

Hydrogen mobility 2020

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City • Date

Name & function • Department

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World leader in gases for industry, health and the environment



- Group revenue: 18.135 M€
- present in 80 countries
- Headquarter: France, Paris
- Stakeholders
 - 67.000 employees
 - 410.000 shareholders
 - 3.000.000+ customers
- Created in 1902
 - 1906 first activities in Belgium
 - 1913 in Netherlands
- 8 research & development centers, > 15 000 patents

Widening of sector and geographic interest at CEO level



H₂ COUNCIL
is enlarging from
Europe to Japan
& Korea, US, Middle
East & China

13, then 18 and now
39 members
at council level by Q1
2018, in just one year



Hydrogen mobility markets: Ready to scale TODAY

Ferries
1 T/day



Cruise ships
10 T/day



**Material
handling
vehicles**
100 kg/day
per site



Trucks
100 kg/day
per truck



Buses
20 kg/day
per bus



Trains
150 kg/day
per train



Individual cars
100-200 kg/day
per station



Drones

Airplanes
Applications



**Bicycles
& scooters**



Air Liquide already started to invest *(decisions to date)*



Mobility for Professionals
US+EUROPE
9 HRS



Mobility for Consumers
US North-East
12 HRS
+ Supply chain



Mobility for Consumers
California
4 HRS



Mobility for Consumers
Japan
6 HRS



Mobility for Consumers
Dubai
1 HRS



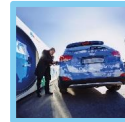
Mobility for Consumers
Korea
1 HRS



Power to Gas
Denmark
5 HRS
+ 1 Electrolyzer



Mobility for Consumers
Germany
12 HRS



Mobility for Consumers
Paris, Brussels and Rotterdam
5 HRS



14 bn m³/yr
1,850 km H₂ pipelines
46 large H₂/CO plants
40 electrolyzers in operation
2 bn € sales

100 Hydrogen recharging stations (HRS) installed by Air Liquide in the world in which 40 directly invested and operated by Air Liquide

Mobility for Consumers Germany



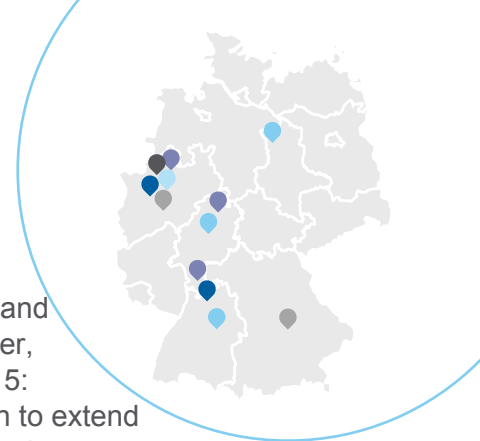
Ingolstadt



Bad Rappenau



Mulheim

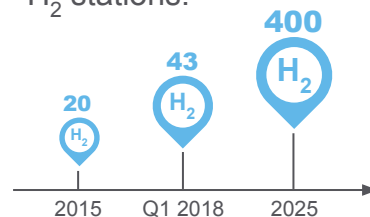


- Creation of H₂ MOBILITY Deutschland Joint Venture by Air Liquide, Daimler, Linde, OMV, Shell and Total in 2015: agreement on a specific action plan to extend the existing network of hydrogen stations in Germany up to 400.

- > 350 M€ investment
- > Max. 90 km distance between each station on motorways
- > 10 Hydrogen Stations in each metropolitan area

- Overall deployment figures

H₂ stations:



Mobility for Consumers France



Alma HRS
(Paris center)



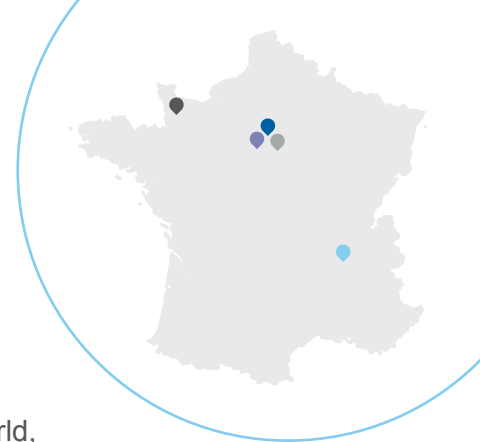
Only airport



Les-Loges-en-Josas
(near Versailles)



Taxi Fleet Project
Paris

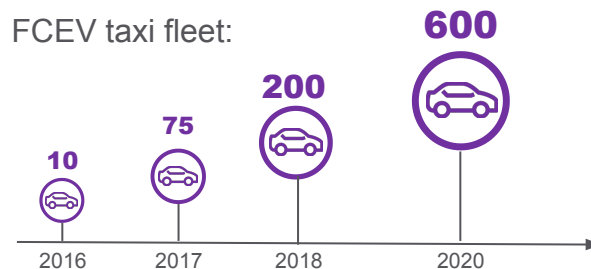


Pioneering innovative H₂ mobility project

- > 1st hydrogen taxi fleet in the world, in partnership with STEP
- > Launch during COP 21 in 2015
- > Starting with 5 taxis, then 75 to date and targeting 200 at the end of 2018
- > 3 HRS to support the growth
- > 2 other HRS in France: in Grenoble and Saint-Lô

