UNLIMITED HYDROGEN

DESIGNER AND MANUFACTURER
OF EQUIPMENT
FOR THE PRODUCTION
& DISTRIBUTION
OF ZERO-CARBON HYDROGEN

BY McPhy

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DESIGNER AND MANUFACTURER

OF EQUIPMENT FOR THE PRODUCTION & DISTRIBUTION OF ZERO-CARBON HYDROGEN

A pioneer of hydrogen solutions in the service of the energy revolution, in ten years McPhy has positioned itself among the world leaders in zero-carbon hydrogen.

Our projects, the trust placed in us by key economic players, and our ongoing policy of innovation coupled with a solid industrial infrastructure allow us to design, manufacture and integrate effective and competitive hydrogen production and distribution equipment, in order to decarbonize the industry, mobility and energy sectors.

Laurent CARME
Chief Executive Officer of McPhy

EDITO

2019 was a pivotal year for hydrogen in the fight against climate change.

The industry's global growth has reached a peak, confirmed by the incorporation of zero-carbon hydrogen in an increasing number of government roadmaps, the development of international coalitions and the realization of the first large-scale projects.

It was also a **year of major change for McPhy,** with the business successfully passing key technological and commercial milestones for preparing the future.

Our strategy centers on helping our customers in the industry, mobility and energy sectors to **successfully transition to business models based on zero-carbon hydrogen, reconciling economic performance and corporate social responsibility.**

The reinforcement of our teams and their fields of expertise, our commitment to ongoing innovation and the increasing industrialization of our manufacturing processes enabled us to **consolidate our position as a key technological and industrial partner for the hydrogen market** and to be chosen to equip **projects heralding the arrival of wide-scale change in the industry.**

These include the scaling up towards multi-MW industrial hydrogen equipment - with McPhy having been selected to equip the largest zero-carbon hydrogen plant in Europe (20 MW), and the inauguration of the first zero-carbon hydrogen refueling station for public transportation in the Hauts de France Region (for 6 buses).

> **We are confident that the combination of rigor, agility, innovation and massification found in our markets will enable us to accelerate the roll out of competitive, high-performance zero-carbon hydrogen ecosystems with unlimited opportunities.**

Our ambition for the future is clear: **to continue our large-scale transition and increase the attractiveness and competitiveness of zero-carbon hydrogen** by continually improving our equipment's performance, with the highest standards of quality and safety, all within a strategy of hydrogen cost reduction.

We're ready for the "Unlimited Hydrogen" era. Are you?

McPhy
Driving clean energy forward

3 MARKETS SERVED
INDUSTRY, MOBILITY, ENERGY

1 INTEGRATED OFFER
ELECTROLYZERS, STATIONS, SERVICES

€ 11.4 MILLION IN REVENUE
AN INCREASE OF MORE THAN 40% BETWEEN 2018 AND 2019

LEADER IN ALKALINE ELECTROLYSIS
The most mature hydrogen generation process on the market, an indispensable technological component for the mass production of zero- carbon hydrogen from renewable electricity

37 MW* OF HIGH-POWER ELECTROLYSIS

24 STATIONS* FOR ZERO-EMISSION MOBILITY

5 SITES IN EUROPE

Ø CARBON HYDROGEN
Clean energy that doesn't generate any carbon at all - during its production or during its use

98 EXPERT STAFF IN THE H_2 VALUE CHAIN

*References that are already operational, being installed or under development | Figures as of 31-01-2020

CLEAN INDUSTRY REVOLUTION

MCPHY SUPPLIES INDUSTRIALISTS WITH DECARBONIZED HYDROGEN, RECONCILING PRODUCTIVITY, COMPETITIVENESS AND SOCIAL RESPONSIBILITY

WIDELY USED FOR ITS FLEXIBILITY, MULTISECTORAL APPLICATIONS AND ITS ENERGY EFFICIENCY, HYDROGEN IS A COMPETITIVE AND ATTRACTIVE STRATEGIC TECHNOLOGY FOR INDUSTRIAL COMPANIES.

