

McPhy

Driving
clean energy
forward

Elektrolyseanlagen für Multi-MW Anwendungen



[mcphy.com](https://www.mcphy.com)

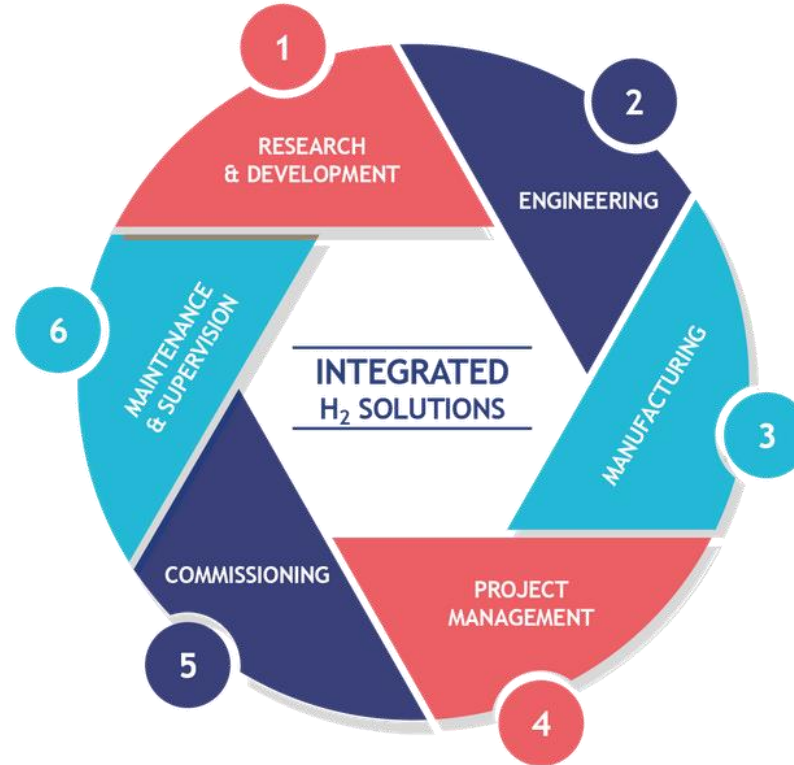
An Overview of McPhy

KEY FIGURES

- 5 sites : France, Germany, Italy, China

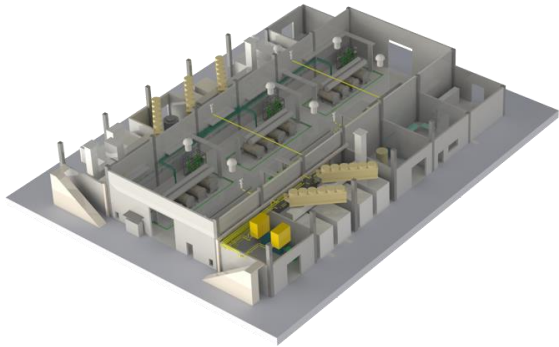


- 15 years of R&D
- ~ 100 employees
- **Flagship Reference :**
 - > 17 MW Electrolysis
 - > 23 HRS in operation
- **Strategic partnership with**

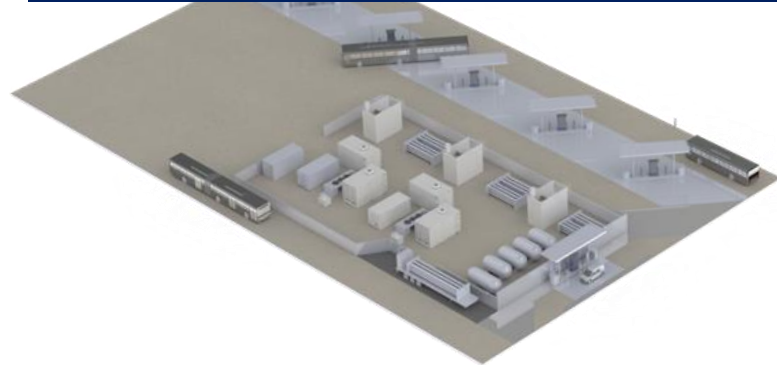


A complete range of hydrogen equipment to design turnkey projects

Electrolyzer for Industry & Energy



Hydrogen Refilling Station for Mobility



Supported by Strong Industrial assets and know-how

McPhy Italy:
Manufacturing Center



McPhy Germany:
Engineering Center



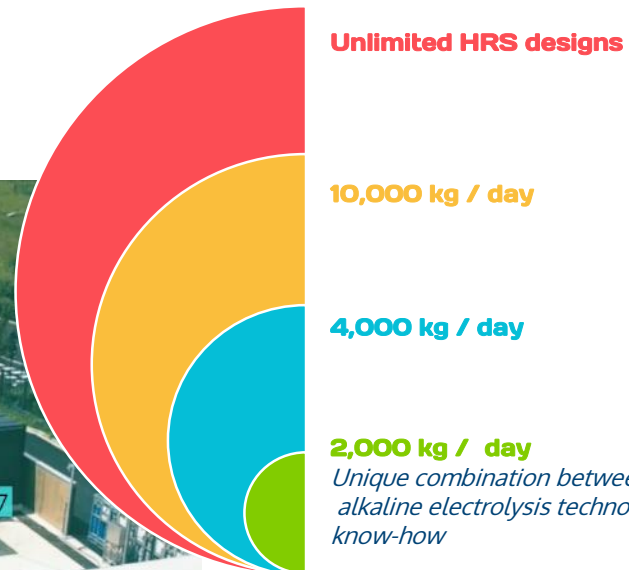
McPhy France:
R&D, HRS Center



HRS - references



| HRS



Unique combination between our high-pressure alkaline electrolysis technology and our HRS know-how

