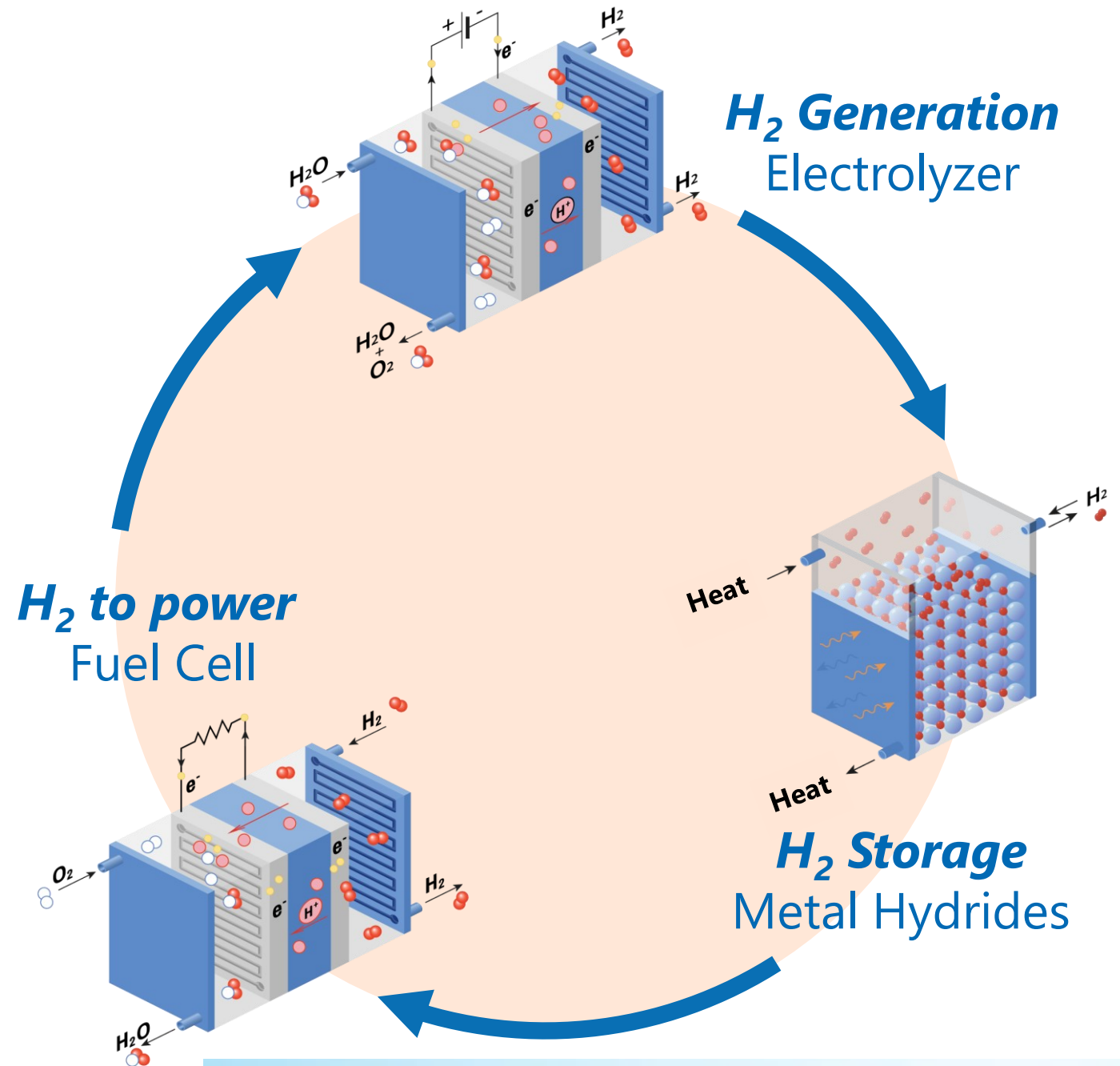




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- *System integrators*
- *Hydrogen projects*
- *Product developers*
- *Hydrogen tech specialists*
- *Hydrogen R&D*





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PART 1 (s. 3-9)

Showcase of BER H₂ projects

PART 2 (s. 10-16)

