

# Hydrogen and Fuel Cells in France



## THE TIME IS NOW!

**A fantastic vector for energy transition, hydrogen enables the convergence of electricity, gas and fuel energy uses:**

- It provides a link between increasing low-carbon production and zero-emission energy solutions**
- It can store surplus of solar and wind electricity and can be converted into electricity and heat for use in industry and transport**
- It allows highly flexible energy consumption while largely using existing infrastructures**

Hydrogen provides synergies by linking electricity and gas networks. It helps to optimise the operation of the energy system as a whole, to integrate more renewable energies into production and consumption and enable a CO<sub>2</sub> and pollutant emission-free economy.

Ecological and efficient, hydrogen is a driver for regional development, as it is produced locally. As such, it contributes to our energy independence and improves France's balance of trade. Its new uses offer significant prospects in the fields of energy, transport and sustainable cities, sectors in which France already has outstanding companies and industries.

France has all the required competencies: cutting-edge research centres, leading groups in the field of energy, industrial gas and sustainable mobility, environmental services working in hydrogen solutions, SMEs and start-ups which have made major innovations, active competitiveness clusters and regional authorities committed to hydrogen mobility and energy.

**France is one of Europe's most committed countries to developing hydrogen energy.**



Association française  
pour l'hydrogène et  
les piles à combustible

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Europe

# HYDROGEN

a vector of renewable energy for... and produced by the different regions

Hydrogen increases energy security in regions by enabling them to use all their renewable resources for low-carbon, pollutant-free applications. In France, several regions are working with manufacturers on innovative hydrogen power projects: Normandy is supporting the deployment of 15 H2 stations between 2016 and 2018 as part of the EAsHyMob project; Bourgogne Franche-Comté is involved in developing industrial, mobility and stationary H2 applications; Europe's largest hydrogen vehicle fleet is in the Auvergne-Rhône-Alpes region; the Hauts de France region is focusing on the hydrogen economy to drive its 3<sup>rd</sup> industrial revolution while the Occitanie region is setting up H2 ecosystems on urban and rural airport sites.

The Territoires Hydrogène call for tenders launched by the French government in 2016 provided a boost to developing the hydrogen industry in the regions: of the 60 projects submitted (on nearly 100 sites), 39 were approved on 79 sites throughout France.

HYDROGEN SOLUTIONS DEPLOYED IN FRANCE FOR DIFFERENT APPLICATIONS

## MOBILITY



Since 2015 the simultaneous deployment of hydrogen vehicles and infrastructures has been underway based on a plan published in 2014 by the Hydrogen Mobility France consortium.

France chose a cluster strategy enabling it to enter the market at the best cost and promote the emergence of local hydrogen ecosystems.



Hydrogen Mobility France is part of the Hydrogen Mobility Europe (H2ME) project.

Hydrogen mobility is being developed in France to cater for all uses:

- Full power or range extender vehicles: Hype taxis in Paris, HyWay utility vehicles in the Auvergne-Rhône-Alpes region,
- Bikes for tourists in St Lo and Cherbourg, NavibusH2 boat in Nantes, fork-lift trucks in warehouses,
- Trikes and quads at La Poste, etc.

## ENERGY



With the increase in renewable energies, surplus electricity could exceed 50 TWh by 2050.

Power-to-gas hydrogen production through electrolysis of water can convert this surplus electricity and manage production variations in a highly flexible way.

It can also help to balance the electricity system and make full use of installed wind and solar capacity as well as existing gas infrastructures.

### THERE ARE TWO DEMONSTRATION PROJECTS IN FRANCE

**GRHYD: the first Power-to-Gas project in Dunkirk**

The hydrogen produced from wind-generated electricity is mixed with natural gas and used to fuel a fleet of 50 buses with Hythane (80% natural gas and 20% hydrogen) as well as a neighbourhood of 200 homes (by injecting hydrogen into the natural gas network).

**JUPITER 1000 in Fos-sur-Mer: 1<sup>st</sup> demonstrator connected to the French gas supply network**

This 1 MWe pilot project will also use wind-generated electricity to produce hydrogen using alkaline water and PEM electrolyzers each with 0.5 MW of power. The hydrogen blended with CO2 will form a synthetic methane. Hydrogen and synthetic methane will then be injected into the gas distribution network. Implementation is scheduled for 2018.

## STATIONARY



From a few hundred watts for individual homes to several megawatts for shopping centres or office blocks, there are fuel cells to suit all requirements.