BY REPLACING EXISTING CARBONIZED ENERGIES WITH CLEAN HYDROGEN, PRODUCED BY ELECTROLYSIS FROM RENEWABLE SOURCES, INDUSTRIALISTS ARE ENTERING A NEW LOW-CARBON ERA.

Low carbon, responsible, innovative and profitable: WELCOME TO THE INDUSTRY OF THE FUTURE

Already used in industry for more than 100 years, hydrogen has seen its development accelerated. On a world scale, industrial chemical and refining applications consume 60 million tons of hydrogen per year.

Almost all of this volume is produced using fossil fuels, based on a production process which is generally accepted to emit ten kilos of CO_2 per kilo of hydrogen produced.

By producing their zero-carbon hydrogen on site, using electrolysis from green electricity, manufacturers ensure their:

- Security of supply and energy independence (freedom from logistic constraints),
- Control over their costs,
- Reliability and continuity of service,
- Drastic reduction of their CO_2 footprint and air pollution,
- On-site production in the best conditions of quality and safety,
- Creation of new business models.

"POWER TO INDUSTRY": ALL SECTORS ARE CONCERNED

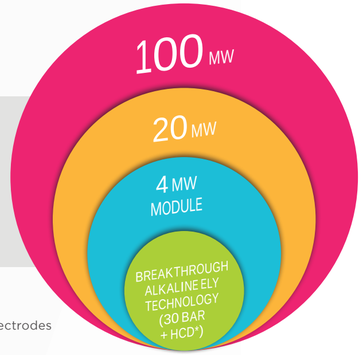
Petrol and gas refineries
fuel desulfurization, e-fuels

Chemical processing
e-methanol, synthesis of ammonia for fertilizers

BUT ALSO: Steel mills, coal-fired plants, thermal power stations (cooling system for alternators), metallurgy, glass production, electronic components, etc.

FOCUS ON CCU: With "Carbon-Capture Utilization", polluting industrial emissions are captured before being released into the atmosphere and then added to hydrogen, allowing synthetic molecules to be created and channelled into new uses: e-methanol, biodiesel, e-fuel, etc.

Qualified and selected by numerous industrialists and/or gas companies, our electrolyzers integrate perfectly into industrial systems, whatever their size or business sector.



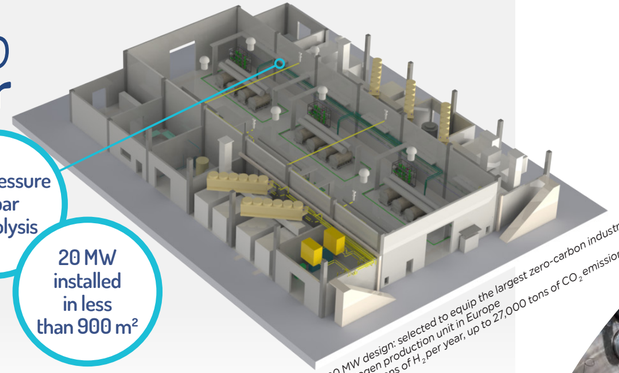
*HCD : High Current Density electrodes

AUGMENTED McLyzer

Advanced high current density electrodes

High-pressure 30 bar electrolysis

20 MW installed in less than 900 m²



20 MW design: selected to equip the largest zero-carbon industrial hydrogen production unit in Europe. 3,000 tons of H_2 per year, up to 27,000 tons of CO_2 emissions abated.

McLyzer: electrolyzers up to **800 Nm³/h** in series

Augmented McLyzer: 20 to 100 MW (scalable: GW) platforms for large-scale industrial applications

30 bar: high pressure production

Very fast response dynamics, perfectly adapted to the fluctuations of the renewables