McPhy's references in Ely : learnings, skills & assets

| Electrolysis

MCPHY WILL HAVE INSTALLED

17 MW

OF HIGH CAPACITY ELECTROLYZERS
= MORE THAN
7 TONS OF CLEAN HYDROGEN
PRODUCED PER DAY

Alc, atm	Audi 6 MW 2013
Alc, atm	Prenzlau 0.5 MW 2013
Alc, pres	H2Ber 0.5 MW 2014
Alc, pres	Hebei 4 MW 2017
Alc, pres	EnergieDienst 1 MW 2017
Alc, pres + PEM	Jupiter 1000 1 MW 2018
Alc, pres	RAG 0.5 MW 2018
Alc, pres	SMT-AG 0.5 MW 2019
Alc, pres	Confid. 2 MW HCD 2019
Alc, pres	Confid. I 1 MW HCD 2019

McPhy | March 2019

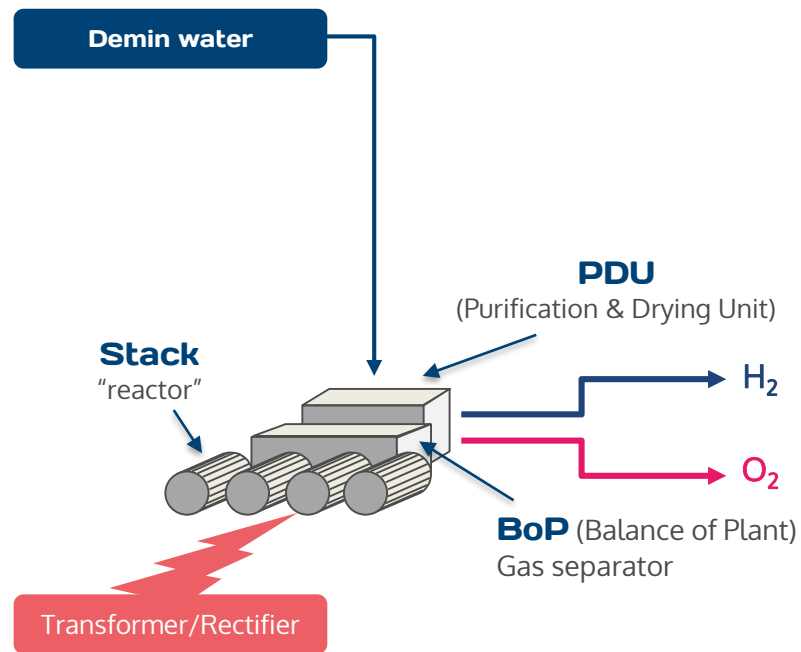


- 100 MW | Platform**
A total footprint below 4,500 m²
- 20 MW | Cluster**
Fast dynamic response time
- 4 MW | Augmented McLyzer 800-30**
High pressure production (30 bar)
- Breakthrough Alkaline ELY Technology**
Unique combination between our high-pressure alkaline electrolysis technology

By the way, how does an eletrolyzer look like ?



1 MW Electrolyzer (indoor installed)



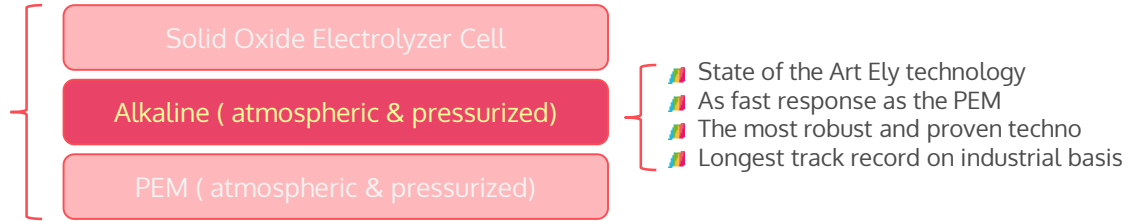
Stack under erection (outdoor case)

Rule of Thumb:
200Nm³/h or 18kg/h
per MW eletrolyzer



McPhy in Hydrogen production units (Electrolyzers)

3 main technologies for electrolyzers:



3 ranges of McPhy electrolyzers :

Less than 500 kW **1**

Small electrolyzer "McLyzer" type
Delivered in containers "plug & play"



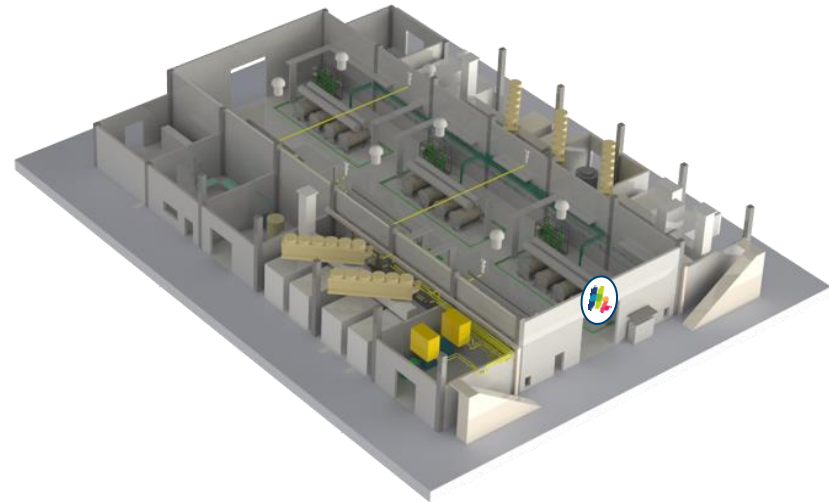
from 500 kW to 4 MW **2**

High Current electrolyzers
"McLyzer HC" type
Delivered in containers "plug & play"



