Manufacturer and integrator of hydrogen fuel cell systems

www.h2sys.fr

History of the company

A CNRS laboratory spin-off (FEMTO-ST and FCLAB), H2SYS was founded in 2017 by six co-founders from the University and Industrial fields:

Ing. Sébastien Faivre
CEO

Pr. Daniel Hissel
Co-fondateur
Conseiller Scientifique
Directeur
CNRS/FCLAB

Pr. Samir Jemei
Co-fondateur
Conseiller Scientifique

Pr. Marie-Cécile Pera
Co-fondateur
Conseiller Scientifique
Vice-directrice Femto-St

Ing. Fabien Harel
Co-fondateur
CTO
Expert système pile

Pr. Frédéric Gustin
Co-fondateur
CPO
Expert électronique de puissance

From this technical expertise acquired over 20 years and relying on world-renowned fuel cell manufacturers, H2SYS has developed the following know-how:

- **Development of fuel cell systems**
- **Development of hydrogen generators**
- **Development and integration of hydrogen energy production solutions**

H2SYS teams

➢ **Workforce 2021: Team of 25 people**

- CNRS technical expertise: 5 persons
- Sales/administrative teams: 6 persons
- Electrical design office team: 5 persons
- Mechanical design office team: 2 persons
- OEM projects team: 4 persons
- Quality/Production team: 3 persons

➢ **Forecast end of 2021: 30 persons**

H2SYS team in December 2019

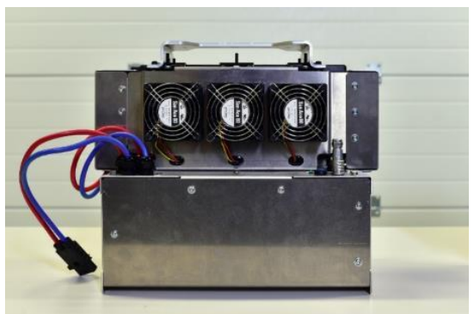
Fields of activity

3 main activities:

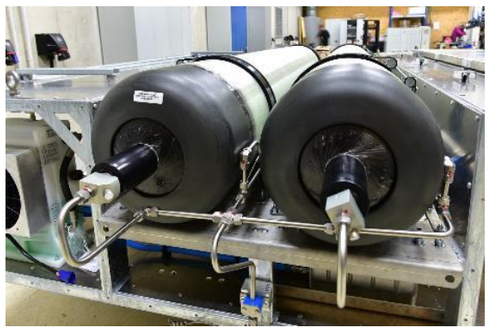
- **Manufacturer of fuel cell systems**
  - AIRCELL® range from 500W to 3kW

- **Integrators of fuel cell system solutions from 1 to 100kW for machine manufacturers (OEM)**
  - Mobility (maritime, river, road)
  - Special machines (handling, logistics)
  - Stationary (back-up, Telecom)

- **Manufacturer of hydrogen generator sets for mobile and stationary applications**
  - Portable generators BOXHY® range 1-8kW
  - Canopy/containerized gensets THYTAN® range 50/130kVA
  - Customized solutions in containers (H2 stockage, hybrid PV, cogeneration, …)



Fuel cell system
AIRCELL®



Integrated H_2 solutions
Stockage + batteries

H_2 portable generators
BOXHY ®

H_2 gensets
THYTAN ®

RECIF project
(cogeneration)

AIRCELL® Fuel Cell Systems

A range of "Plug & Play" power supplies

500W

1000W

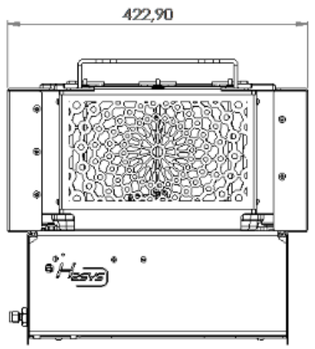
3000W

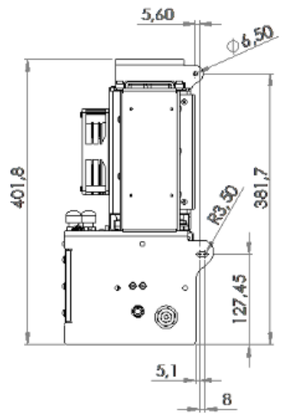
AIRCELL® a functional brick to be integrated