High energy efficiency

A mature, industrialized process

Robustness

Simple installation and commissioning

Compactness

Remote supervising and piloting

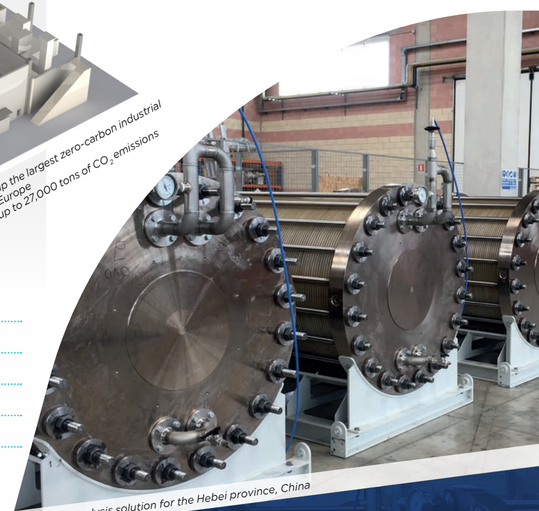
Economic competitiveness

AUGMENTED MCLYZER: NEW GENERATION ALKALINE ELECTROLYSIS FOR 20 TO +100 MW ARCHITECTURES

A true **breakthrough technology,** our "Augmented McLyzer" electrolyzers combine the **reliability and the maturity of alkaline technology with great flexibility.** They integrate new generation **electrodes with high current density** (doubled compared to standard electrodes) that significantly increase the performance of our equipments, all within a compact design. Based on a 4MW module design, our systems are created to scale up with your operating rhythm.

"Bigger scale, lower costs": the scaling up and industrialization of electrolyzers will make it possible to bring about a drastic reduction in the purchasing costs and the democratization of hydrogen.

McPhy
Driving clean energy forward



4 MW electrolysis solution for the Hebei province, China

FOCUS ON PIEL

[From 0,4 to 12 Nm³/h | 1 to 8 bar] Perfectly in line with discontinuous applications and the requirements of light industry, the new generation PIEL by McPhy offers a solution that is perfectly adapted to the jewellery sectors – goldsmithing, meteorology, and the glass industry, or welding operations – brazing, and thermal processing.

CLEAN MOBILITY REVOLUTION

MCPHY
CLEAN HYDROGEN PRODUCTION AND DISTRIBUTION SOLUTIONS FOR ZERO-EMISSION MOBILITY

HYDROGEN ESTABLISHES ITSELF AS A ZERO-EMISSION ALTERNATIVE FUEL THAT CAN SIGNIFICANTLY REDUCE AIR POLLUTION IN THE TRANSPORT SECTOR BY ELIMINATING THE EMISSION OF POLLUTANTS AND CO_2.

ENSURE HIGH-QUALITY SERVICE, ALL WHILE CONTRIBUTING TO IMPROVE AIR QUALITY AND PUBLIC HEALTH

With their great autonomy and fast refueling, hydrogen vehicles are attracting a growing number of communities, manufacturers or managers of automobile fleets and plants or logistic platform operators.

They find the perfect union of operating convenience, continuity of service and participation in the fight against air pollution.

All types of mobility are concerned:

- Land: utility vehicles, passenger cars, buses, big rig trucks, lift trucks,
- Railway: trains,
- Or maritime: river shuttles, boats.

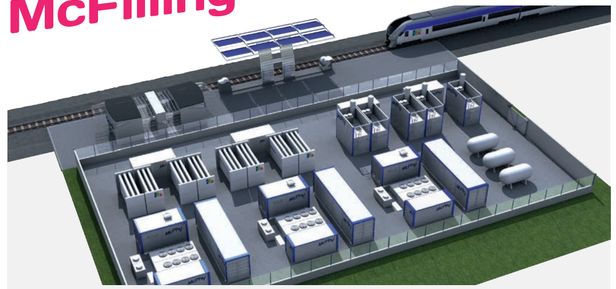
TOWARDS "ZERO EMISSIONS" HEAVY TRANSPORTATION

Hydrogen is **the only scalable technology, capable of meeting the massive needs of heavy-duty transportation**, which amount to hundreds or even thousands of kilograms of hydrogen each day:

- A zero-carbon hydrogen, produced on site by alkaline electrolysis, cost-competitive with carbonated hydrogen (SMR),
- A clean alternative fuel, whose price at the pump is competitive with diesel,
- "Bigger scale, lower costs": the scaling up and industrialization of hydrogen stations will make it possible to bring about a drastic reduction in the purchasing costs and the democratization of hydrogen mobility.