Overall deployment figures

FCEV taxi fleet:

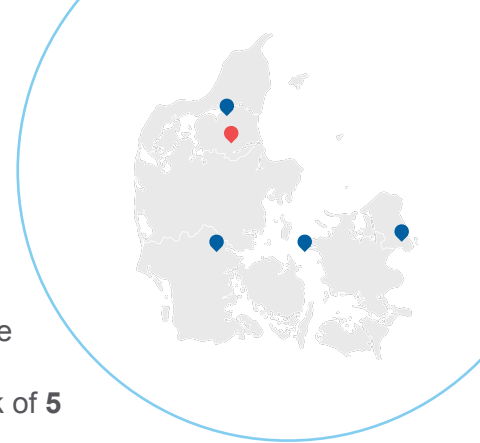


Power to Gas Denmark



40%

renewable energy
from wind



Air Liquide masters the whole value chain from production, to storage and distribution through its network of 5 HRS.

HyBalance

Largest European industrial power-to-H₂ demonstrator, project lead by Air Liquide

- > Started in January 2018
- > 1.25 MW PEM Electrolyser
- > Demonstrate the complete value chain from hydrogen renewable energy production to end users.
- > Hydrogen delivered to local industrial customer
- > Decarbonated hydrogen used for clean mobility through the network of 5 H₂ stations operated by Air Liquide

HYDROGEN: 40 YEARS EXPERTISE IN DIVERSE APPLICATIONS



Ariane 5
28t/launch



Glass
80t to 500m³/h



H₂ ultra pure
50 TO 500 m³/h



Fuell cell vehicle
1kg for 100 km



Chemicals
Ex: 0,067t/ton Anilin
Petroleum refining
(desulfuration & hydrocracking)
10-100 km³/h



Heat Treatment
10m³/h (batch)
1000m³/h (continous)

WIDE ACCESS TO AIR LIQUIDE DEDICATED NETWORK



Pipeline network of more than 2.225 km in northern Europe (France, Belgium, Netherlands)




HYDROGEN & ENERGY: HOW DOES IT WORK

How is hydrogen produced ?

- Methane reforming (with heat)
- Water electrolysis (with electricity)
- Byproduct from chemical process
- Wide variety of energy sources, including renewables and biogas

Coupled to a hydrogen fuel cell: a power generator

-  ty production, only water as by-product
→ At least 50% H₂ production for energy applications through carbon-free processes by 2020



FILLING PLANT LILLO



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GREEN ORIGIN HYDROGEN



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Registered office: Diamant Building • Boulevard A. Reyerslaan 80 • 1030 Brussels • Belgium

YOUR REPUTATION IS MINE.

Validation of claim methodology “Green Origin¹”

On behalf of AIR LIQUIDE Vincotte performed a validation of the methodology used to establish a type II environmental claim of a net direct zero carbon footprint for the energy consumption from production to delivery (production, purification, compression, filling, transport and delivery) of H₂ labeled “Module Green Origin”.

Validation procedure

The validation was performed by Vincotte in accordance with the methodology and procedures set out in the Claim Protocol Validation Report² and the Verification Protocol Report³. The Claim Protocol and the Verification Protocol were developed according to the ISO 14020:2000 “Environmental labels and declarations – General principles” and ISO 14021:2001 “Environmental labels and declarations – Self-declared environmental claims (Type II environmental labelling)”.

Declaration of independence

The validation was carried out by Vincotte as an independent third party.

H2 refueling station Zaventem - Belgium



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H2 refueling station Rhoon - Netherlands



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BUS PROJECTS WITH OUR PARTNERS



De Lijn - Pitpoint

- 5 H₂ buses
- January 2017



RET

- 2 H₂ buses
- September 2017



CONNEXION

- 4 H₂ buses
- September 2018



TWINNING ENERGY - Supply of Hydrogen



COGEN on Hydrogen with Van Wingen



The Green Wave in Power Solutions



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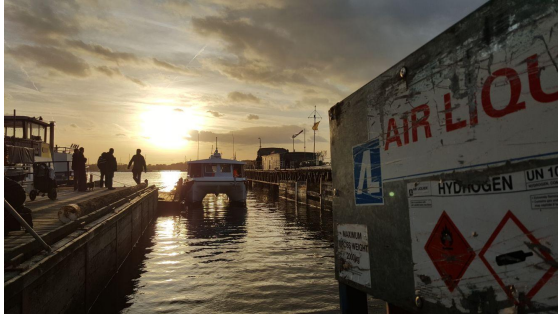
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CMB - Hydroville



CMB Technologies



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H2 station to refuel the Hydroville - [link](#)



PRIORITY BENELUX - BE READY FOR THE JIVE 2 CALL



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GIVE LOCAL SUPPORT TO H2 PROJECTS BENELUX

