INTERNATIONAL PARTNERSHIP FOR
HYDROGEN AND FUEL CELLS IN THE ECONOMY

IPHE Country Update June 2020: FRANCE

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

- **Ministers Bruno Le Maire and Elisabeth Borne met the Hydrogen Council in Paris**. For its 3rd Annual Meeting, the Hydrogen Council met in Versailles on 20th of January on the sidelines of the "Choose France Summit" organized by President Macron.

  The Minister of Economy and Finance, Bruno Le Maire, and the Minister of Ecology and Inclusive Transition, Elisabeth Borne, addressed the Hydrogen Council members engaged in scaling up hydrogen solutions. "France believes in hydrogen. This technology is strategic if we want to achieve a zero-carbon economy. I therefore proposed to Emmanuel Macron that the hydrogen sector be chosen, within the framework of the "Productive Pact", among those whose development must be accelerated" said Bruno Le Maire.

- **Launch by the French Government two new Calls for Expressions of Interest on Hydrogen**. With a budget of €22M, a first AMI «Aid for the emergence of hydrogen mobility in the rail sector» addresses the regional rail transport authorities and aims to support the emergence of hydrogen mobility in the rail sector via bi-mode trains (electric/hydrogen).

  A second AMI "Large-scale projects on the design, production and use of hydrogen systems" launched in January with mid-term closures mid-April (160 proposals) and end of June, to identify the structuring projects for the hydrogen sector and to accelerate the large-scale development of innovative technological levels on industrial and infrastructure projects.

  The Ministry states that "The most effective structuring projects to develop the industrial clean hydrogen production can be supported in calls for projects launched in April 2020 or be supported at European level, for example in the framework of major projects of European Projects of Common European Interest (IPCEI)".

- **Recovery plan for the automotive sector**: On 26th of May, President Macron presented the stimulus package for the automotive sector, which he described as historic and focuses on clean cars. Thus, the bonus for electric vehicles (including those running on hydrogen) is increased to €7,000 for individuals and €5,000 for businesses. In addition, an aid of € 5,000 will be granted for the purchase of an electric vehicle as part of the conversion premium (which will be accessible to three-quarters of the French). It will be valid for the first 200,000 vehicles.

- **Recovery plan for the aeronautic sector**: **Green aircraft: €1.5 billion by the end of 2022** (8 June). In addition to its immediate support for the aerospace sector, the government's recovery plan also aims to intensify R&D on "environmental disruption": accelerate the work on the green or sustainable aircraft. For this, no less than €1.5B will be released by the end of 2022 with the objective "to develop a regional aircraft with hybrid propulsion for commissioning at the end of the decade", stresses Elisabeth

Borne, Minister of Ecological Transition. For the successor to the Airbus A320, the timetable is also tight since it is a question of developing a first demonstrator between 2026 and 2028 with an entry into operation between 2033 and 2035. With two areas of work: "energy efficiency thanks to a 30% decrease in fuel consumption and a 100% biofuel capacity" and "the switch to hydrogen as a primary energy".

2. Hydrogen and Fuel Cell R&D Update

- CEA received the award of EARTO (European Association of Research Technology Organisations) Innovation Awards 2019 in the Impact Expected category for the development of the Smart Energy Hub, a hybrid energy storage and co-generation system, enabling buildings to use their own clean and local energy supply. CEA – rSOC Solution, Energy transition on the move.

- **Artificial photosynthesis: hybridizing molecules and materials based on abundant elements for the production of H2**. As part of the “Make Our Planet Great Again” initiative, CEA, in collaboration with Néel Institute and EPFL, have taken another step towards the preparation of a sustainable photo-electrode for hydrogen production. It is based on a hybrid architecture, a semiconductor that absorbs light and is interfaced with a molecular catalyst. The system consists of only non-toxic elements found in abundant quantities in the Earth’s crust. The strategy is to use a mixed semiconductor oxide composed of iron and copper to absorb visible light and generate an electron flux from the electrode where it is deposited to its surface with an aqueous solution.

3. Demonstration, Deployments, and Workforce Developments Update

- **Symbio, a Faurecia Michelin Hydrogen Company** (Nov 2019): Equally owned by Faurecia and Michelin, the joint venture will invest €140M now, notably in a new factory in the region of Lyon. Symbio aims at becoming a world leader in hydrogen mobility by developing, producing, and marketing hydrogen fuel cell systems for light vehicles, commercial vehicles, buses and trucks, as well as for other areas of electromobility. Chaired by Fabio Ferrari, the founder of Symbio, it aims to hold 25% of the hydrogen market with a turnover of €1.5B by 2030.

- **Alstom a major player in hydrogen trains**: After 18 months of testing, the two trains, which were put into service in September 2018, travelled 180,000 km. With this pilot operation, Alstom demonstrated that it is possible to use fuel cell technology for the daily transport of passengers. This success makes Alstom a major player in the market for green and sustainable mobility solutions for rail transport». Alstom is to build hydrogen trains for Italy (a five-year agreement signed with SNAM), to deliver 41 Coradia iLint trains to the Länder of Lower Saxony and Hesse in 2022 and has tested for ten days at night, without a passenger, in the north of the Netherlands.