Hydrogen Station McFilling 20-350 Sorigny.

AUGMENTED McFilling


Augmented McFilling hydrogen station: 2 tons per day configuration / 12 trains scenario, including 6 MW of electrolysis (3 x Augmented McLyzer 800-30 high current density)

EXAMPLE OF POSSIBLE SCENARIOS

- 12 TRAINS
- 50 TRUCKS
- 100 BUSES

McFilling: a wide range of small, medium and large capacity stations

350 and/or 700 bar

Augmented McFilling: as of 2 tons per day, a modular solution with no limits in terms of capacity

Interfaces with an **electrolyzer** for true clean mobility chain

Zero-emission mobility: zero particles, zero CO_2, zero noise

Compact and modular

AUGMENTED MCFILLING: A NEW GENERATION OF HYDROGEN STATION FOR HEAVY-DUTY TRANSPORT

A true concentration of **technological and digital innovation,** Augmented McFilling by McPhy is a **unique and proprietary design philosophy** that supports the heavy-duty transport sector's transition towards the large-scale use of low carbon hydrogen. Combining the best of alkaline electrolysis and hydrogen station technologies, Augmented McFilling is an intelligent system capable of being **dynamically reconfigured** to offer you multiple modes of operation that will **optimize our customer's TCO** (Total Cost of Ownership) in real time.

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© Photo Crédit : Arnaud Février/ENGIE
Hauts de France: first zero-carbon hydrogen station for buses in France (200 kg of hydrogen/day, 0.5 MW of electrolysis).

FOCUS ON SUPERVISION SOFTWARE

Embedded supervisory software makes our Augmented McFilling station dynamically reconfigurable. The station autonomously defines its optimal operating scheme and (re)routes the flows, from production to distribution to the vehicle, via compression and storage steps to deliver hydrogen at the lowest cost while ensuring service continuity and maximum availability.

CLEAN ENERGY REVOLUTION

MCPHY
AGILE HYDROGEN SOLUTIONS TO SUCCEED IN THE ENERGY REVOLUTION

BY TRANSFORMING SURPLUS RENEWABLE ELECTRICITY INTO ZERO-CARBON HYDROGEN, MCPHY FACILITATES THE LARGE-SCALE INTEGRATION OF CLEAN ENERGY INTO THE ENERGY MIX.

INCREASING THE SHARE OF RENEWABLES IN THE ENERGY MIX

Solar, wind, hydraulic: energy transition depends on renewable energies.
They can answer the growing needs for energy, all while:

HYDROGEN, AN AGILE ENERGY

In the face of the massive deployment of renewable energies, by nature intermittent and difficult to predict, hydrogen seems to be a flexible and competitive solution.

- Flexibility and balance for the network: compensate for the intermittence of renewable energies,
- Matching supply and demand thanks to hydrogen storage,
- Reliable energy reserve for insular or off-grid locations and a backup solution and/or autonomous energy (buildings, telecom antennas, data centers, ...).

Jupiter 1000 | Power to Gas: first industrial demonstrator at the megawatt scale in France (0, 5 MW alkaline electrolysis + 0, 5 MW PEM electrolysis).

MCPHY ELECTROLYZERS: A DEMONSTRATED DYNAMIC RESPONSE

The McLyzer range is positioned as the ideal tool to stabilize the electric grids confronted by a growing influx of renewable electricity and participates in the primary and secondary reserves.

Its dynamic response to power fluctuations and its durability have long been demonstrated through data collected since 2014 on the "H_2Ber" Power to Gas project in Berlin.

Designed by McPhy to limit their operating impact on the environment, these hydrogen generators combine a zero-loss purification unit with a closed-loop system to reduce the consumption of water to the strict minimum during its transformation into hydrogen.

