

EMITECH GROUP:

HYDROGEN ACTIVITIES

*January 2022*

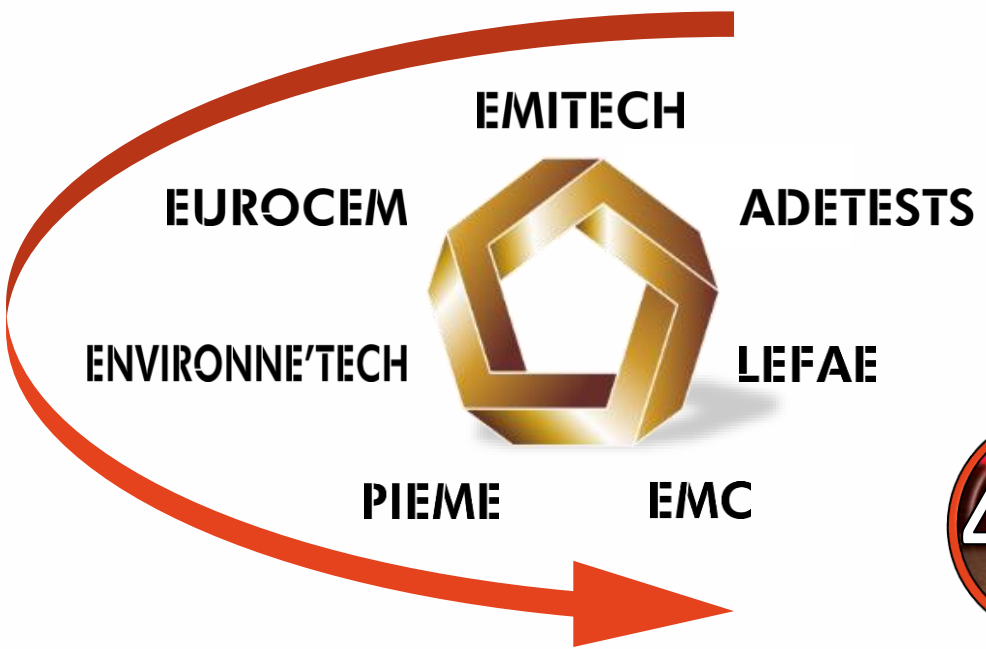
**H<sub>2</sub>**  
**EMITECH**  
**ENVIRONNE'TECH**  
**LEFAE**



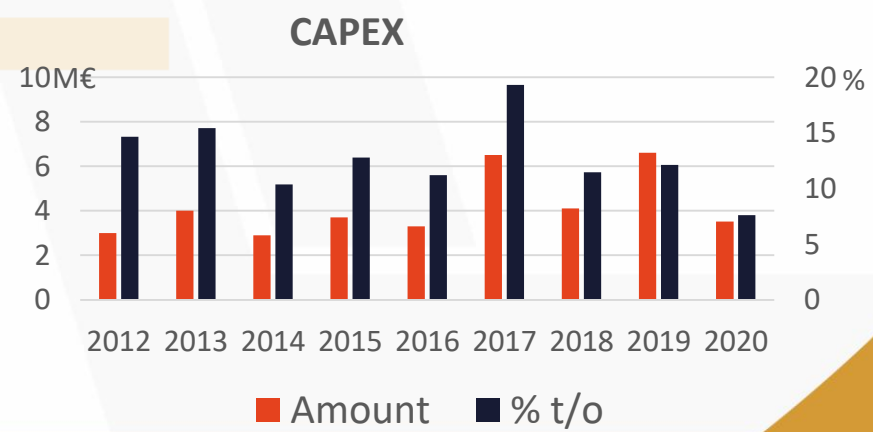
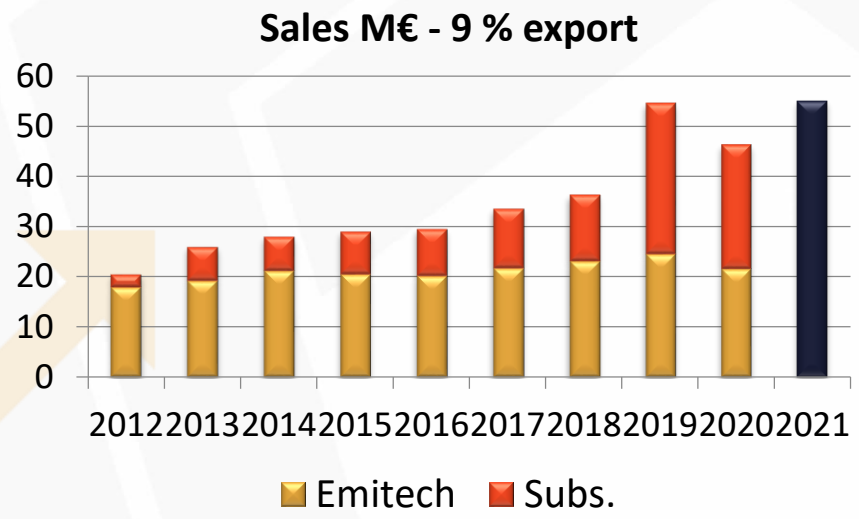
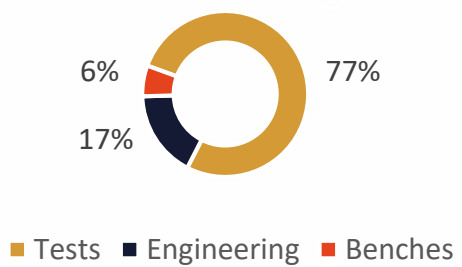
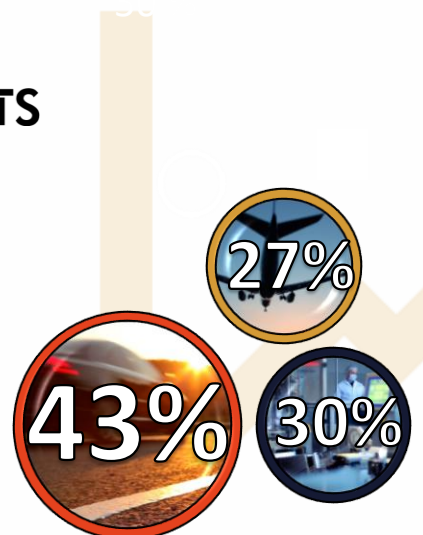
*Nous transformons vos essais en succès !*