4 MW to > 100 MW **3**

Multi MW units: Standard brick 4 MW,
standard cluster 20 MW, up to > 100 MW platforms



Our Core Modules

McLyzer 200-30

Capacity:
200 Nm³/h
> 430 kg/d

Containerized solution:
1 x 30' + 2 x 20'
Solution for HRS up to
400kg/d , PTG and PTP

Spec. Energy consumption:
5 kWh/Nm³

McLyzer 400-30

Capacity:
400 Nm³/h
> 860 kg/d

Containerized solution:
2 x 20' + 1 x 40'
Solution for large HRS, PTG
and PTP

Spec. Energy consumption:
5 kWh/Nm³

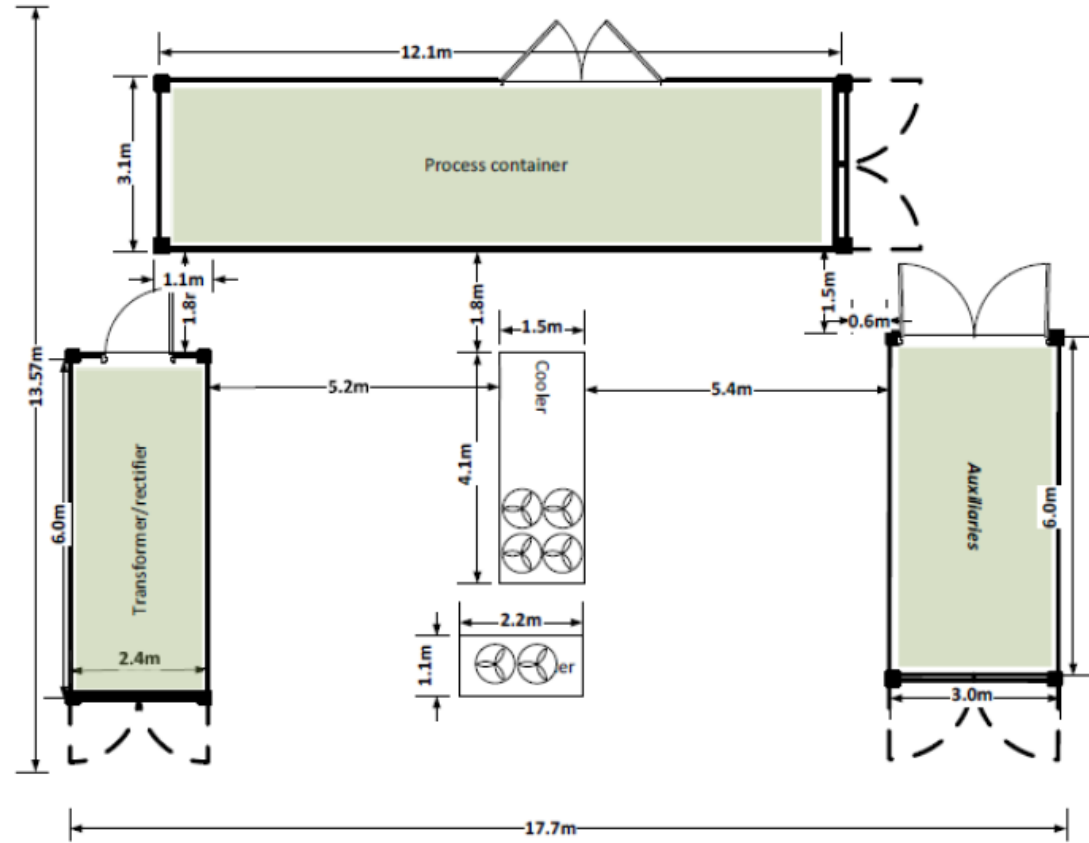
McLyzer 800-30

Capacity:
800 Nm³/h
> 1.720 kg/d

Base for Multi-MW plants

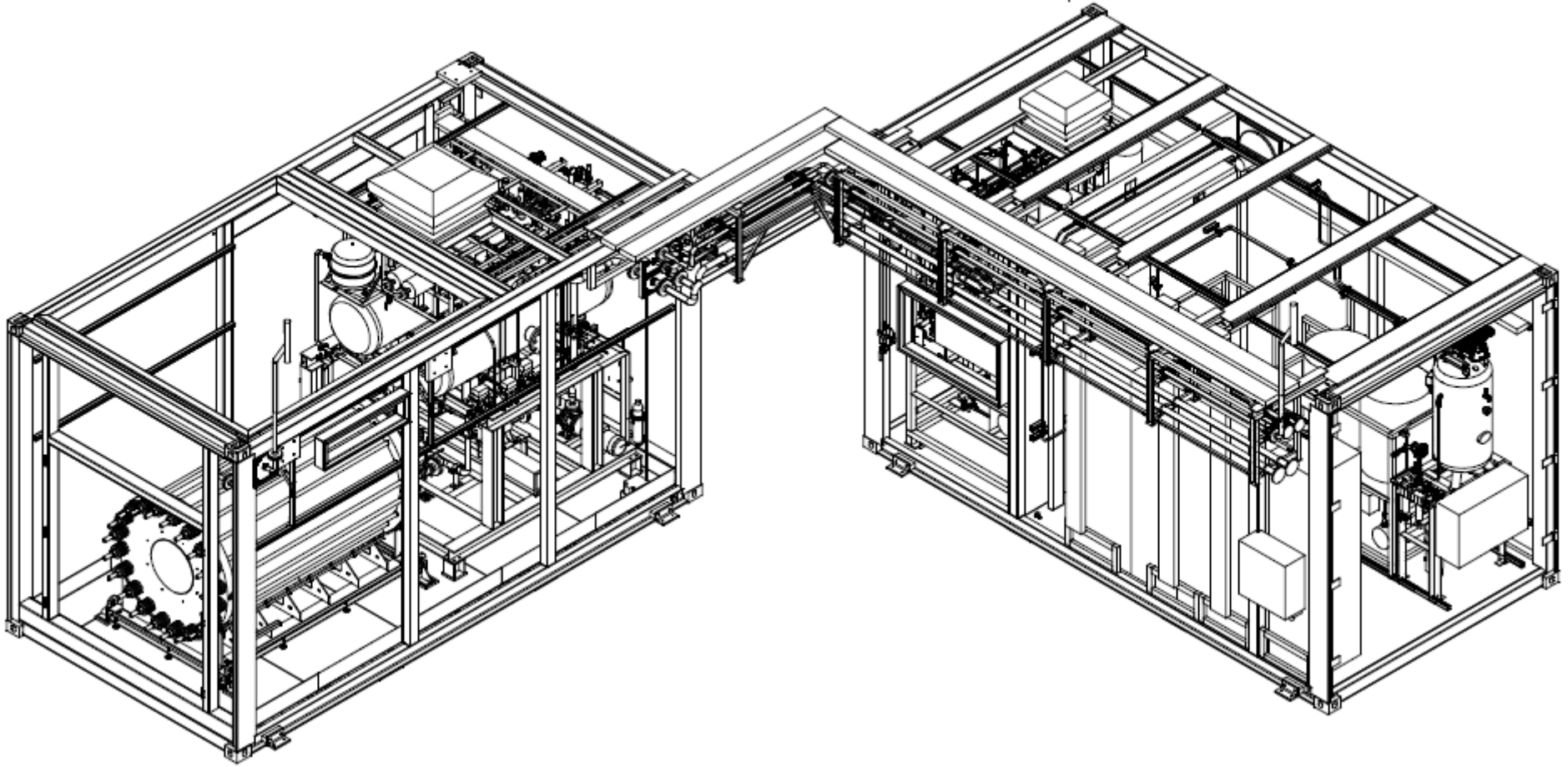
Spec. Energy consumption:
5 kWh/Nm³

Example of a 2MW unit
(similar principle as for 0.5 or 1MW)



Layout of a McLyzer 400-30 – not contractual / for reference only – actualization of layout will be provided with basic design informations.

