

Alcimed

Hydrogen, vector of energy transition

Paris, May 3rd, 2018 – Hydrogen, applied for the first time in the field of aerospace, particularly in the Apollo Program, is now invading our daily lives. The many initiatives around this promising energy vector and the creation of the International Hydrogen Council in 2017 (around the French groups Air Liquide, Alstom, Engie and Total) are clear signs that the hydrogen revolution is in motion. Its high energy efficiency and storage capacities position hydrogen as a substitute for fossil fuels and as an integrator of renewable energies.

By injecting this vector into the current energy landscape, hydrogen is initiating an enormous transition towards new energy. Alcimed, a consulting company specialized in innovation and the development of new markets, is looking into the ambitions and challenges related to this hydrogen revolution.

Promising technical developments

Recent developments have enabled to overcome the technological limitations linked to hydrogen fuel cells. *"The durability and reliability of the new hydrogen fuel cells now allow for the safe diversification of applications, even in the aerospace industry,"* says Pierre Gadrat, Business Unit Director at Alcimed. Easy Jet has been conducting flight tests with hybrid aircrafts equipped with hydrogen fuel cells since 2016, and the Dassault group is developing new innovative technologies for future generations of hydrogen aircrafts. In addition, the decrease in the quantity of platinum used as a catalyst reduced manufacturing costs by up to 80%. These technological advances are mainly due to the new developments towards the storage of dihydrogen in compressed form, such as in the new Plastic Omnium tanks that can safely hold up to 700 bar (prototype presented in 2016).

The multiple applications of hydrogen

Following ambitious development programs, such as the "Programme Horizon Hydrogène Energie" (H2E), coordinated by the Air Liquide Group between 2008 and 2015, many proofs of concept have been completed in various sectors.

The miniaturization of hydrogen fuel cells opens doors to many mobile applications. In 2016, the British research team Intelligent Energy designed mini batteries that fit perfectly on the back of an iPhone 6. A clean supply with an autonomy of one week and whose recharge, using a compressed gas cartridge, is no more complicated than that of a lighter. In this way, hydrogen has the potential to revolutionize our habits!

Hydrogen-powered installations can also be used to supply electricity to isolated sites or to produce heat for residential areas. The Japanese government is leading the example by implementing a fuel cell generator boiler program, which now equips more than 200,000 homes. In Europe, the German manufacturer Viessmann is offering two models of hydrogen boilers since 2017, betting on a strong market expansion within 3 years. Applications for industry are also being developed to ensure a more reliable energy supply. Last year, for example, the Billecart-Salmon champagne house equipped itself with a hydrogen fuel cell to avoid micro power cuts on its installations.

"Nevertheless, it is in transportation that hydrogen has been causing a significant revolution in recent years" explains Vincent Pessey, Project Manager at Alcimed. Many vehicle models are starting to use hydrogen: on land, on water and in the air! In Europe, initiatives are rising, very often led by local authorities around captive fleets. This year, for example, the city of Nantes has installed a hydrogen-powered river shuttle. In Paris, about fifty taxis have adopted hydrogen fuel cells in partnership with the Air Liquide group (Hype - STEP). In Germany, the operation of the first hydrogen train line started in December 2017, with the support of Alstom. Safran has also developed a hydrogen fuel cell to supply power to aircraft ancillary systems.

These examples among many others - more than 50 projects identified in France in 2018 by the French Association for Hydrogen and Fuel Cells (Afhyac) - reflect the enthusiasm for this new energy vector.

The Hydrogen Revolution: two challenges to be met

Decarbonize hydrogen production

However, hydrogen is not a primary energy source unlike fossil fuels. It is therefore more or less "green" depending on its manufacturing technique. 95% of the hydrogen obtained today comes from fossil fuels. Water electrolysis and biomass gasification are other production techniques that produce hydrogen without any CO₂ emissions. In addition, it is possible to combine a hydrogen production unit with intermittent electricity sources (wind, solar, etc.) in order to convert energy surpluses directly. This "Power to gas" strategy would make it possible to integrate renewable energies and contribute to clean mobility by reinjecting the hydrogen produced into existing gas networks.

The profitability of "Power to gas" is on a good track. Strong research activities tend to reduce the cost of installations, in particular for electrolyzers. Moreover, if the evolution of the energy mix makes it possible to achieve a cost of electricity from renewable sources that is competitive with the price of reformatting gas, "100% green" hydrogen could be even used in industrial processes.

Will the French model allow the establishment of a global distribution network?

Beyond the problems of storage and acceptability, the implementation of a hydrogen distribution network bears a significant cost. Currently, the Air Liquide supply station for the automotive industry costs more than one million euros. The establishment of a reliable and secure distribution network to meet global demand is at the heart of the concerns. In Germany, the H₂ Mobility program aims to create a unique network of 400 hydrogen distribution stations for the automotive industry by 2023. On the contrary, in France, various initiatives are rising around regional hubs, such as the HyPort project, which aims to develop a real hydrogen ecosystem at the airports of Toulouse-Blagnac and Tarbes-Lourdes-Pyrénées. According to Pierre Gadrat, *"the French development model seems better able to support the growth of hydrogen and its various applications by installing a multi-purpose distribution network"*.

Moreover, in order not to slow down industrial developments, expansion strategies that take into account local political and regulatory constraints must be defined in order to ensure genuine synergy between the stakeholders.

About Alcimed - www.alcimed.com

Founded in 1993, Alcimed is an Innovation and New Business Consulting firm specialized in sectors driven by innovation: life sciences (food, biotech, healthcare), energy, environment, aeronautics, chemicals, cosmetics, materials, building, transportation, space and defense. Our purpose is to help both private and public decision-makers exploring and developing uncharted territories, dealing with new technologies, new offers, new geographies, possible futures, and new ways to innovate. Alcimed's clients are: industrial leaders, start-ups, SMEs, major companies, private equity players and public institutions. Alcimed's team is made up of 200 highly-skilled, multicultural, passionate individuals with a double culture in science/technology and business. The company, headquartered in Paris, accounts 8 offices in 6 countries: Belgium, France, Germany, Singapore, Switzerland and USA. Alcimed is a member of CroissancePlus and the ACI (Association des Conseils en Innovation).

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