# 1. EMITECH GROUP

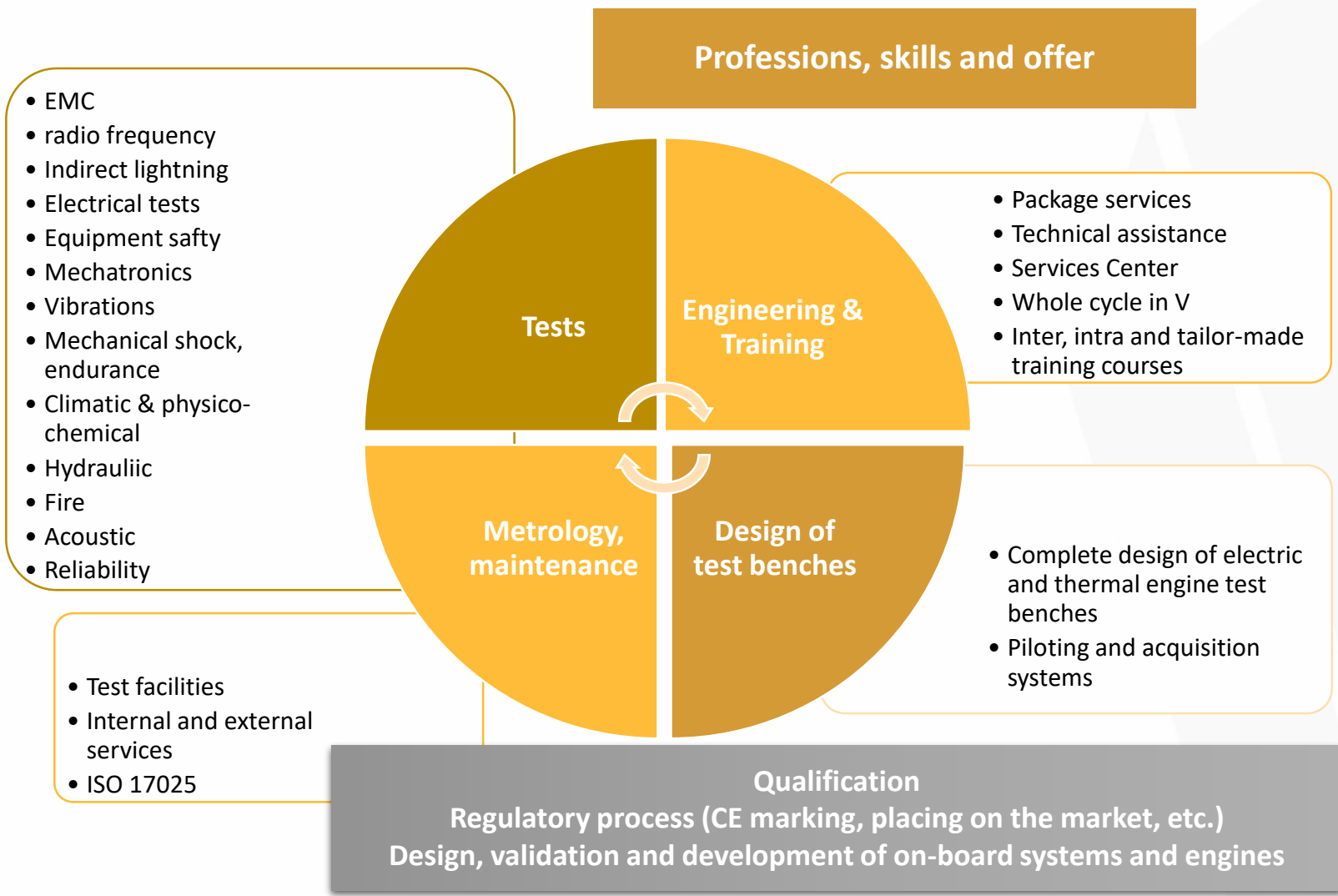
# FIGURES OVERVIEW



**Emitech SAS** and its 6 subsidiaries  
**Headquarters** - Montigny-le-Bretonneux (78)  
**16 labs** – 37.000 m<sup>2</sup>  
**180** simultaneous test campaigns  
**Independant Group**  
 Turnover – **55 M€**  
**530** employees



# OUR SKILLS - SUMMARY



## Recognitions and accreditations



## OEM accreditations



# CUSTOMERS PORTFOLIO (SOME OF)



## OEM – Tier 1

Logos of OEM and Tier 1 suppliers including:

- BOSCH
- STELLANTIS
- PORSCHE
- Continental
- faurecia
- veoneer
- Valeo
- SAFT
- Ferrari
- HELLA
- Autoliv
- MAGNA
- FLASTIC OMNIUM
- TOTAL
- BorgWarner
- RENAULT NISSAN
- MAHLE
- Eberspächer
- MASERATI

## FUEL CELL STACKS / H2

## BATTERIES

## E - MOTORS

## POWER ELECTRONICS

Logos for Fuel Cell Stacks / H2:

- faurecia
- SYMBIO - ZERO EMISSION MOBILITY SOLUTIONS
- FLASTIC OMNIUM
- EODev

Logos for Batteries:

- BMZ - THE INNOVATION GROUP
- VOLVO
- RENAULT NISSAN
- STELLANTIS
- TUV SUD
- DRAXLMAIER
- smart
- DAIMLER
- BlueSolutions
- SAFT - a company of TOTAL
- FORSEE POWER
- PowerTech - ADVANCED ENERGY STORAGE SYSTEMS