Example of a 0,5MW unit
(valid up to 2MW)





Exemple of a 0,5MW unit
(valid up to 2MW)



PtG | References under operation: Audi (Werlte) - 2013



6 MW



Industrial hydrogen & Power-to-Gas: Audi, One of the first PtG project in Europe

- Operated by Audi
- **6 MW atm** Hydrogen production
- **In operation since October 2013**

H₂BER | the First Multi-Energy-Refueling Station in Europe

KEY FIGURES

- Electrolyzer connected to both the grid and the wind park
- World first Multi Energy refueling Station operated by Total
- Located at the airport of Berlin
- Commissioning: May 2014



McLyzer 250 kg/day
42 bar system Electrolyzer



H₂BER | the First Multi-Energy-Refueling Station in Europe

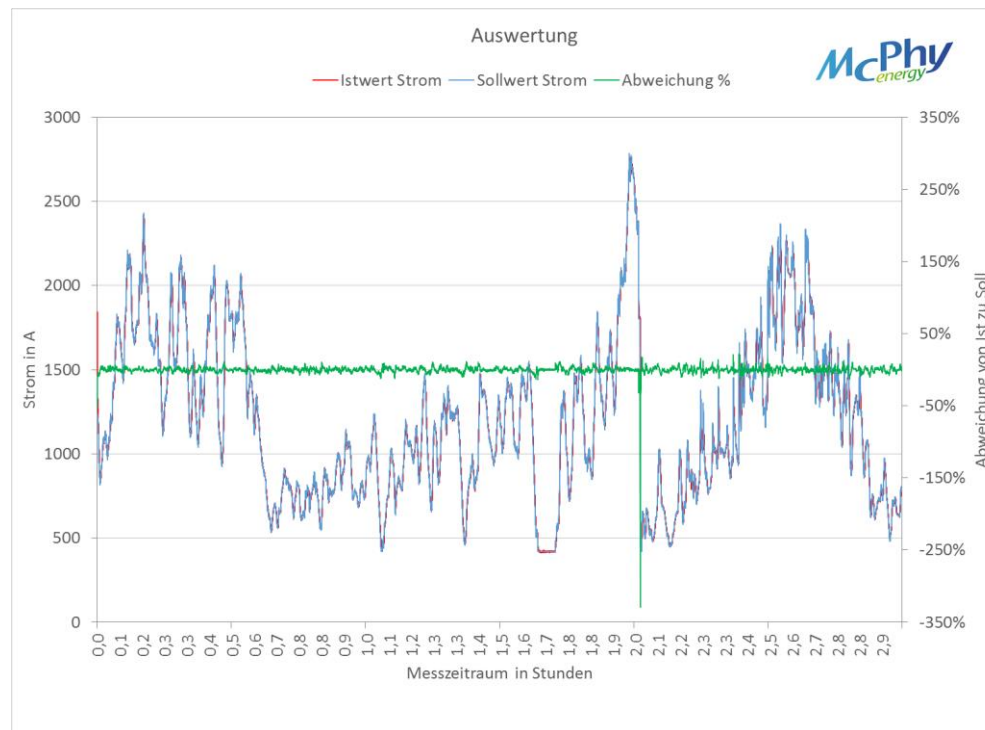
Concept:



