

The GRHYD project

Grid Management by Hydrogen Injection for Reducing Carbonaceous Energies

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Background and Overview of GRHYD

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Investment for the Future: The GRHYD 'Power-to-Gas-to Grid' project



- Selected mid-2011 by the French Government, as part of the 'Investment for the Future' pilot and technology platform for renewable and low carbon energy: hydrogen and fuel cells.
- France's first ever 'Power-to-Gas-to-Grid' project in France and a significant step towards the development of hydrogen at urban level.
- The GRHYD project also addresses the theme of "Hydrogen for a Sustainable City" as this energy is Green.



An Experts Partnership to build a new supply chain based on Hydrogen-enriched natural gas



- Dunkirk municipality
- The area's public bus company, DK'BUS Marine.
- Leading energy company ENGIE plus 3 subsidiaries:
- ENGIE Ineo (energy management for the H2 production & storage station,
- with **GRDF** (GN-H2 mix injection and distribution in the gas grid),

– and **GNVERT** (CNG) for the Hythane®
 refueling station for buses.

- OEMs: AREVA H2Gen and McPhy Energy, for H2 production and storage
- **R&D** and technical centers, CEA, INERIS, CETIAT



GRHYD = Two pilots based on Hydrogen to assess the relevance of underlying Power to Gas supply chain

GRHYD Objective : Produce H2 from renewable electricity, supply it to customers as an NG-H2 mixture by means of the gas distribution grid, and consume it locally

Residential use, heating, cooking, hot water, CHP, and mobility (fuel for buses)

A NEW TYPE OF GAS FOR GRID



A new kind of gas for homes A new 200-home estate will be supplied with NG-H2 blends. The H2 content may fluctuate but will never exceed 20% vol.

SUSTAINABLE MOBILITY



A new fuel for urban buses By piloting Hythane® fuel on a commercial level. The NGV station and dozens of urban buses will be adapted to Hythane® (20% vol. H2)

Environmental and economic matters addressed via the pilots

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Power to Gas has major environmental benefits

- Unlocks markets for renewable and low carbon energy sources, through their conversion into hydrogen gas.
- It opens up several options, including H2 injection into the natural gas grid and utilization of the H2/NG blend as a vehicle fuel (Hythane®, 'H2 enriched NG'):
 - Higher engine efficiency (+7% vs CNG)
 - Lower emissions of local pollutants (-10% vs CNG)
 - Lower consumption of primary energy (fossil energy replaced by renewable H2 energy).



GRHYD Project to explore the conditions for expanding the Hythane® fuel market



R&D Pilot : « new gas for residential uses » Hythane® to be supplied to 200 houses

Electricity supply + H2 production & storage	NG supply + Hythane® injection New distribution grid (low pressure) Gas appliances (boilers, radiators, cookers etc.)
Objectives	Progress
Technical feasibility study	 Design optimization of the H2 chain vs energy needs (heating, hot water, cooking) and availability of 'green' electricity
Safety (regulations)	 French Ministry gave in June 2016 its approval for injecting H2 in gas grid, for GRHYD experimentation
Performance assessment of 'green' H2 production & storage	 Technology innovation for electrolysis (PEM) and H2 storage (at low pressure on metallic hydrides)
Social acceptance	 No objection for this new 'gas' at home, but clear and complete information needed
Assessment of economic and environmental results.	 Support mechanism to valorize the renewable value of this green gas, to be designed (guarantee of origin,)

H2 Injection into the distribution gas grid will be effective in the first month of 2018

R&D Pilot : « new gas for residential uses » Progress on H2 production & storage station

AREVA H2Gen electrolyze

10 Nm³ H2 /h



McPhy solid hydrures storage

4 - 5 kg H2



Industrial Pilot "Hythane® fuel for bus fleet" Deployment of a new vehicle fuel on a commercial scale

Electricity supply + H2 production & storage	CNG supply + Hythane® injection Inner pipe network (automatics, monitoring) NGV buses (Hythane® adaptation)	
Objectives	Progress	
Technical and economic analysis of Hythane®	 Design optimization of the H2 station vs fuel needs and 'green' electricity 	
Safety (regulations)	Ongoing risk assessment & management for permitting issue	
Deployment of Hythane®	 Bus, engine and depot adaptation Regulation for vehicle "homologation" to be adapted (IVECO) Hythane® fuel station start planned for 2018 	
Social acceptance	 Introduction of the new fuel to passengers: no objection noticed trough first sociological studies 	
Development of a sustainable economic model	 Early Life Cycle Analysis (LCA) Ongoing negotiation between Hythane® supplier (ENGIE GNVERT) and Dunkirk municipality for a 15 years contract 	





Thank you !

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