McPhy Hydrogen Refueling Station - HRS McFilling 40-350 FaHyence Project

Fuel Cells and Hydrogen Joint Undertaking
Giornata Nazionale di Lancio del Bando 2018 in Horizon 2020

Rome, 26 February 2018
Agenda

McPhy: company presentation and product range

HRS Product Range

FaHyence Project

McFilling 40-350 / McLyzer 20-30
Company Presentation and Product Range
McPhy History: “Born from innovation, driven by ambition”

2008
- Creation
- Fundraising €1.6 M
- Beginning of business development

2010
- Fundraising €13.6 M

2012
- Acquisition ENERTRAG Hytec
- McPhy listed on stock exchange €32 M

2014
- Piel acquisition

2016
- First PtG project: Jupiter 1000

2017
- SimpleFuel unveiled
- Coupling ELY + Station

8 years of R&D, in partnership with CNRS and CEA, combining academic approach & industrial vision

Piel and HYTEC products: a long industrial history and expertise

SOLID-STATE STORAGE SOLUTIONS

ALKALINE ELECTROLYZERS

PEM ELY

HYDROGEN REFUELING STATIONS

Laboratory 1 kg H₂

1st storage sold (5 kg H₂)

Big tanks of solid-state storage (150 kg H₂)

Alkaline electrolyzers 1.0

Alkaline ELY 2.0 + Coupling with storage

Alkaline electrolyzers 100 Nm³/h

Hydrogen Refueling Stations
Empowering energy transition via the deployment of hydrogen applications

Hydrogen can be turned into clean fuel to charge the hydrogen vehicles, injected into the gas networks, used as a raw material for the industry, or as an energy storage solution to give the flexibility requested for the smart grids monitoring.

<table>
<thead>
<tr>
<th>HYDROGEN MOBILITY</th>
<th>INDUSTRIAL H₂</th>
<th>H₂ IN THE TERRITORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>To fuel all types of mobility: captive fleets (utility vehicles, lift trucks), public transportation (buses), urban cars (privately owned vehicles)</td>
<td>To supply the industrial sites with low carbon hydrogen, reconciling the issues of productivity and social responsibility</td>
<td>To make the energy transition a success, thanks to a local production approach and a wide range of uses anchored in the territories’ reality</td>
</tr>
<tr>
<td>Zero-emission: no noise, no particles, no CO₂</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>STORAGE &amp; POWER TO POWER</th>
<th>POWER TO GAS</th>
<th>RESEARCH &amp; INNOVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity stored in the form of hydrogen for isolated sites (island environment, ...) and back-up solution for energy autonomy (buildings, relay antenna, data centers, ...)</td>
<td>To valorize and store large amounts of renewable energy in the form of hydrogen, then integrated into the gas network or distributed as clean fuel</td>
<td>Alongside the R&amp;D platforms: to contribute to both the deployment of innovative hydrogen solutions, and the development of promising business models</td>
</tr>
</tbody>
</table>
A complete range of hydrogen equipment to design turnkey projects

**Hydrogen production equipment**

*Piel and McLyzer Electrolyzers*
- From 0.4 to 400 Nm³/h and beyond
- Pressure range of 1 to 30 bar

**Hydrogen storage solutions**

*McStore*

**Hydrogen refueling stations**

*McFilling and SimpleFuel™*
- From 5 to 200 kg of hydrogen per day
- Distributes 350 and/or 700 bar
“Fit for purpose” products to support Mobility Projects

Which Product and HRS?
Solutions best suited to your reality and business

• Whatever your activity, we design hydrogen solutions best suited to your reality and business.
• Our vision is pragmatic: it’s all about using our hydrogen expertise to enhance your productivity, energy efficiency and economic performance.
• A deep analysis of your needs is followed by the design of a hydrogen solution aligned with your activity and specificities, easily integrated into your organization.
• In addition to our three ranges of hydrogen equipment (production, storage, valorization), we implement a “system approach” and a strong service offer as well, aiming to offer you a tailored-to-your-needs solution.
McFilling: a plug and play technology
Simplicity, efficiency, modularity

• A modular solution, sized according to the real needs of the market (type and number of vehicles)
• Containerization
• Flexible placement (deported) of the refueling dispenser on the Client’s site
• Dual pressure
• H₂ source: On-site electrolysis or tube trailer
• Additional high pressure storage
• Pre-cooling / Cooling
• IR Communication
• Remote monitoring/ Supervision
• Customization
## McFilling & SimpleFuel | HRS Product range