H₂BER | the First Multi-Energy-Refueling Station in Europe

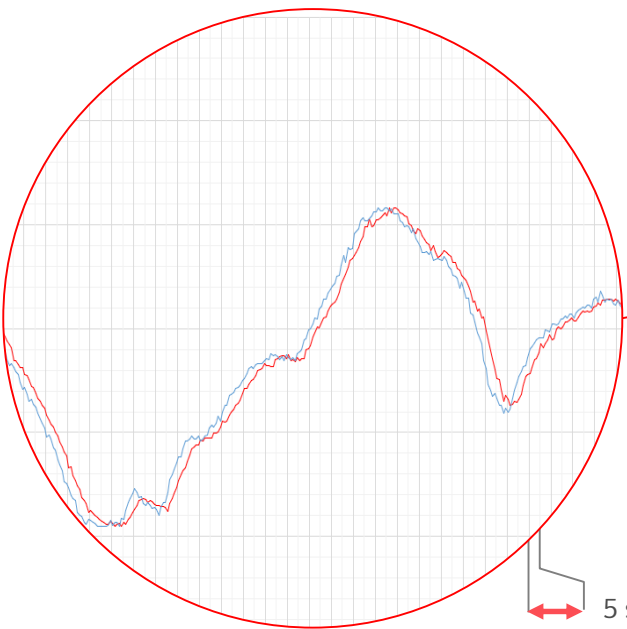
Proven:

- ✓ Overall Stack efficiency of 83%
- ✓ Utilization of electricity from wind by 99% despite high load changes during the energy supply
- ✓ Production of hydrogen with a stable, high quality fit for Fuel Cell Electric Vehicles like Toyota, Hyundai, Mercedes Benz etc.
- ✓ Gas is produced with 30bar pressure, optimized for industrial solutions and direct injection into the gas grid.

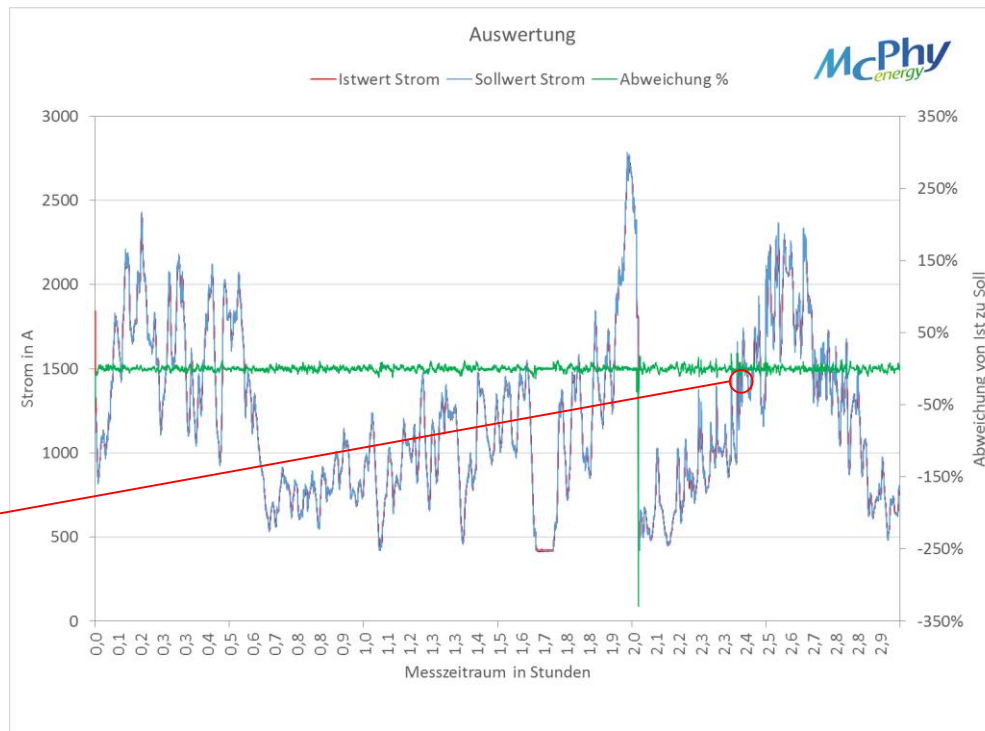


Red: Energy Input
Blue: Energy conversion by electrolyser
Green: deviation in %

H₂BER | the First Multi-Energy-Refueling Station in Europe



5 sec (measuring step 1 sec)



Red: Energy Input
 Blue: Energy conversion by electrolyser
 Green: deviation in %

