¹² Can be expressed in MW of Installed Capacity to use the electricity from renewable energy generation, and Annual MWh of stored energy capacity

¹³ Operator has an obligation to return the electricity stored through the use of hydrogen back to electricity

¹⁴ Operator has the opportunity to provide the stored energy in the form of hydrogen back to the energy system through multiple channels (e.g., merchant product, enriched natural gas, synthetic methane for transportation, heating, electricity)