<table>
<thead>
<tr>
<th>Type</th>
<th>Type of vehicles</th>
<th>Pressure</th>
<th>(H_2) kg / day</th>
<th>(H_2) Source</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>SimpleFuel</td>
<td>Logistic – Utility vehicles</td>
<td>350 bar</td>
<td>5 - 10 kg</td>
<td>ELY</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>700 bar</td>
<td>5 – 10 kg</td>
<td>ELY</td>
<td>1st installation in the US, more than 300 refueling</td>
</tr>
<tr>
<td>McFilling</td>
<td>Utility vehicles – Bus – Passenger cars</td>
<td>350 bar</td>
<td>20 - 40 kg</td>
<td>ELY or tube trailer</td>
<td>1st installation in 2015</td>
</tr>
<tr>
<td></td>
<td></td>
<td>350 bar</td>
<td>80 – 200 kg</td>
<td>ELY or tube trailer</td>
<td>Delivery Q4 2017</td>
</tr>
<tr>
<td></td>
<td>+ Dual Pressure</td>
<td>80 – 200 kg</td>
<td>ELY or tube trailer</td>
<td>Delivery Q4 2017</td>
<td></td>
</tr>
<tr>
<td></td>
<td>700 bar</td>
<td>200 kg</td>
<td>ELY or tube trailer</td>
<td>Delivery Q1 2018</td>
<td></td>
</tr>
</tbody>
</table>
Our References - 8 McFilling out of 16 HRS in France

• Paris, for the City of Paris
  Partnership with Idex
  Municipal utility vehicles
  Delivery and commissioning: December 2015

• Rouen, for City of Rouen
  In partnership with GNVert
  Fleet of utility vehicles
  Delivery: May 2017

• Nantes, for SEMITAN
  Delivery: July 2016

• La Motte Fanjas (McPhy)
  • Sarreguemines, for the intercommunity authority
    FaHyence project
    11 utility vehicles
    Delivery: April 2017

  • Valence, starter kit for the intercommunity authority
    Fleet of utility vehicles
    Delivery: Q1 2016

  • Lyon, for GNVert (Engie)
    Phase 1 of the Hyway program
    Fleet of utility vehicles
    Delivery: January 2016
    Phase 2 on-site electrolysis to be integrated up to 80 kg/day

  • Grenoble SYMBIO
    Maintenance

9 stations = 210 kg H₂
= 21 000 km
Zero-emission per day
The FaHyence Project – The Partners & Role

CASC - Communauté d’agglomération Sarreguemines Confluences - owner and operator of the HRS
- Commits to energy transition strategy focusing on low carbon mobility

EDF - through subsidiary Regional Grand Est
- Provided technical expertise together with Eifer
- Supplies station with green energy guaranteed by certificate of origin

Eifer - European Institute for Energy Research
- Provided technical expertise

McPhy - designed, manufactured and delivered first HRS 40 kg/day (McFilling 40-350)
- HRS integrated with innovative high energy efficiency electrolyzer for on-site H2 production - McLyzer 20-30

Symbiofuelcell
- Delivered Range Extenders (hydrogen-electric) Renault Kangoo equipped with 22kWh battery and a 5 kW fuel cell
The FaHyence Project - A Multi Energy Service Station

- A multi energy service station - electrical charging and HRS
- 1st Hydrogen Refueling Station (HRS) in France producing hydrogen on-site and on-demand from renewable energies
- Fundings received from European Union under Horizon 2020 program through FCH-JU - subsidy agreement n. 671438
- Refuels Range Extender Kangoo and adapted to different commercial H2 vehicle models
- Contributes to cross-border hydrogen mobility with Germany and Benelux
HRS Solution: McFilling General Concept – McFilling 40-350

McFilling 40-350
40 kg / day – 350 bar
T 20

SAE J2601 T20 compliant

Flexible H2 Supply with Electrolyzer or Tube Trailer

HRS 350 bar able to refill both Light Duty Vehicles and Passenger Cars

Electrolyzer
On-site H₂ production

Buffer
Intermediate storage

Gas plate and Compression unit

Connector
H₂ distribution
McLyzer20-30 - dynamic response, low energy consumption, compact

- Nominal Load: 0% to 100% in < 30 sec.
- Off Peak: 100% to 0% in < 5 sec.
- McLyzer solution adapted to Solar and Wind load variation
- Contribution to frequency stabilization

McLyzer 20-30
Containerized
Easy to Maintain

Energy Efficiency 4.9
Kwh/Nm3

Purification Unit
20 Nm3/h
SAEJ 2719
ELECTROLYSIS SOLUTIONS FOR MOBILITY | Focus on international references

H₂ refueling station of Woodside (California)
• Call for tenders by the California Energy Commission in May 2014
• Hydrogen production equipment
• Refueling 25 cars / day
• Commissioned in 2016

Total multi-energy station of Berlin-Schoenefeld (Germany)
Berlin Airport HRS : McPhy Solutions

McLyser 100 : 250 kg/jour à 42 Bar

McStore 100 : 100 kg/day Metal Hydride (3,3 MWh)

In partnership with LINDE
HRS 200 : 200 kg/day
350 / 700 bar
Thank you!

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