PtG | EnergieDienst, ENBW Group (Germany) 1 MW at 30 bar



- First hydrogen project in partnership with Center For Solar Energy
- **2 McLyzer 100 : 200 Nm³/h – 1 MW at 30 bar**
- Inauguration November 2018, commissioning in May
- H₂ application : mobility, Industry, Storage

1 MW

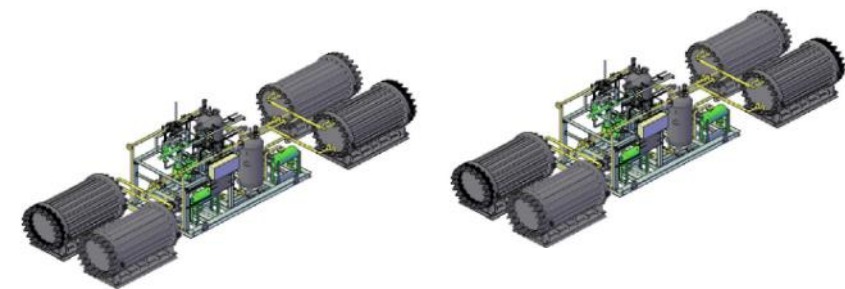


HEBEI | 4-10W Platform



4 MW

- Realistic outlook to a 10MW-platform today (HEBEI):
 - Currently the shown layout is equipped with 4 Module of 2 MW with stacks of 0,5 MW
 - Complete showcase for a wind power driven hydrogen plant incl. truck-out infrastructure and future HRS (400 kg)



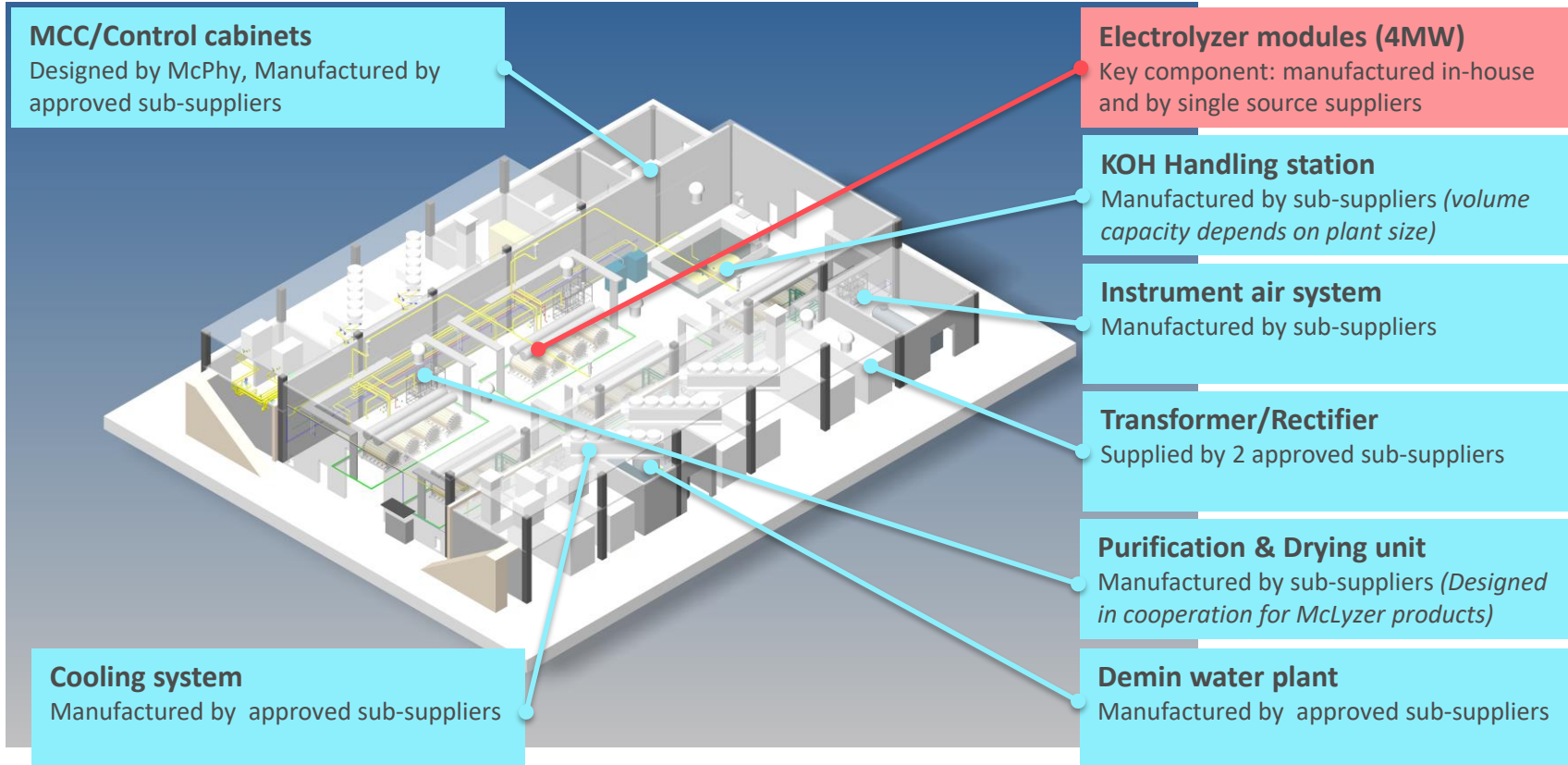
McPhy to set up its first station for 6 hydrogen buses in the Hauts de France region