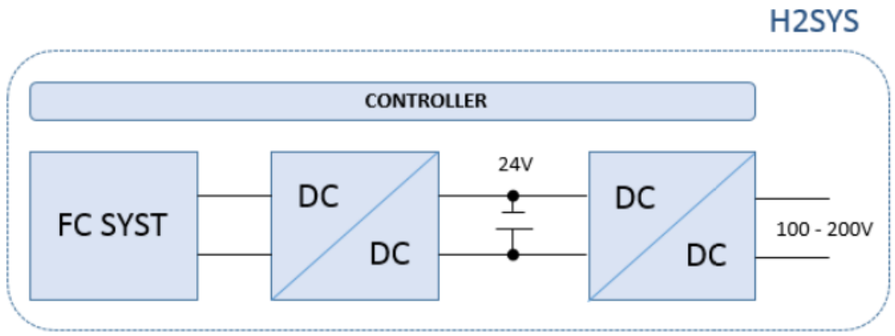
AIRCELL® is a complete fuel cell system to convert hydrogen into electricity.

- **Complete "plug & play" system:**
  - ✓ Intègre un stack PEM « cœur de pile »
  - ✓ Associated cooling function
  - ✓ Hydrogen line installed with integrated regulator
  - ✓ Hydrogen and electrical safety: T°C sensor, pressure sensor, H2 sensor
  - ✓ Control and command boards: current limitation, controlled stop, controlled purge
  - ✓ Communication interface: collection of operating data

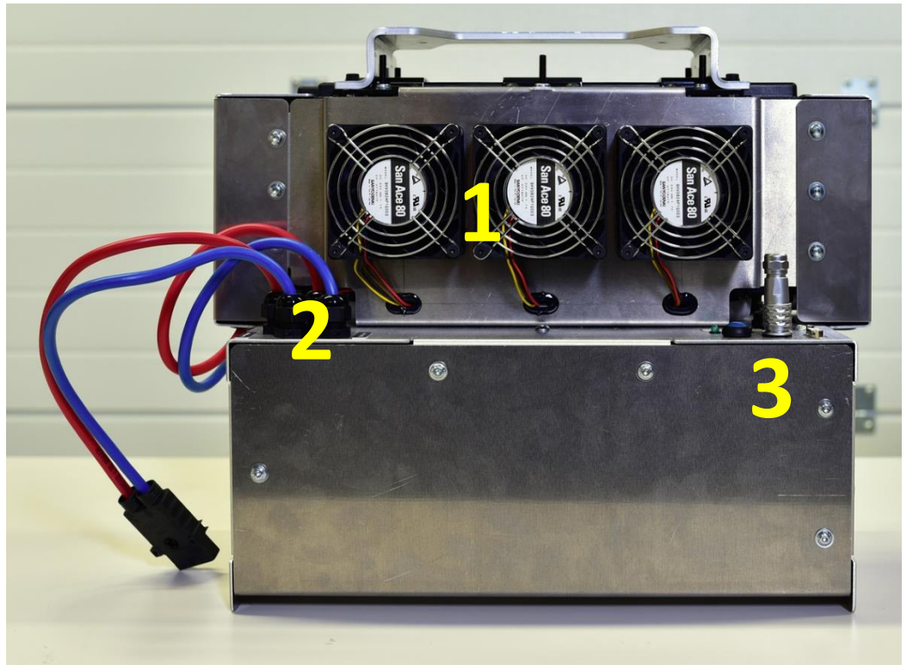
- **Several configuration options:**
  - ✓ Supply of output converters (voltage regulation)
  - ✓ Definition of speeds Can
  - ✓ Possibility to associate a Modbus interface
  - ✓ Supply of a hybrid system: battery + Dc/Dc + battery