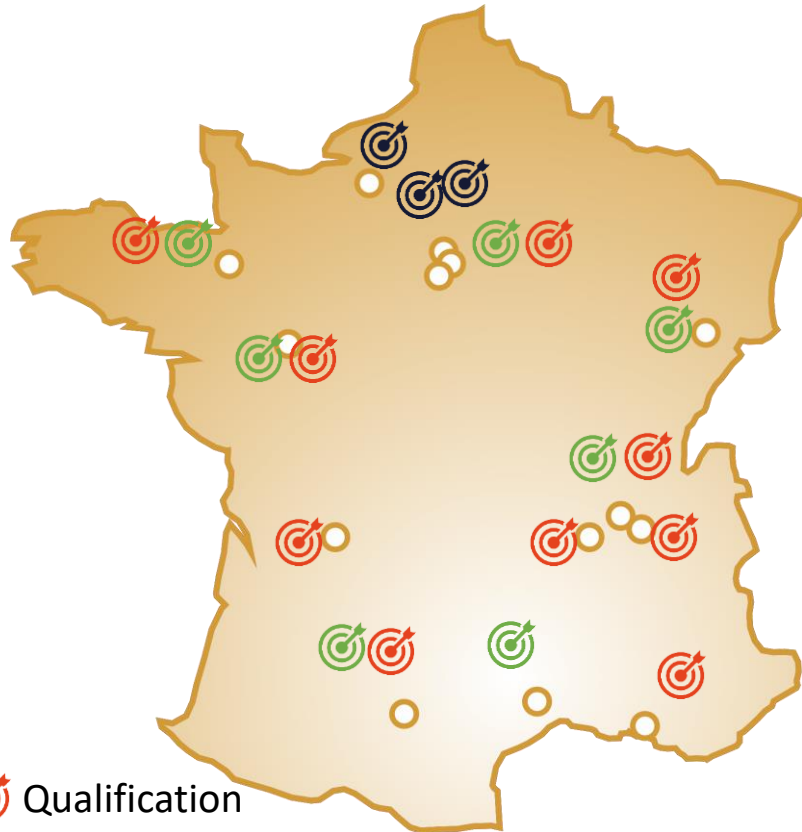
Logos for E - Motors:

- EMOTORS
- Valeo SIEMENS eAutomotive
- Valeo 48V

Logos for Power Electronics:

- Valeo SIEMENS eAutomotive
- EATON
- APOJEE
- punch powertrain - Gear up for the future

# OUR FOOTPRINT



 Qualification

 Regulatory process

 Conception, validation and development of onboard systems and engines

- Electromagnetic compatibility
- Radiofrequency
- Indirect lightning
- Electrical tests
- Equipment security
- Mecatronics
- Vibrations at low, medium and high frequencies
- Mechanical, endurance
- Climatic and Physico-chemical tests
- Hydraulics
- Fire
- Acoustic
- Durability, Reliability

## Ile-de-France

Montigny Le Bretonneux (2),  
Achères, Bosroumois, Osny

## Grand Est

Sochaux

## Rhône-Alpes

Lyon, Bourgoin-Jallieu,  
St-Chamond

## Grand Sud

Montpellier, Marignane

## Grand Ouest

Rennes, Angers (2)

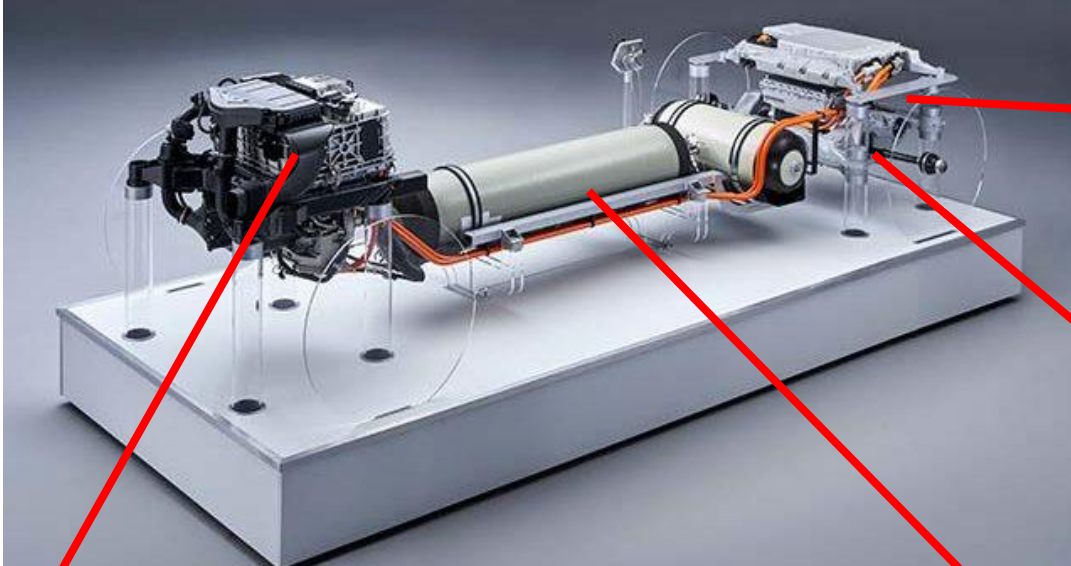
## Sud Ouest

Angoulême, Toulouse



## 2. HYDROGEN ACTIVITIES

# COMPLETE H<sub>2</sub> POWERTRAIN VALIDATION



## Fuel cell stack

(according to OEM specifications)

- Environmental test (EMC, Electrical, Mechanical, Climatic ...) with H<sub>2</sub> filling systems available in our laboratories / our test means (ex : shielded room, climatic chamber ...)

## Batteries

(ECE R100 Rev 2, ECE R10, UN38.3...)

- Characterization and tuning tests
- Validation tests (cycling, EMC, vibrations, fire, abusive...)

## E-motors

(ECE R10, R85, R101,...)

- Characterization and tuning tests
- Validation tests (EMC, Electrical...) : 250kW Emotor system integrated inside shielded room available !