KEY FIGURES

- Deployment scheduled in the summer of 2019
- The future Bulle 6 line will be the first in France exclusively operated with hydrogen buses

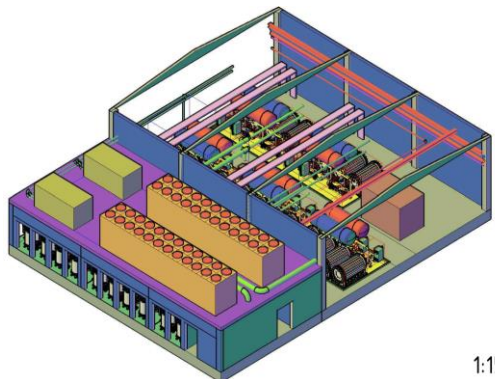


20 MW Cluster – General Architecture & Key Systems



from 100 MW Platform to GW ELY Plant

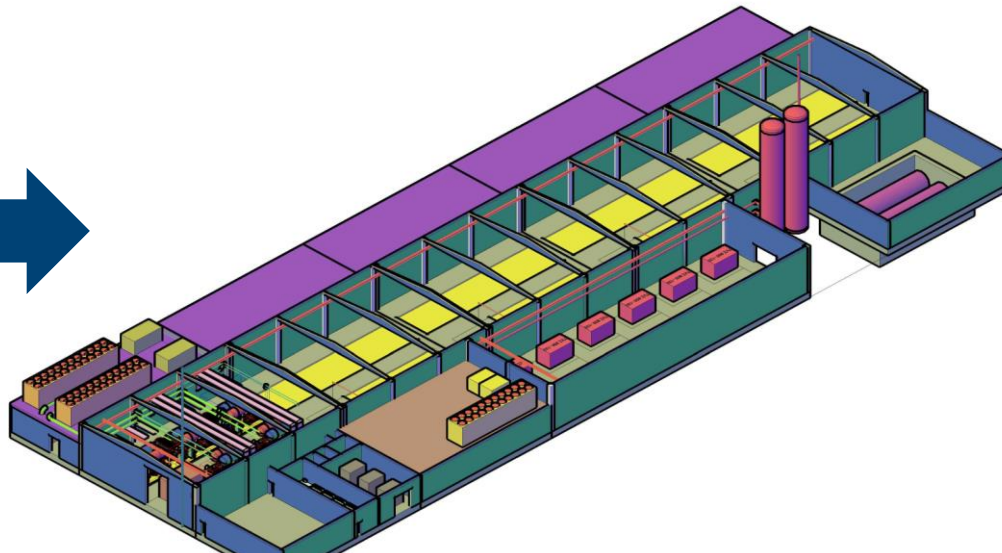
**STEP II > 20 MW Cluster and
100 MW ELY Plant**
2019 : 20 MW Cluster
2020 : 100 MW Plant