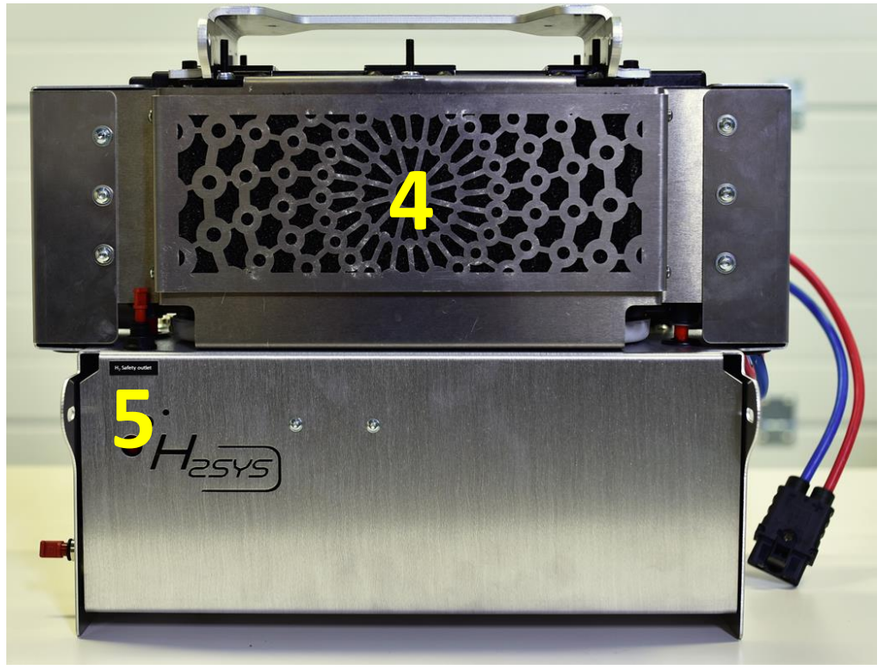






Plug & Play system Aircell®





1. Fans
2. Electrical output
3. Control/command
   - SUB-D9 communication port
   - External power supply 24 VDC
   - Start/Stop button (manual procedure)
   - System information LEDs
4. Air filter
5. Pressure relief valve
6. Fuel cell input/output
   - Hydrogen inlet 2-9 bar
   - Water/H_2 purge

Technical specifications Aircell® range

Performances \ AIRCELL Model	600 ACS	1000 ACS	2000 ACS	3000 ACS
Nominal power (W)	600	1000	2000	3000
Maximal power (W)	750	1200	2350	3400
Output voltage (V)	12 – 18	18 – 28	36,5 – 56	52 – 80
Min. / Max. Current (A)	5 – 50 / max. 65A dur. 30 s			
Sizes (mm): L x l x h [1]	392 x 214 x 330	436 x 158 x 330	441 x 122 x 550	445 x 122 x 634
Mass (kg) [1]	10	13	20	24

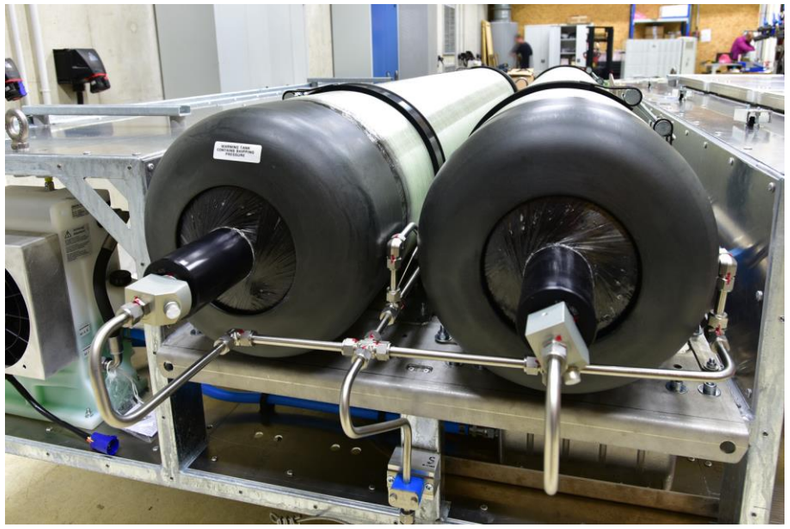
[1] Sizes and mass of the system may vary without any prior notice.