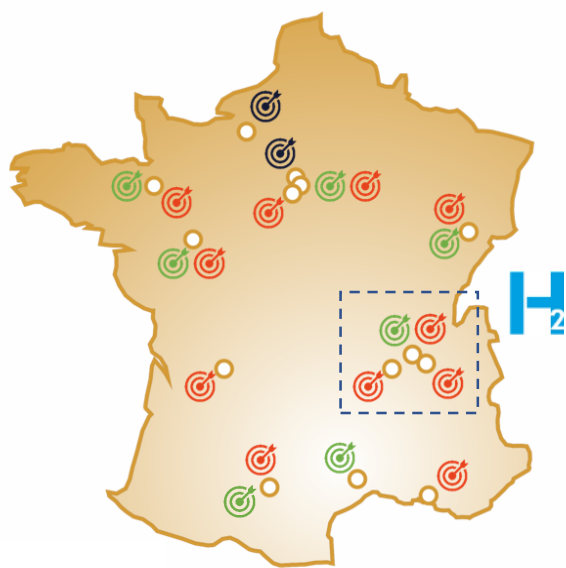
## Hydrogen tank, Valve

(R134, ISO/TR 15916, SAE J2579...)

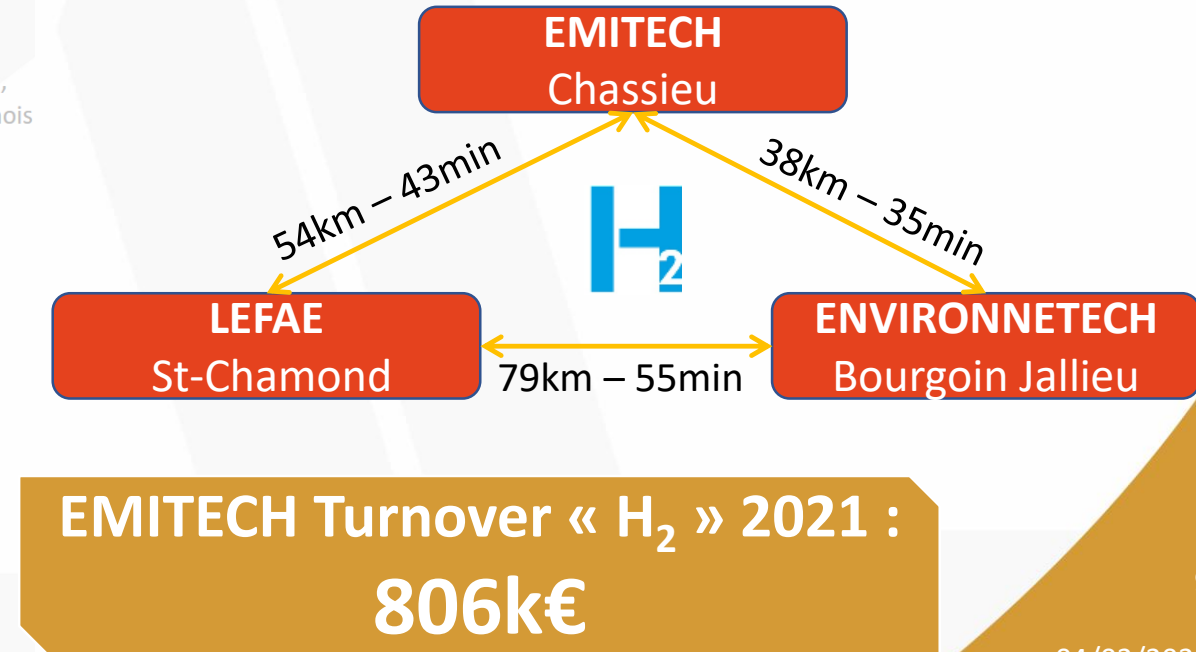
- Hydraulic and pneumatic testing
- Shock and fire tests
- Reliability tests (TPRD and valves)

# EMITECH H2 ACTIVITIES

- History: Start of Hydrogen activities within EMITECH group in mid-2020.
- ENVIRONNE'TECH and EMITECH laboratories, located respectively in Bourgoin-Jallieu (Isère) and Lyon-Chassieu (Rhône), are able to perform environmental test (MECA/CLIM + EMC/ELEC) for complete system / fuel cell stack H<sub>2</sub>. For example, testing of **45kW fuel cell stack** complete system, qualified in full load configuration (300A<sub>dc</sub> to 400A<sub>dc</sub> current at FC outputs) for automotive applications.
- LEFAE laboratory is specialized in tank testing, including fire tests. Lab capabilities are still growing toward **Type IV H<sub>2</sub> tank testing activities**.
- Depending on test requests from our customers, H<sub>2</sub> installation of « pilot » laboratories can be duplicated in another EMITECH lab. In addition, complementary testing can be performed in other Emitech facilities, as the free field site in Aunainville (Eure et Loire), like CE Marking, already performed on **H<sub>2</sub> power generator** (60kVA).



<b>Ile-de-France</b>	Montigny Le Bretonneux (2), Dourdan, Achères, Bosroumois
<b>Grand Est</b>	Sochaux
<b>Rhône-Alpes</b>	Lyon, Bourgoin-Jallieu, St-Chamond
<b>Grand Sud</b>	Montpellier, Marignane
<b>Grand Ouest</b>	Rennes, Angers (2)
<b>Sud Ouest</b>	Angoulême, Toulouse



# EMITECH TEST LABS FOR H<sub>2</sub> EQUIPMENTS / APPLICATIONS


**EMC:** Development / performance / endurance tests (Bosroumois)

**EMC:** Test bench design department / Development tests (Achères)





**LEFAE:** Tank tests / Fire tests (St Chamond)

**EMITECH:** EMC Test **Battery** LV/HV (Montigny Le Bretonneux)

**EMITECH:** EMC Test **Fuel cell stack / systems / hydrogen EUT** (Lyon) 

**ENVIRONNE'TECH:** Environmental tests (MECA/CLIM) + **Fuel cell stacks / systems / hydrogen EUT** (Bourgoin-Jallieu) 

+ **EMITECH:** Free field site (Aunainville - 28) for EMC civil application – CE marking, for example on **H<sub>2</sub> power generator**

-  Qualification
-  Regulatory process
-  Conception, validation and development of onboard systems and engines
-  « Pilot » Laboratory, with H<sub>2</sub> distribution system available (new activity, started in 2020)

# UPDATE: ACHIEVABLE TEST STANDARD / TEST SPECIFICATIONS

EMITECH development is still going on, by increasing our capabilities above the requirements of classic test standards / test specifications: we are now able to support you with specific tests required for equipment including hydrogen !