These cells are supplied by the natural gas distribution network. As part of the European Ene.field project, different types of fuel cell were installed in individual homes and small businesses in Alsace. Similarly, as part of the Epilog project, three natural gas fuel cells were installed in a home, a nursery

and a small apartment building in Forbach in Moselle. These cells reliably supply heat and electricity to the occupants, with a 40% energy saving compared with a separate condensing boiler system.

Hydrogen also offers a choice of solutions for securing the supply to remote sites and equipment, critical applications and mobile equipment.

There are an increasing number of demonstration projects in France, including in Cirque de Mafate on Réunion Island and Refuge du Col du Palet in Vanoise.

ALL HYDROGEN & FUEL CELL PROJECTS IN FRANCE ON AFHYPAC WEBSITE: [www.afhypac.org](http://www.afhypac.org)



OÙ SE SITUENT LES PRINCIPAUX PROJETS HYDROGÈNE FRANÇAIS ?

The French Association for Hydrogen and Fuel Cells (AFHYPC) is a non-profit organization (French Law of 1901) in charge of promoting the hydrogen and fuel cells technologies and coordinates actions of the major H2 stakeholders in France.

#### AFHYPC'S MISSIONS:

**Accelerate hydrogen solutions for clean mobility and integration of renewable energies in energy systems by:**

**Communication & Information:** gather and disseminate scientific, technical and regulation information

**Lobbying:** play an active role in contacting public authorities and policy makers to promote national hydrogen program

**Expertise:** publish studies on important issues for deployment of hydrogen solutions and hydrogen market in France (e.g. Economic models for H2 applications).

**AFHYPC is the key partner of Ministries and policy makers (Ministère de l'Écologie, de l'Énergie et du Développement Durable, Ministère de l'Économie, Ministère de la Recherche, ADEME, ...) in various fields:**

| **Policies, Regulation codes & standards to enable early markets to grow**

| **Information & training**

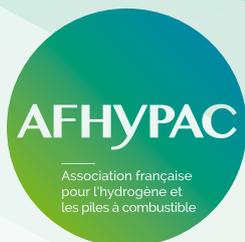
| **Prospective studies for gaining increased support from policy-makers:**

- Hydrogen & fuel cells for clean mobility
- Lean-CO2 & renewable Hydrogen production in smart energy grid.

AFHYPC's members are industrial companies (large or small), public or private organisations, research and technical centres and specialists that are willing to promote hydrogen as a clean and sustainable energy carrier:

AIR LIQUIDE, AREVA Stockage d'énergie, AXA, Compagnie Nationale du Rhône, EDF-EIFER, EFI Automotive, ENGIE, GRTgaz, MICHELIN, Plastic Omnium Auto Inergy, Dassault Aviation, TOYOTA, Carrefour, SNCF, CEA, CNRS, INERIS, Fédération FCLAB, Institut Carnot Mines, CNRS GDR HysPAC, LEMTA, 2BEGAS H2, Actys-BEE, AD-VENTA, ALCRYS, ATAWAY, AREVA H2Gen, AvenHyr Conseil, Bulane, Enercat, Ergosup, GreenGT Technologies, HASKEL France, HERA France / ALBHYON, HINICIO, HP Systems, Hydrogène de France, HySiLabs, ITM Power, MaHyTec, McPhy, NEXEYA, PaxiTech, Powidian, Pragma Industries, PV Puech Long, Raigi, Seiya Consulting, SERTRONIC, Somax Energy, STEP, SWAGELOK, Sylfen, Symbio, Tronico-Alcen, VDN, WH2, AprISTHY, AVERE-France, Chambre de Commerce et d'Industrie du Var, Communauté d'Agglomération du Grand Dole, Conseil Départemental de la Manche, Conseil National des Professions de l'Automobile, Conseil Régional de Normandie, Grenoble Alpes Métropole, Métropole Rouen Normandie, Nantes Métropole, Mission Hydrogène, PHYRENEES, Pôle d'Excellence Énergie 2020, Pôle Véhicule du Futur, SIPPAREC, SyDEV, Tenerrdis, Wind for Future.

<http://www.afhypac.org/association/membres/>



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[www.afhypac.org](http://www.afhypac.org)

28, rue Saint-Dominique  
75007 Paris, France

[info@afhypac.org](mailto:info@afhypac.org)

Follow us on Twitter: @afhypac