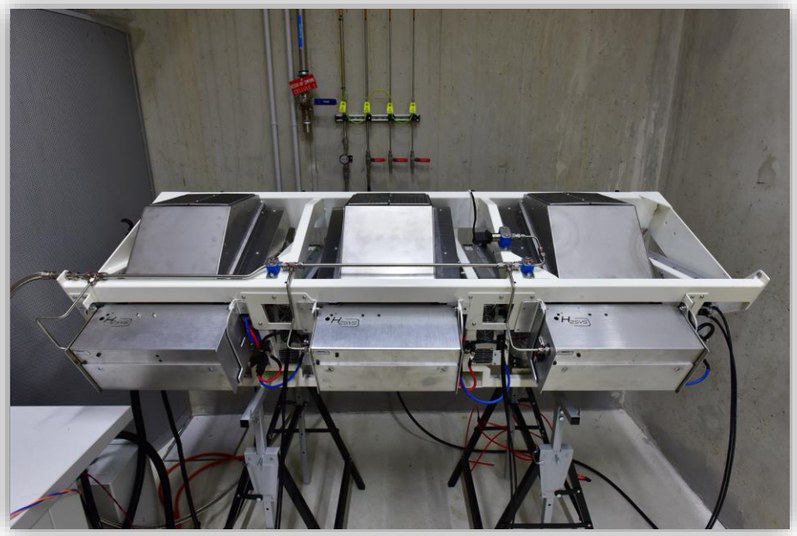
Hydrogen				
Hydrogen specification	Minimum quality grade 3,5 (99,95%) [2]			
Hydrogen inlet pressure	2 – 10 bar			
Fuel consumption (g/kWh)	65 g/kWh			
Nominal fuel consumption (Nl/min)	6 Nl/min	10 Nl/min	20 Nl/min	30 Nl/min

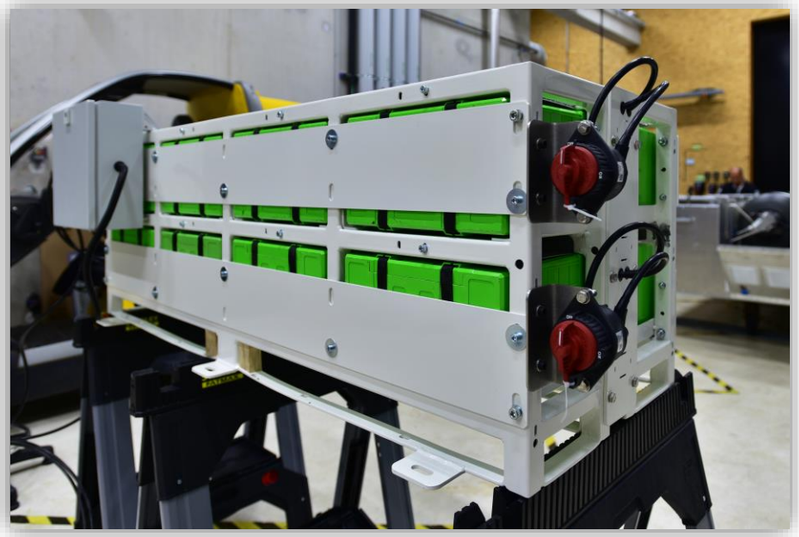
[2] According to quality characteristics of Type 1, Grade E and Category 3 hydrogen fuel specified in BS ISO 14687-3:2014.