Example below with several automotive and H2 dedicated standards:

## H<sub>2</sub> STANDARDS:

IEC 62282-x-xxx (fuel cell stack and equipment including hydrogen)

EC79/2009-UE406/2010 (equipments and tanks)

UN/ECE No. 134 (tanks)

ISO 11119 (tanks)

ISO 19880 (devices)

SAE J2579\_201806

## Non-H<sub>2</sub> STANDARDS also applicable on H<sub>2</sub> systems:

ECE R 10

Customer specifications (ex : PSA B21 7110 et 7112 ; RSA...), see complementary list in the next slide.



Tests are also applicable on aerospace, military, railway, marine, industrial applications with associated standards already mastered by the labs of the group.

# UPDATE: ACHIEVABLE TEST STANDARD / TEST SPECIFICATIONS FOR ENVIRONMENTAL TESTS (AUTOMOTIVE APPLICATIONS)

EMC / ELECTRICAL TESTS

MECA / CLIM TESTS

## LV Low voltage

## HV High Voltage

Test Standards

ISO 16750-3 (Meca) / ISO 16750-3 -4 (Clim) / ISO 16750-3 -5 (Chimical)

CISPR25 (emissions)  
ISO 11452-1 à 11 (immunity)  
ISO 11451 (immunity, vehicle level)  
ISO 16750-2 (electrical)  
ISO 7637 -1 à -3 (transient, emission and immunity)  
ISO 10605 (ESD)

Manufacturer specifications

**All manufacturers specifications** including :  
PSA [B21 7110]  
RSA (Renault) [36-00-808]  
VW [LV124]  
Nissan [28401 NDS xx]  
Toyota ( [TSC xxx] (specific)  
Jaguar JLR [JLR-EMC-CS- v1.0] (specific)  
Volvo [515-003]

Mainly :  
PSA [B21 7120 Meca ; B21 7130 Clim]  
RSA (Renault) [36-00-802]  
VW [LV124]

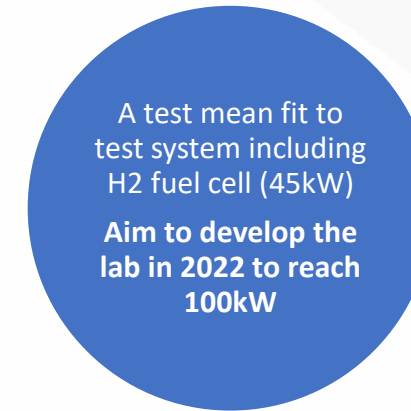
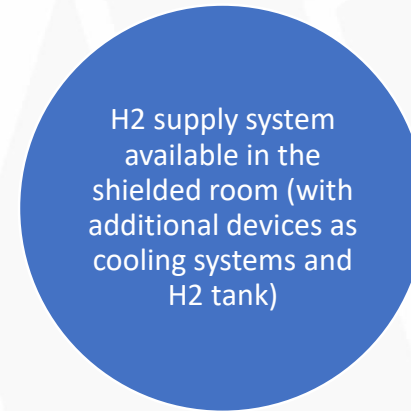
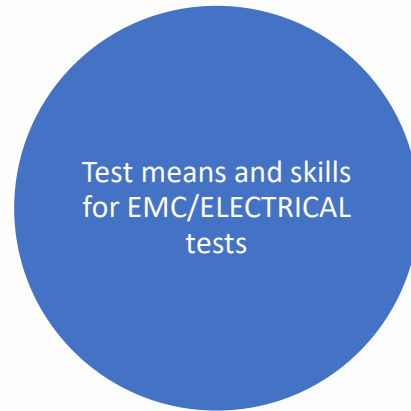
Mainly : RSA (Renault) [RNDS-C-00513]  
PSA [B21 7112]  
VW [LV123]  
Volvo [31857169]

12

04/02/2022

# EMITECH H<sub>2</sub> — EMC AND ELECTRIC TESTS

- OUR CONCEPT :



Chassieu shielded room  
Size : 70m<sup>2</sup> (LxH):  
11.16m x 6.2m x 5.35m  
Equipped with DC LV / DC  
HV filters + AC filters + all  
classic test means required  
for EMC Testing.

EMITECH is able to perform  
mostly all standards and  
automotive specifications in  
the field of EMC and  
ELECTRICAL qualification  
tests.

H<sub>2</sub> distribution system with  
safety devices, air extraction,  
H<sub>2</sub> tank station (4 x V18 rack for  
a total amount of 56kg of H<sub>2</sub> at  
200 bars), H<sub>2</sub> safety detection  
sensor

# EMITECH H<sub>2</sub> — EMC AND ELECTRIC TESTS

2022 future development is to reach 100kW capabilities (45kW now)

- EMITECH Chassieu (69) :

A laboratory dedicated to **EMC and ELECTRICAL tests**, ready for qualifications of all kind of equipments including high-power Fuel-Cell systems.



« H2 ready » Shielded room

« H2 » storage facilities and distribution system including safety sensors

Cooling system

Additional services (power supplies, filters, LISN, High current LISN, HVDC load rejection on the grid...)

EMC test means and skills (emissions/immunity)

# EMITECH H<sub>2</sub> — EMC AND ELECTRIC TESTS IN FREE-SPACE ZONE

- **EMITECH Aunainville (28) :**

- A site with a **free-space zone** allowing testings of all kinds of equipments, including Hydrogen systems.
- Test zone dedicated to **Civil applications / CE Marking**.
- History EMITECH 2021 : CE Marking test campaign (according to Directive CEM 2017/30/UE ; IEC 61000-6-1/2/3/4) on **H<sub>2</sub> power generator** (tested with 60kVA loads).



