INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

IPHE Country Update September 2023: FRANCE

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1. Hydrogen and Fuel Cell R&D Update

- **Hydrogen industry: job vacancies soar**. Between 2019 and 2022, the number of job offers for dihydrogen (H2) production rose by 77%, a phenomenon boosted mainly by government investment in the development of a low-carbon industry. By 2022, the industry was employing 5,800 people directly - almost double the number in one year, but still a long way from the 100,000 expected by 2030 - and looking for 6,800 additional professionals. This growth has not been without its problems: 85% of the professions in demand remain under "high" or "very high" pressure. This finding is the result of the DEF'HY project carried out by France Hydrogène and its partners (Pôle Emploi, the private agency Adecco, and the Carif-Oref training information resource center), and supported by the French government as part of the France 2030 plan's "Skills and Professions of the Future" call for expressions of interest.

- **France Hydrogen association has published a guide to hydrogen-powered refuse collection vehicles**. The 30-page document is designed to help local authorities in their decision-making process. There are currently 12,000 vehicles in circulation in France. Due to new regulations, such as the ZFE (Low-emissions areas), these trucks will have to evolve. Alternatives include gas and electric power, as well as fuel cells. Compared with batteries, hydrogen offers many advantages. Firstly, there's a comfortable range of 150 to 400 km (depending on the amount of fuel), and energy consumption that meets the constraints of long distances and hilly terrain. The solution is significantly more expensive than its diesel equivalent, but this must be weighed against the total cost of waste collection and treatment.

- **ADEME report on decarbonizing the ammonia sector**. The French Agency for Ecological Transition (ADEME) recently published a sectoral transition plan for the ammonia industry in France. Ammonia (NH3) is currently consumed in France to the tune of 1.7 Mt, mainly for fertilizer production, using hydrogen produced from natural gas. According to the report, new outlets for ammonia could multiply with the development of non-biological fuels (RFNBO), notably for the maritime and aeronautical sectors: "the advent of these new markets means that global ammonia consumption could increase between 1.29 and 3.8 times by 2050 compared with 2015, according to the literature". As a carbon-intensive industry, France's four ammonia production sites are responsible for 3% of direct greenhouse gas emissions. To address these emissions, ADEME is exploring

two avenues: renewable and low-carbon hydrogen from water electrolysis and carbon capture and storage (CCS).

- **A team of French CNRS researchers wins the 2023 European Inventor Award**. The Grenoble-based team, made up of Patricia de Rango, Daniel Fruchart, Albin Chaise, Michel Jehan and Nataliya Skryabina, was rewarded for developing a solution which, thanks to magnesium hydride (a recyclable material), enables hydrogen to be stored in the form of a solid disk, making it safer, more energy-efficient, and easier to store and transport.

- **The 3rd plenary session of the French Hydrogen Research Federation (FRH2).** This annual meeting of the FRH2 was held in La Réunion from May 22 to 26. With 170 participants and 90 oral presentations by young doctoral students, internationally recognized researchers and industrialists. This unique national event provided an opportunity to take stock of current research and future projects on hydrogen storage devices, all types of fuel cells, electrolyzers and associated systems. These plenary sessions confirm CNRS's position as a key player in R&D in France. The event was also intended to support the efforts of the La Réunion region in building its Hydrogen Roadmap, and testifies to the region's current dynamism in developing the sector.

2. Demonstration, Deployments, and Workforce Developments Update

- **A hydrogen-powered vineyard tractor in Champagne**. Epernay-based Exxact Robotics (a subsidiary of the Exel Industries group) has developed the world's first hydrogen-powered vineyard tractor: the Traxx concept H2. This tractor is equipped with a fuel cell and high-power batteries supplying up to 35kW. It is also equipped with two tanks containing just over 9 kg of hydrogen. This impressive capacity enables the Traxx Concept H2 to run for up to 12 hours at a time. What's more, hydrogen makes the machine lighter, quieter, more efficient and quicker to refuel.