- **Power to Gas: hydrogen injected into the gas network by Jupiter 1000** (20 Feb) In Fos-sur-Mer (Bouches-du-Rhône), the demonstrator Jupiter 1000 injected hydrogen for the first time on the gas network on February 20. An important milestone for this French Power to Gas project.

- **Lhyfe, new French startup, plans to deploy twenty green hydrogen electrolysers in four years** (April). After a first order made in February for its future Bouin site in Vendée, the green hydrogen producer Lhyfe (15 employees) ordered 20 electrolysers from the Norwegian group NEL. Lhyfe plans to install them in the next four years on production sites in France and abroad, for local authorities and industry. They are

initially intended for hydrogen-powered buses and household garbage trucks in the West of France. In addition to the €2.8M already invested in the creation of its R&D centre, which should be launched in 2021, Lhyfe plans to invest €5.5M in research and development over the next three years. The French bank of investment Bpifrance announces in May that it will support Lhyfe up to half of this new investment. Lhyfe intends to open in 2021 the first green hydrogen plant in France, produced by power from wind turbines, near the Bouin wind farm.

- **Hyflexpower** (2 June) Engie Solutions, Siemens Gas and Power, Centrax, Arttic, the German Aerospace Centre and four European universities are launching the first "power-to-X-to-power" demonstrator project, incorporating a hydrogen-powered gas turbine. The European project Hyflexpower was launched as part of the Horizon 2020 framework programme. It is the "first industrial demonstrator in the world power-to-X-to-power equipped with an advanced hydrogen turbine," said the project partners. This demonstrator will be installed at the Smurfit Kappa PRF site in Saillat-sur-Vienne (Haute-Vienne), where Engie Solutions operates a 12 MWe cogeneration plant that produces steam for industrial use.

4. Events and Solicitations

- 18 November 2020 RENCONTRES INTERNATIONALES DES VÉHICULES ÉCOLOGIQUES (RIVE) Paris
- 24-26 November 2020 SALON DES MAIRES ET DES COLLECTIVITÉS LOCALES Paris
- 09-10 December 2020 ENERGAÏA, FORUM DES ÉNERGIES RENOUVELABLES Montpellier
- 10-11 February 2021 HYVOLUTION 2021 Paris
- 13-15 April 2021 SEMAINE DE L'INNOVATION TRANSPORT LOGISTIQUE (SITL) Villepinte
- 08-11 June 2021 SEANERGY Nantes
- 09-11 June 2021 8E ÉDITION DES JOURNÉES HYDROGÈNE DANS LES TERRITOIRES Dunkerque

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

The French Government communicated on the results of the support of calls for projects (CFP) in 2019:

- €11.5 million for the 5 winners of the CFP industry and
- €80 million for the 20 winners of the CFP mobility are mobilized

6. Regulations, Codes & Standards, and Safety Update

Development is underway of an ordinance and a decree to define the terminology of the different types of hydrogen, various measures regulating its production, transport, storage and traceability, a framework to support the production of renewable and low carbon hydrogen, and guarantees of origin for renewable and low carbon hydrogen following article 52 of the Energy-Climate law. The two regulations should be published in early November 2020.

Summary Country Update June 2020: FRANCE

Transportation	Target Number	Current Status	Partnerships, Strategic Approach	Support Mechanism
Fuel Cell Vehicles[1]	5,000 by 2023 20,000 – 50,000 by 2028	400 (Dec 2019)	National Implementation Plan based on a cluster model approach	Subsidy for purchase (national government initiative on electrical vehicle, European projects)
FC Bus	200 by 2023 800 - 2,000 by 2028	17 (April 2020)	European projects 3E Motion + Jive 2. Current projects of 450 buses by 2025	Subsidy for purchase (European project + regional funds)
Fuel Cell Trucks[2]				
Forklifts	No target	290 (April 2020)	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 May 2020: 4	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 May 2020: 3	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 May 2020: 13	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. Objective fixed by the Energy Storage Plan from the "New French Industry"

[2] As above

35 MPa Delivered		As of May 2020: 11	National Implementation Plan based on a cluster model approach	Subsidy for installation and operation (European and national projects)
20 MPa On-Site Production		As of May 2020: 5	HRS for bikes	
20 MPa Delivered		As of May 2020: 2	HRS for bikes	
Stationary	**Target Number[3]**	**Current Status**	**Partnerships, Strategic Approach**	**Support Mechanism**
Small[4]	No target	112	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]				
Regional Grid[8]				
Telecom backup				

[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)

H_2 Production	Target[9]	Current Status	Partnerships, Strategic Approach	Support Mechanism
Fossil Fuels[10]	10% of decarbonised H2 (ca. 100 000 tonnes) used in the industry by 2023 and 20-40% by 2028			
Water Electrolysis[11] (PEM, Alkaline, SOEC)				
By-product H2	No target			
Energy Storage from Renewables	**Target[12]**	**Current Status**	**Partnership, Strategic Approach**	**Support Mechanism**
Power to Power[13] Capacity	No target	100 kWe	Myrte platform in Corsica connected to the grid	
Power to Gas[14] Capacity	No target	1 MW	• 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 (Nm^3, 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)