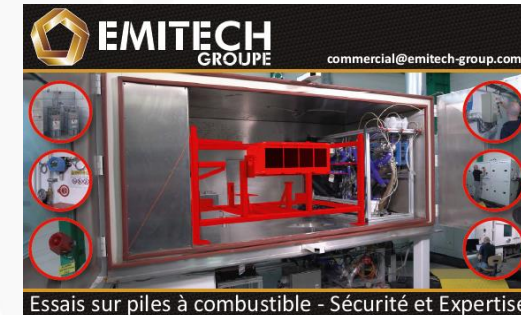
# EMITECH H<sub>2</sub> — MECHANIC AND CLIMATIC TESTS

2022 future development is to reach 100kW capabilities (45kW now)

## • ENVIRONNETECH Bourgoin Jallieu (38) :

A laboratory dedicated to **MECHANICAL and CLIMATIC tests**, equipped with **specific test means** (mostly developed in-house) to cover every conditions of every fields and applications (Aerospace, Military, Automotive, Rail, Marine, Civil industry...). A specific zone has been adapted to fuel cell and H2 applications.

Internal development by ENVIRONNETECH engineering department: custom climatic chamber to test a complete fuel cell systems in respect with safety rules.



Essais sur piles à combustible - Sécurité et Expertise



Centres d'essais CEM, mécaniques, climatiques et physico-chimiques

Nous disposons de l'expertise et des moyens requis pour qualifier vos piles à combustibles en regard des exigences en environnement requise par vos donneurs d'ordre

Adaptabilité

Réactivité

Disponibilité

Des essais en fonctionnement sous alimentation en hydrogène

Nos essais CEM et climatiques sont réalisés avec la pile en combustible alimentée en H<sub>2</sub>.

Nous gérons le stockage H<sub>2</sub>, sa distribution jusqu'à nos moyens d'essais, la sécurité des installations (capteurs, extracteurs...) et les servitudes associées aux piles à combustible.



EMITECH EUROCEM ADETESTS ENVIRONNETECH DIRAC PIEME LEFAE EMC

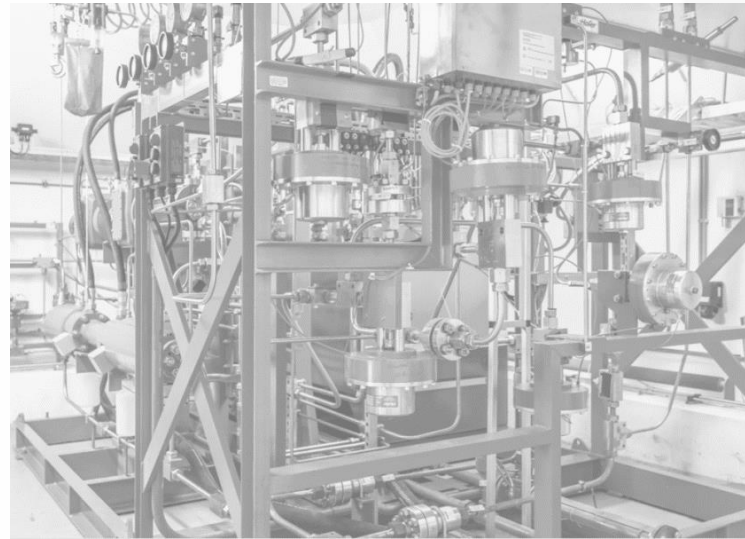
# EMITECH H<sub>2</sub> — FIRE AND TANK TESTS

- LEFAE – Saint-Chamond (42) :

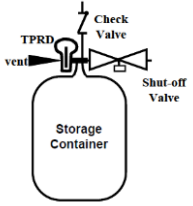
A laboratory dedicated to **MECHANICAL AND CLIMATIC TESTS** with a unique skills in the group for **FIRE tests**. Available capabilities to **test tanks** (hydraulic and pneumatic tests: endurance, overpressure, burst pressure, drilling ...).

To increase the existing offer: Improvement of existing tests (classic tank type I or II) and development engaged to become a **type IV H<sub>2</sub> tank test laboratory**.

20 years of experience in developing test benches and test methods to perform qualifications on systems.

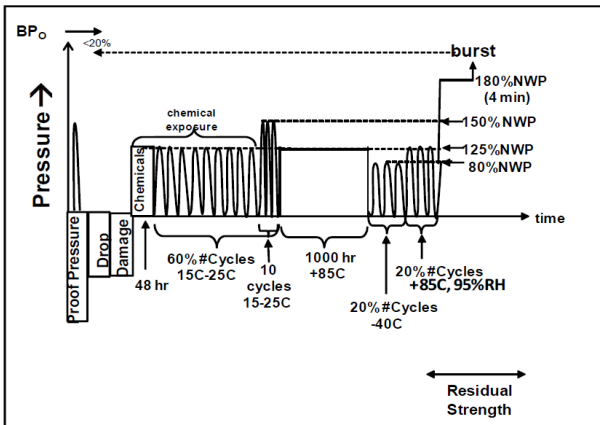


# EMITECH H<sub>2</sub> — FIRE AND TANK TESTS



• LEFAE – Saint-Chamond (42) :

Test benches internal development by LEFAE engineering department, potentially adapted to requirements and specificities of the customer products.



## Test feasibility matrix UNECE R134

Addendum 133 – Regulation No. 134	Requirement	Means	LEFAE Approach	Delay for Approach
<b>Verification tests for baseline metrics</b>				
Baseline initial burst pressure	2,25xNWP or 3,5xNWP	Pressure bench	Standard test	2 Weeks
Baseline initial pressure cycle life	1,25 x NWP	Pressure bench	Standard test	2 or 4 months (**)
<b>Verification test for performance durability (sequential hydraulic tests)</b>				
Proof pressure test	1,5 x NWP	Pressure bench	Standard test	2 Weeks
Drop (impact) test	Not applicable	Drop zone	Standard test	4 Weeks
Surface damage	Not applicable	Pendulum	Standard test	4 Weeks
Chemical exposure and ambient temperature pressure cycling tests	1,25 x NWP	Pressure bench	Standard test	2 or 4 months (**)
High temperature static pressure test	1,25 x NWP	Pressure bench Climatic chamber	Standard test	4 Weeks
Extreme temperature pressure cycling	1,25 x NWP	Pressure bench Climatic chamber	Standard test	4 months (**)
Residual proof pressure test	1,8 x NWP	Pressure bench	Standard test	2 Weeks
Residual strength Burst	0,8 x BPinit	Pressure bench	Standard test	2 Weeks
<b>Verification test for expected on-road performance (sequential pneumatic tests)</b>				
Proof pressure test	1,5 x NWP	N2 Pressure bench	Standard test	2 Weeks
Ambient and extreme temperature gas pressure cycling test (pneumatic)	1,15 x NWP	H2 Pressure bench	Not engaged	Not applicable
Extreme temperature static gas pressure leak/permeation test (pneumatic)	1,25 x NWP	H2 Pressure bench	Not engaged	Not applicable
<b>Verification test for service terminating performance in fire</b>				
Fire test	NWP	N2 Pressure Fire bench	Standard test	4 Weeks