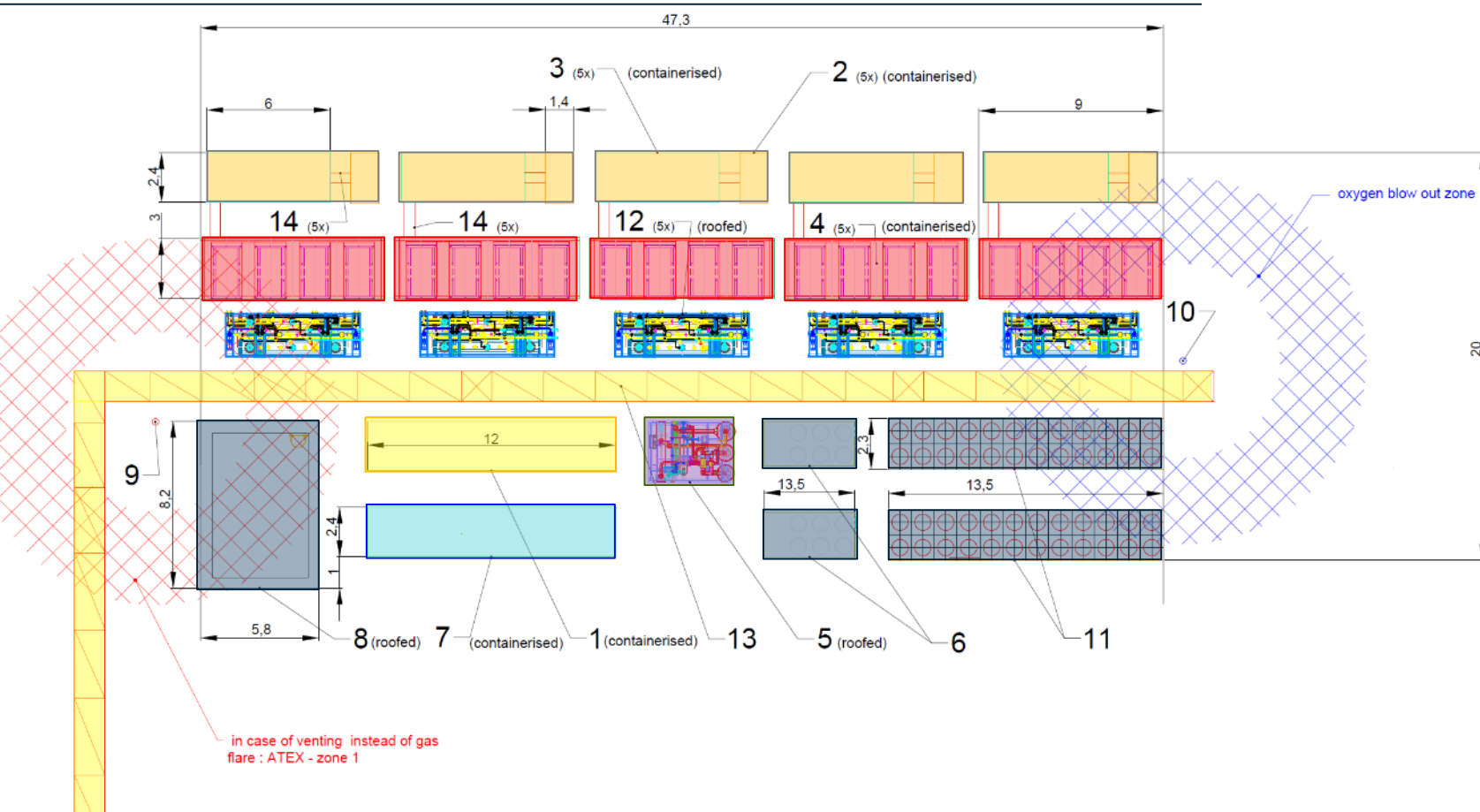
**100 MW Plant :
20 MW Cluster X 5**

1:15C

STEP III > 100 MW Cluster and GW ELY plant
2021 : 100 MW Cluster "New Design"
2025 : 1 GW Plant



**GW ELY Plant :
100 MW Cluster X 10**



item	description	note
1	ultra pure water treatment plant	containerised
2	transformers for electrolyzer	containerised
3	rectifiers for electrolyzer	containerised
4	5 x 4MW electrolyzer module	4 x cell stacks per module, containerised
5	purification and drying unit (PDU) for 20 MW cluster, roofed	
6	chiller for 20MW cluster	2x
7	main control cabin (MCC)	containerised
8	koh storage	roofed
9	hydrogen vent	
10	oxygen vent	
11	cooler for 20MW cluster	2x
12	process unit	outdoors, 5x, roofed
13	pipe bridge with header lines	
14	cable duct	

Pathways for Hydrogen and the Value for Europe

Mobility

- Ships
- Trains
- Trucks
- Busses
- Cars

Energy

- Grid Services
- Energy storage
- Energy supply

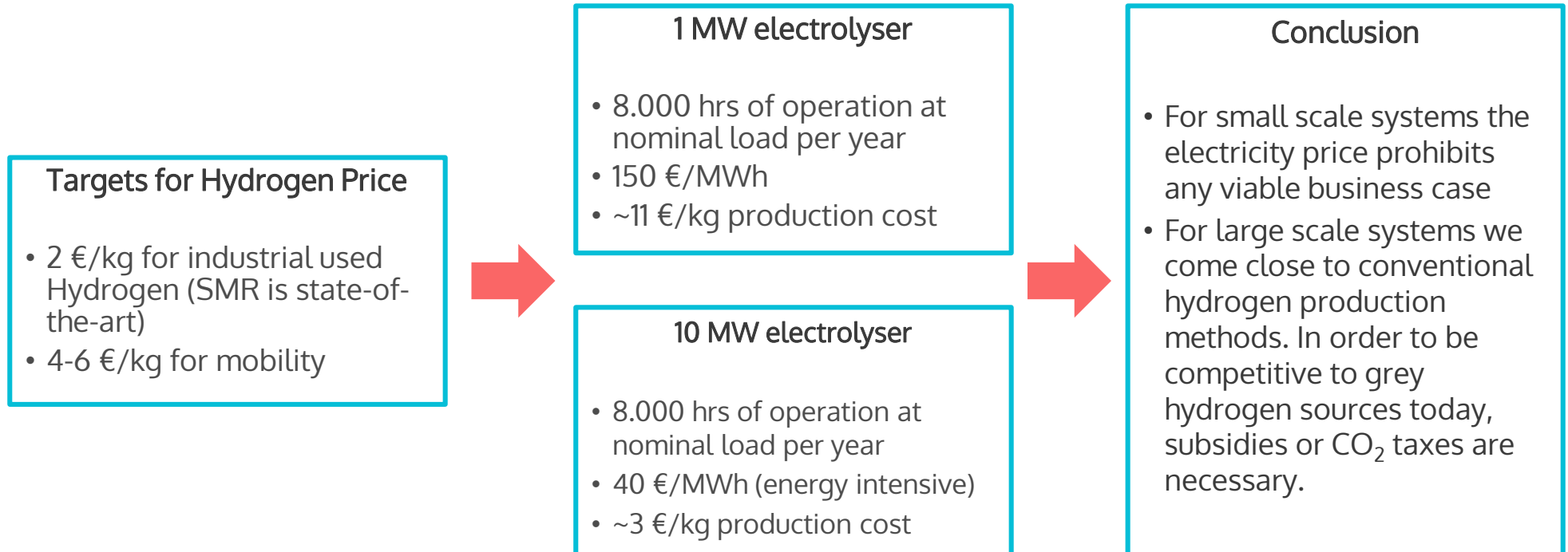
Industry

- Refinery
- Ammonia / Methanol
- Steel
- Glass
- Methane



Electrolysers, Hydrogen storage systems, Refueling Stations, Combined Heat and Power Plants are all System designed, engineered and manufactured in Europe.

The Business Case for Green Hydrogen in Germany



McPhy

Driving
clean energy
forward

Thank you!

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