OEM Solutions

Expertise in the integration of hydrogen systems







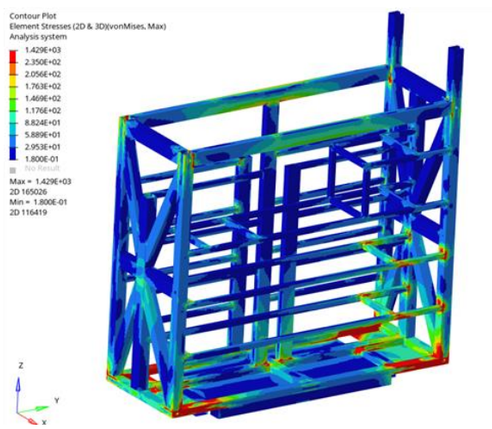
H2SYS: Partner for your Hydrogen project

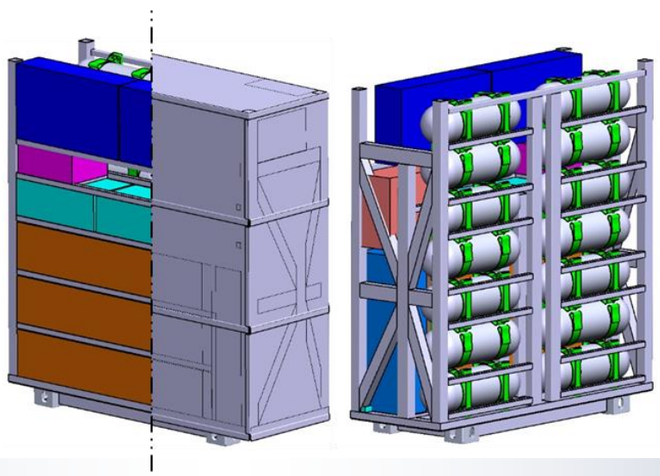
Support in the study and design of prototypes until the realization of industrial pre-series

- A dedicated design office for the analysis of the project
  - ✓ Sizing of the system according to the load profile and the desired autonomy
  - ✓ Electrical and fluidic design
  - ✓ Mechanical integration study
  - ✓ Supply of integration diagrams

- Realization of prototypes and pilot projects
  - ✓ Benchmarking and selection of hydrogen subsystem suppliers
  - ✓ Development of steering and control systems
  - ✓ Supply of hydrogen equipment + assembly (tanks, fuel cells)
  - ✓ Supply of the associated power electronics (batteries, converters, electronic cards)

- Other services:
  - ✓ Training / Commissioning on site
  - ✓ Risk analysis





The partnership between FC LAB and H2sys

Partner testing and development platform:

- Building dedicated to hydrogen testing
- 1200 m² of test facilities (H2, nanoparticles, electricity, network coupling)

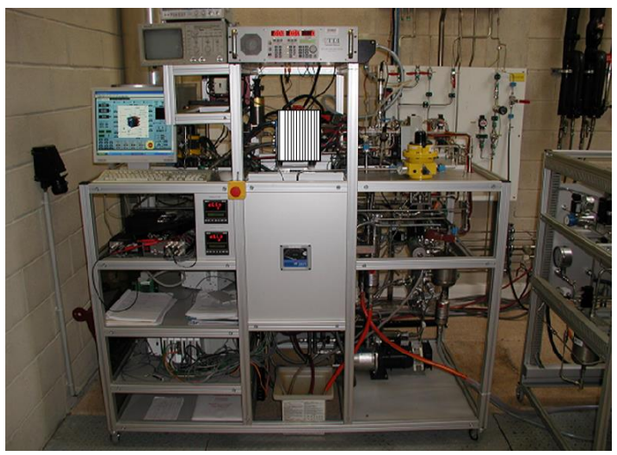
A hydrogen competence center that has been a reference in France since 1999:

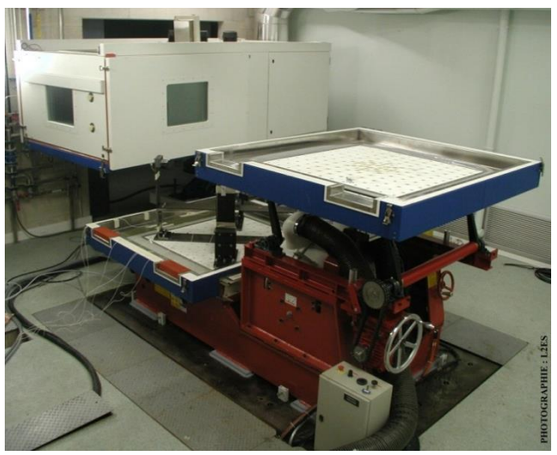
- 8M€ of investments in infrastructure
- 5M€ of investments in testing means
- 55M€ of operating budget (salaries and collaborative projects)

The FCLAB:
An R&D center to test and validate the solutions developed in real conditions and long-term qualification tests.

Unique testing capabilities on the market:

- Test bench for stationary FC systems from 100W to 120kW (under development)
- Test bench for mobile FC systems (vehicles) up to 100kW
- Vibration table test bench
- Climatic and temperature test chambers
- Long-term tests (24h/7d) under real conditions (electrical and thermal cycles, etc.)





BOXHY® hydrogen generators

A range of « zero emission » portable generators

BOXHY® a « zero emission » portable generator

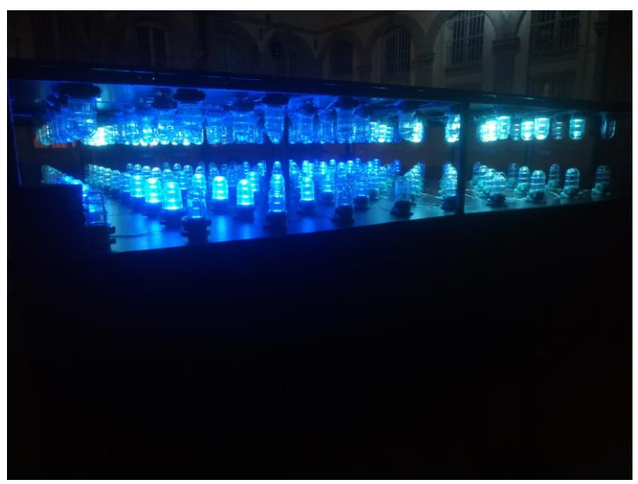
BOXHY is a hydrogen-powered electricity generator:

- **Easy to use:**
  - ✓ An inlet for the H_2 bottle
  - ✓ A stop/start button
  - ✓ A HMI

- **An innovative, silent and non-polluting solution:**
  - ✓ No gas emissions (no CO2 or sulphurous gas emissions)
  - ✓ A noiseless generator (<50 dB - no vibration)
  - ✓ 3 years of development and field tests with manufacturers and professionals

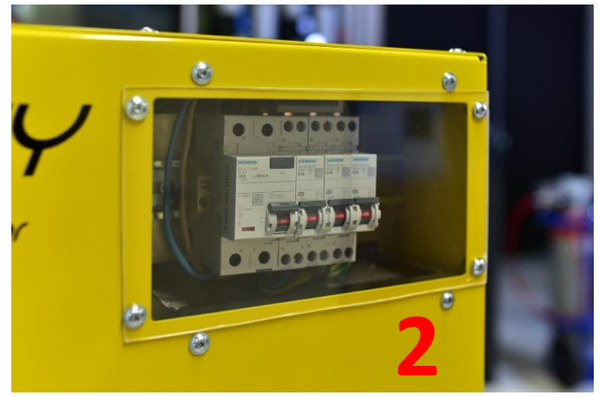
« The Good Day by Engie » event - June 2019

Since the BOXHY introduction:
3.2 MWh of electricity production
> 10 000 h of field tests
> 2,4 T of CO_2 avoided