# EMITECH H<sub>2</sub> — FIRE AND TANK TESTS

- **LEFAE – Saint-Chamond (42) :**

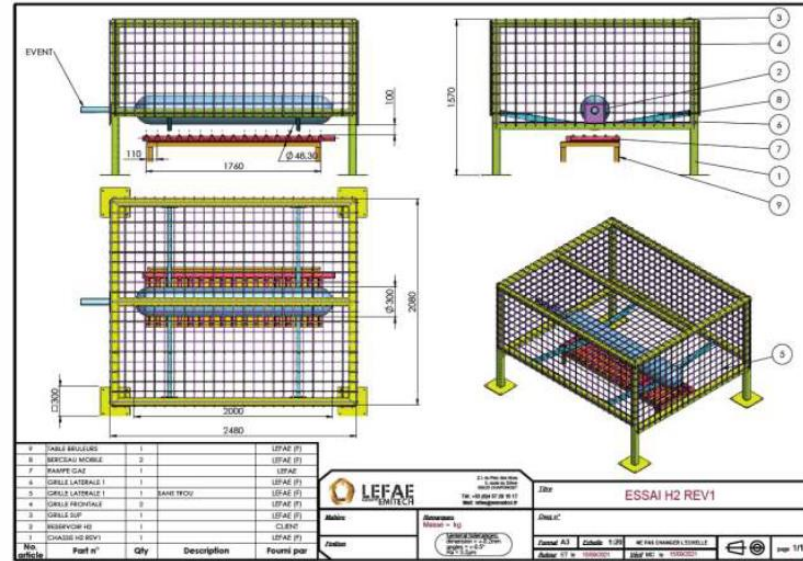
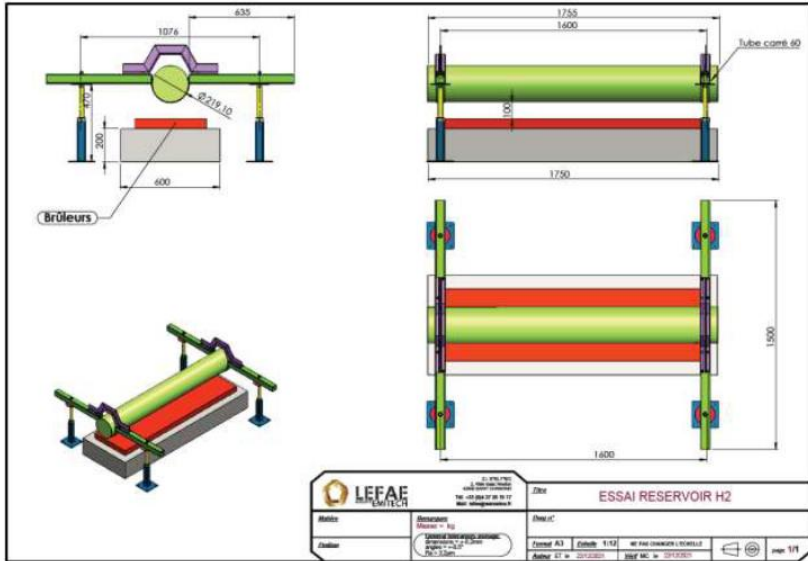
**New test bench developed by the LEFAE engineering department (2022): Fire test bench according to UNECE R134 specifications.**

Test Bench able to generate Localized Fire Exposure and Engulfing Fire.

Test Performance on tank filled with AIR / WATER / AZOTE.

Test applicable with or without overpressure.

Test with tank filled with HYDROGEN not possible at this time.



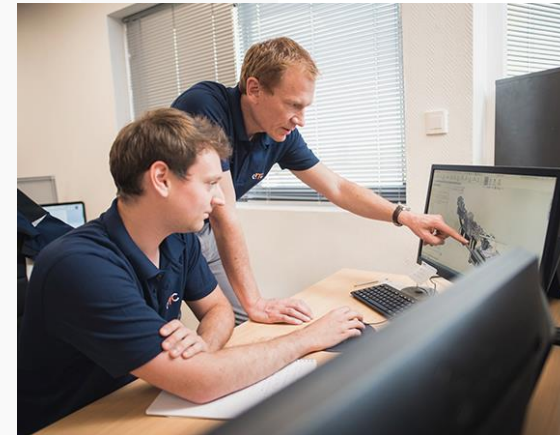
→ Test bench burner view during validation / development phase.