- **Summer festivals powered by hydrogen**. From the foothills of the Auvergne volcanoes to the Bay of Saint-Brieuc, a number of eco-responsible summer festivals have decided to use hydrogen fuel cells as an alternative to diesel for their power generators.

- **Hydrogen at the Paris Air Show**. A few days before the show, the French President Macron unveiled a plan for carbon-free aircraft. He announced that the State would support the aerospace industry with €300 million a year over the period 2024-2030. This envelope will be used to fund research and innovation to decarbonize the aviation sector. The aim is to develop clean fuels, as well as new aircraft and engines. In addition, President Macron has declared that €200 million of public and private funding will be allocated to start-ups in the aviation sector, to support the development of small electric or hydrogen-powered aircraft. President Macron announced the winners of a France 2030 call for projects on low-carbon aircraft. In the hydrogen sector, there are two winners. The first is Blue Spirit Aero, which presented the full-size Dragonfly cabin at Le Bourget for the very first time. This zero-emission hydrogen aircraft will make its first test flight next year, with a view to certification in 2026. The second winner is Beyond Aero.

Its project involves the design, production and ground testing of a 2 x 300 kW fuel cell propulsion system.

- Europe's largest (i.e. a capacity of 1 tonne per day) hydrogen refueling station opened for business. Located at Porte St. Cloud on Paris, it is also the largest within a city area.

- **Air Liquide inaugurates a heavy-duty station in Fos**. The Air Liquide Group has just inaugurated a hydrogen filling station for trucks in Fos-sur-Mer, near Marseille. A 700-bar charging point with a capacity of one tonne per day, it will be used by Iveco, Air Liquide's partner in the HyAMMED project.

- **Genvia inaugurates its electrolyser pilot line**. The inauguration of the pilot production line marks a major milestone in Genvia's history in Occitanie but also for the industry in France. From 2025, Genvia plans to supply hydrogen hubs with electrolyzers, mainly for industry and mobility. The plan is to ramp up production, with the creation by 2030 of a high-temperature electrolyser megafactory in the Béziers region, with an annual capacity of 1 GW, rising to 10 GW. Genvia is also working on the production of full-scale experimental prototypes: the first demonstrator will be deployed in 2025 at ArcelorMittal's Saint-Chély-d'Apcher site.
- **HYVIA aims for parity with electric vehicles by 2025**. HYVIA Operations Manager Mehdi Ferran says "This is indeed the core of our strategy, to make our hydrogen vehicles competitive quickly. Our aim is to reach price parity with electric models by 2025. To achieve this, we'll be drawing on the full range of automotive engineering skills. We're in talks with a number of traditional suppliers to bring them on board for the development of specific hydrogen projects. I'm thinking, for example, of air compressor suppliers who offer products for petrol and diesel vehicles, and we want them to work with us on the hydrogen side. The executive adds: "The factories exist, we just need to make a few adaptations. They know how to mass-produce reliable products. This will lead to cost breakthroughs, as we move from small volumes to mass production. The cost of certain components could be halved or tripled.

- **Storengy tests renewable hydrogen storage by adapting a salt cavern**. Excavated at a depth of almost a kilometer beneath the commune of Étrez, a salt cavern managed by Storengy, with the project name of Hypster, is destined to store not natural gas, but renewable hydrogen produced on site.

3. Events and Sollicitations

- 7 December 2023 Annual Conference of France Hydrogen, Salons Hoche, Paris

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

Open call for projects:

- DECARB IND+: On June 23, Ademe launched the DECARB IND+ call for projects, aimed at "decarbonizing large-scale industrial sites" through process modification. Candidate projects must have a public support

requirement of between €30 and €200 million, and an investment amount in excess of €50 million.

- **€4 billion for low-carbon hydrogen production**. The French Minister for Energy Transition, Agnès Pannier-Runacher, has announced the signature of a decree launching a support mechanism for the production of low-carbon hydrogen. The government will therefore allocate €4 billion via calls for tender. The decree was published on September 3 in the "Journal Officiel", Decree 2023-854 and sets the regulatory provisions specifying the procedure for selecting projects to benefit from the support mechanism for the production of renewable and low-carbon hydrogen.