Instantaneous adaptability to power fluctuations in electricity from renewable energies

System services participation (primary and secondary reserves)

High energy efficiency

Economic competitiveness

Reliability and robustness of a mature technology

Easy to use and maintain

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EnergieDienst : 1 MW of electrolysis in Germany

FOCUS ON POWER TO GAS

A true "bridge" between the electric and gas grids, Power to Gas brings flexibility and can increase the clean energy share, all while managing investments:

- Using existing grid infrastructures
- Coupling with other industrial or mobility applications

This solution has been widely adopted by large companies around the world.

AUGMENTED HYDROGEN SOLUTIONS

TO STRENGTHEN THE ATTRACTIVENESS AND PROFITABILITY OF CLEAN HYDROGEN, MCPHY RELIES ON ITS CAPACITY FOR INNOVATION, BACKED BY A PREMIER INDUSTRIAL INFRASTRUCTURE.

AN INTEGRATED APPROACH TO RESPOND TO YOUR LARGE-SCALE APPLICATION NEEDS

BREAKTHROUGH TECHNOLOGIES

RESEARCH & INNOVATION

In one decade, McPhy has acquired a solid expertise in hydrogen technologies for the reduction of carbon footprints in the industry, mobility and energy sectors. Combined with a policy of ongoing research and innovation, this allows it to work on continually improving its equipment - to achieve the highest standards of performance, quality and safety.

MODULARIZED & SCALABLE SYSTEMS

DESIGN & ENGINEERING

McPhy applies its strengths in technological and scientific leadership to designing scalable architectures for the production and distribution of zero-carbon hydrogen, ready for the massification of the sector. All this based on a standardization approach which meets both the needs and the techno-economic demands of markets.

MANUFACTURING CAPACITIES x100

MANUFACTURING & COMMISSIONING

McPhy's market reach and that of its services is worldwide, coupled with a solid industrial infrastructure, designed to scale-up in line with the markets. McPhy has five centers of excellence in Europe:

- France: one engineering site, an innovation platform, test bench and industrial manufacturing site dedicated to our hydrogen stations (ISO 9001), and a business unit in Paris,
- Germany: engineering for multi-MW electrolysis systems,
- Italy: a large industrial site certified ISO 9001 and dedicated to the assembly of PIEL electrolyzers and the production of our large capacity stacks (multi MW).

For the installation and commissioning stages, McPhy has created a Services team, supported by a first class international partnership network.

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Driving clean energy forward

VALUE CREATION € $ CN¥

CUSTOMER SATISFACTION

Our strategy centers on helping our customers in the industry, mobility and energy sectors to successfully transition to business models based on zero-carbon hydrogen. We design hydrogen systems based on real-world conditions and which are scalable for the future, reconciling the demands for both economic performance and social responsibility.

	SMALL	LARGE	AUGMENTED
ELECTROLYZERS	**Piel** **0.4 to 12 Nm³/h** (1 to 8 bar) **McLyzer** **20 to 80 Nm³/h** (30 bar)	**McLyzer** **100 to 800 Nm³/h** (30 bar)	**Augmented McLyzer** **Multi-MW, GW designs**
STATIONS	**Starter Kit** **McFilling 20 kg** (350 bar)	**McFilling 500** **350 bar:** 100 to 800 kg per day **700 bar:** 100 to 600 kg per day **Dual Pressure 350/700 bar:** 100 to 600 kg per day	**Augmented McFilling** **Multi-tons designs**
SERVICES	**Supervision and remote control, preventive maintenance, training of your teams, etc.**		

McPhy

Driving
clean energy
forward

FACED WITH ENVIRONMENTAL, ECONOMIC AND SOCIETAL CHALLENGES, A NEW ENERGY MODEL IS EMERGING, ROOTED IN THE TERRITORIES, AND BASED ON NON-CARBON EMITTING ENERGIES.

Used as a feedstock in industrial processes, converted into clean fuel for zero-emission vehicles, or used to facilitate storage and flexibility for electricity and gas networks: ***zero-carbon hydrogen - produced by electrolysis using renewable electricity - plays a central role, and contributes to the decarbonization of all sections of the economy and the emergence of a societal model that is more carbon neutral.***

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