# EMITECH H<sub>2</sub> — CONVERSION OF THERMAL TEST BENCH TO H<sub>2</sub> TEST BENCH

- EMC – BU test bench – Achères (78) :

An **engineering department** dedicated to **test benches and associated equipments developments**, to support customers in the conversion of their « classic » test bench to "H<sub>2</sub>" test mean:

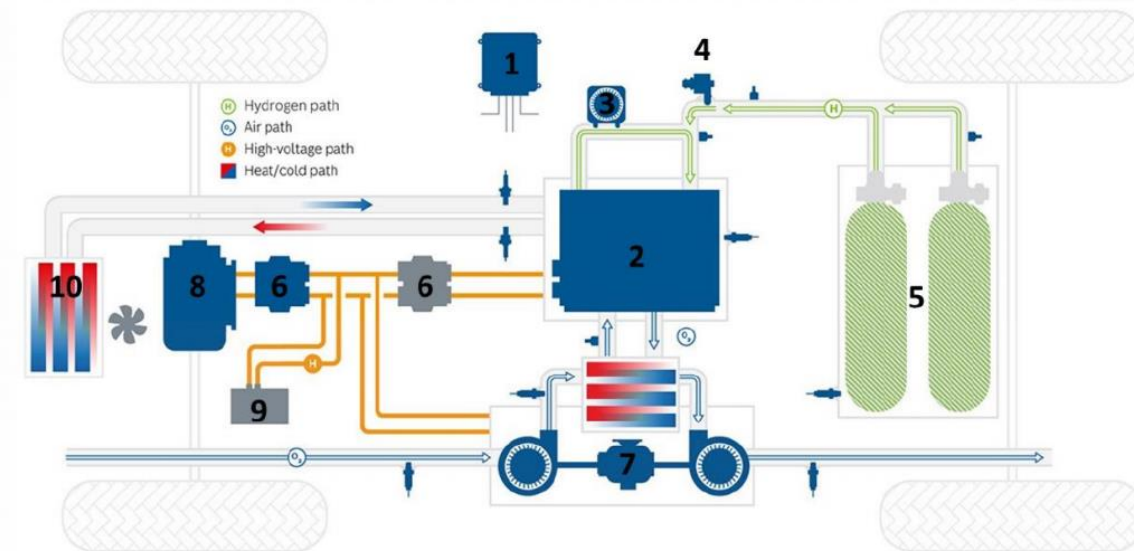
- Support for risk analysis, with notified certification body
- Specification, sizing and choice of requested equipments.
- Synoptics, schemes and integration plans in the customer site.
- Integration and installation in the customer site with management of building site operations.



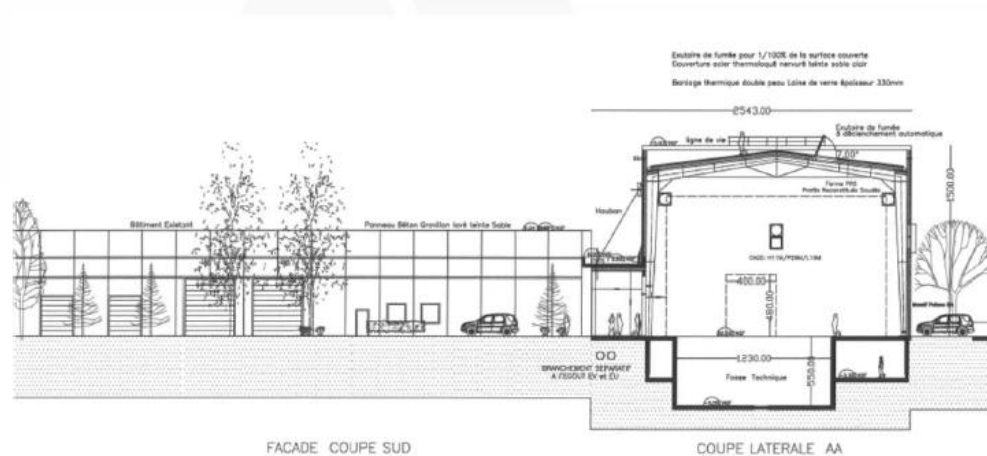
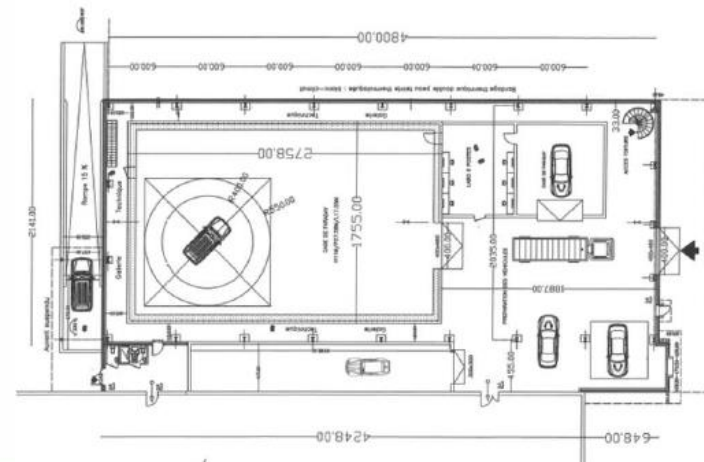
# EMITECH ACTIVITIES COVERING MATRIX



Item	Tested devices	Functional tests	Qualifications & validations tests
1	Fuel cell control unit	X	X
2	Fuel cell stack		X H <sub>2</sub>
4	Hydrogen gas injector	X H <sub>2</sub>	X H <sub>2</sub>
5	Hydrogen high pressure tank		X
6	Electric converter	X	X
7	Electric air compressor	X	X
8	E-motor	X	X
9	Battery LV/HV	X	X
10	Intercooler	X	X
	Complete system	X	X



- Increase of environmental lab testing capabilities to reach **100kW for Fuel-Cell systems** in EMITECH at Chassieu (EMC) and ENVIRONNE'TECH at Bourgoin-Jallieu (MECA / CLIM).
- Test benches development and increase of **test tank capabilities** in LEFAE laboratory at Saint-Chamond (EC79, R134...).
- ENVIRONNE'TECH **Buidling adaptation** with dedicated zone for Batteries and **Hydrogen testing activities** (MECA / CLIM).
- Potential installation of a **H2 refuelling station** near the future huge shielded room « ADAS » dedicated to automotive applications at montigny-le-Bretonneux (Shielded room 28m x 18m x 15m for vehicle testing, including road simulator roller test bench with 6T axle weight capabilities associated to a 11 meters turntable).



Your unique contact in the EMITECH group for all hydrogen activities:

**Julien FLOCH**

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More pieces of informations available on our websites:

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[www.lab-lefae.com](http://www.lab-lefae.com)

[www.environnetech.fr](http://www.environnetech.fr)

[www.emcfrance.fr](http://www.emcfrance.fr)