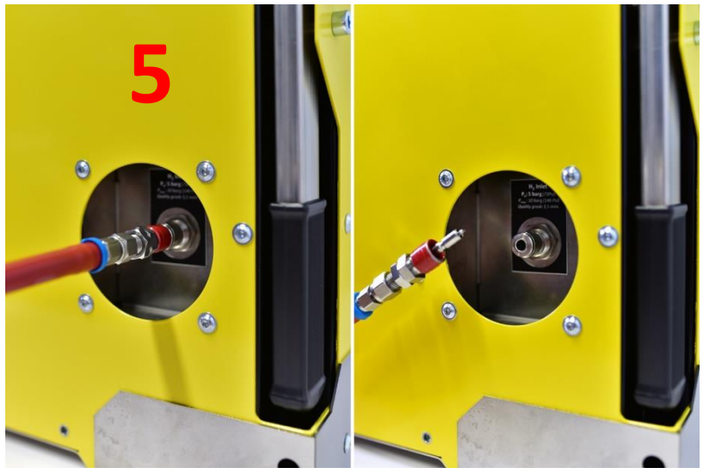


Fête des Lumières – December 2019

BOXHY®: Plug & Play system



1. Control panel
   - H2SYS HMI
   - Emergency stop
2. Electrical protections
3. 16A / 32A connection sockets
4. Protection and ventilation of FC systems
5. H_2 inlet
6. Integrated transport handles



BOXHY®: technical specifications

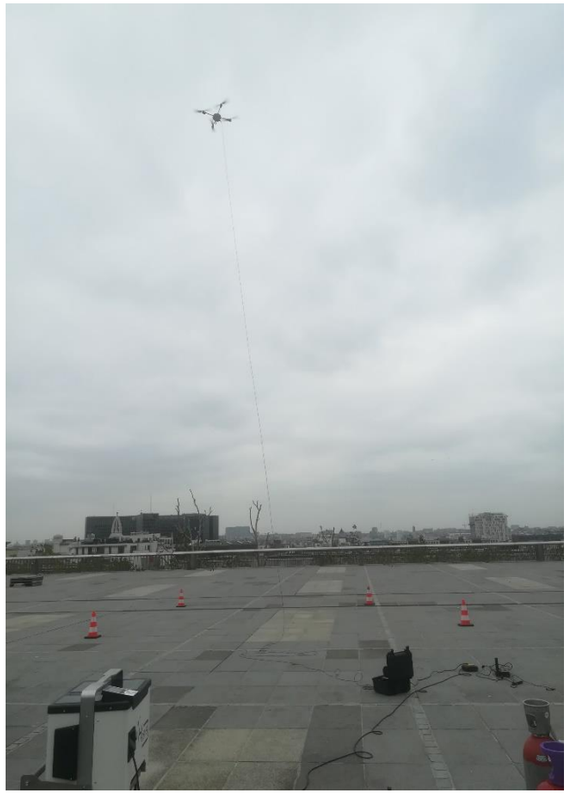
Performances \ H2 Power range	BOXHY 1	BOXHY 2	BOXHY 5	BOXHY 8
Fuel cell power (W) – Eco mode	650	1000	3200	3200
Full power (W) – Boost mode	1100	3150	5200	8340
Boost mode duration time (min)[1]	20	30	30	20
Plug current and output voltage	2 x 16A – 230 VAC		2 x 16A + 1 x 32A – 230/400 VAC	
Sizes (mm)[2]	500 x 440 x 580		700 x 440 x 580	
Weight (kg) [2]	25	40	65	80

[1]Boost mode provide with battery. Customizable parameter – [2]Sizes and weight may vary without prior notice according to specifications.

Hydrogen	
H2 specifications[3]	Minimum quality grade 3,5 (99,95%)
H2 inlet pressure with external tank	Min 2,5 barg – Max.10 barg
H2 filling (with optional H2 tank)	Fueling in 350 bar hydrogen station

[3] According to quality characteristics of Type 1, Grade E and Category 3 hydrogen fuel specified by ISO 14687-3:2014.

BOXHY®: Examples of outdoor use



H2SYS References list

Stationary and mobile applications

H2SYS References :

Success Story

WeLoveGreen- France

- Provide a music festival with electricity from a hydrogen genset
- Commissioning: May 2019
- Partnership between ENGIE (gas provider) and H2SYS for the power supply on a start-up village in the We Love Green festival (Paris)

CLEAN, QUIET, RELIABLE

HYDROGEN: A SOLUTION FOR A SUSTAINABLE FUTURE

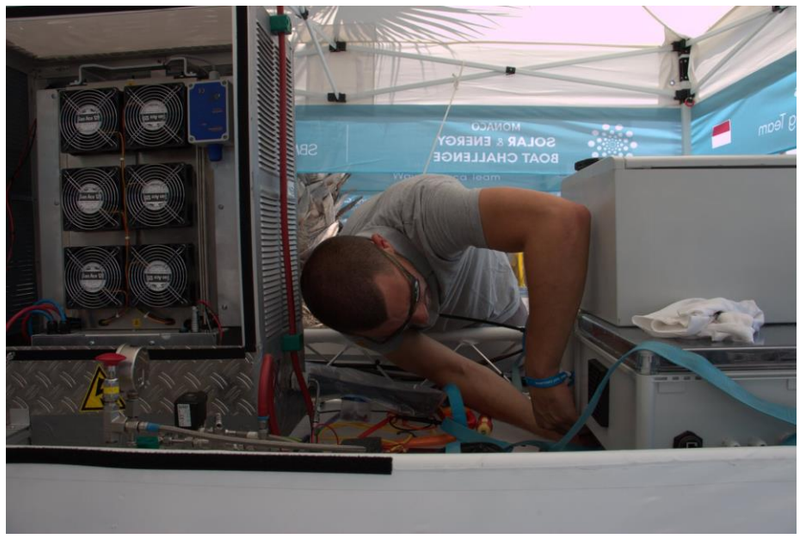
H2SYS References :

Success Story

SBM offshore - Monaco

Renewed partnership:
S&BC Race 2020 – 2021 editions

- Running a boat on hydrogen: Torqeedo 5 kW electric motor
- Commissioning: June 2019 for the Energy and Solar Boat Challenge
- Integrator partner: SBM Offshore
- H2SYS services: realization of the electrical diagrams and supply of a 3 kW fuel cell + 48 Vdc DC/DC converter and a Modbus supervisor



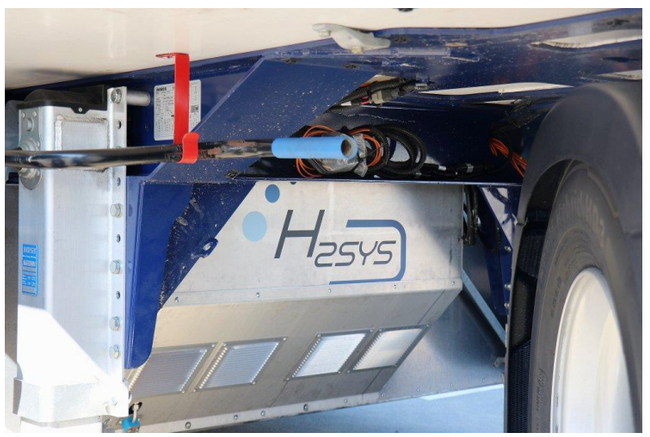
CLEAN, QUIET, RELIABLE
HYDROGEN: A SOLUTION FOR A SUSTAINABLE FUTURE

H2SYS References :

Success Story

Projet Road - France

- 1st refrigerated truck powered by hydrogen
- Commissioning: July 2019
- H2SYS subcontractor for the design of the hydrogen generator (15 kVA) and the onboard H2 storage.



CLEAN, QUIET, RELIABLE

HYDROGEN: A SOLUTION FOR A SUSTAINABLE FUTURE

Contacts

General management	Sébastien FAIVRE, CEO sebastien.faivre@h2sys.fr +33 3 84 58 36 53
Sales & Marketing	Bertrand BAUCHARD, Sales & Marketing Director bertrand.bauchard@h2sys.fr +33 6 70 81 98 16
OEM projects	Théophile HABERMACHER, Commercial Manager theophile.habermacher@h2sys.fr +33 6 88 79 65 90