Electrolyzer product development



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ENPHOS



1 MW PEM Electrolyzer
preliminary design

2023-2024: 160 kW PEM Electrolyzer
design and installation



12/09/24 IDROGENO SICURO E SOSTENIBILE

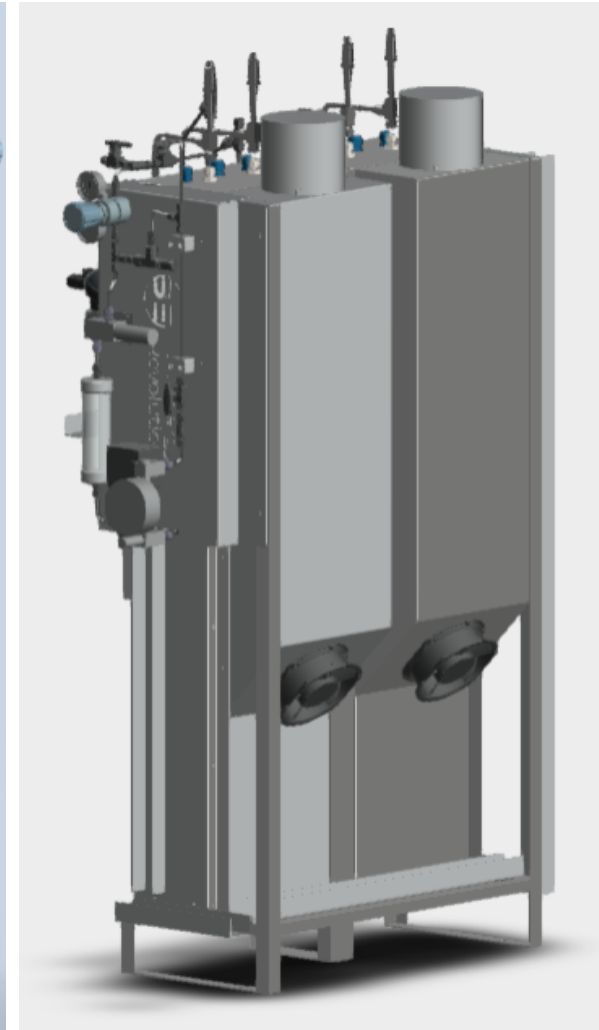
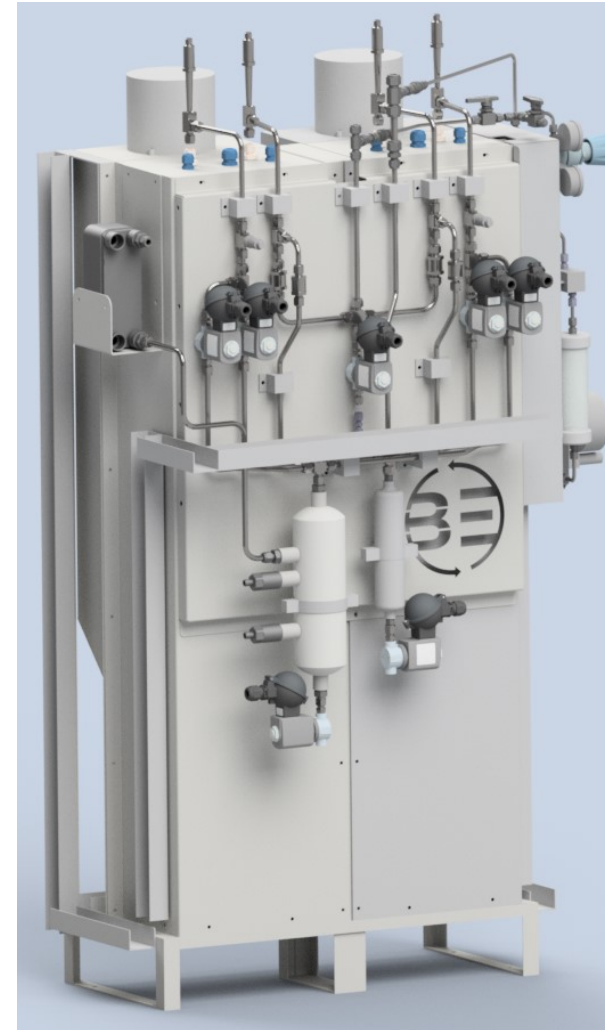
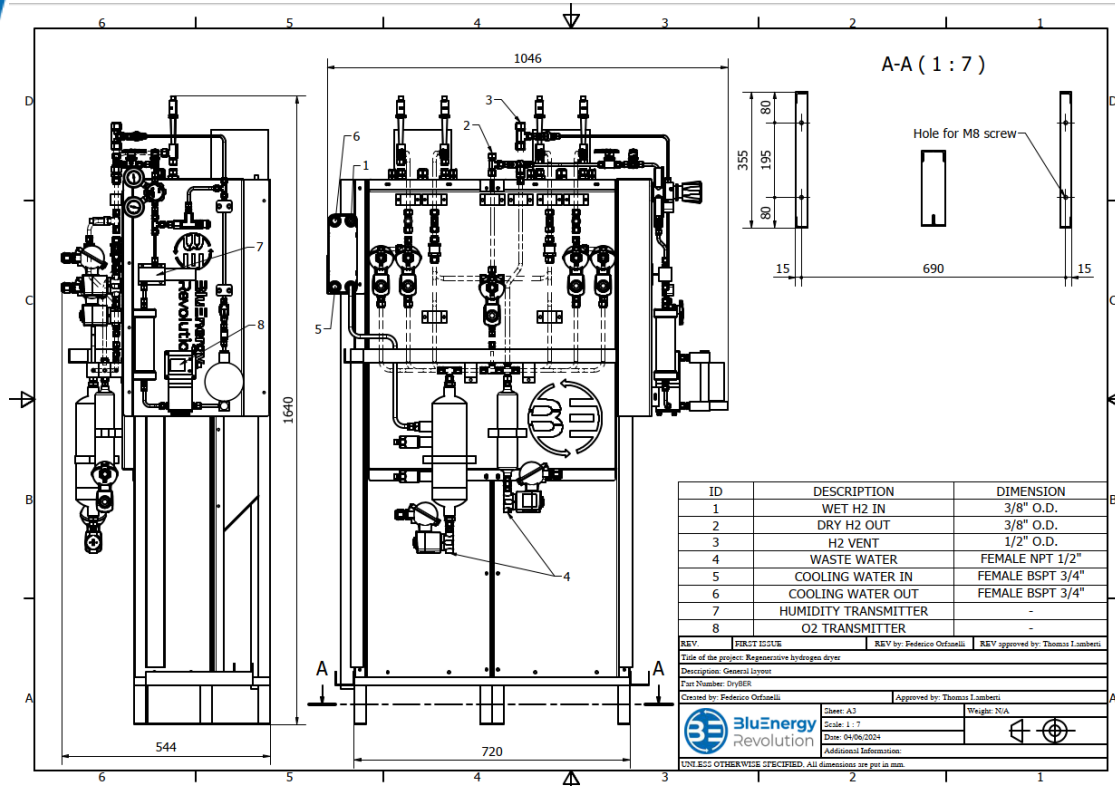




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2023-2024: Regenerative Dryer Product

CE marking pending



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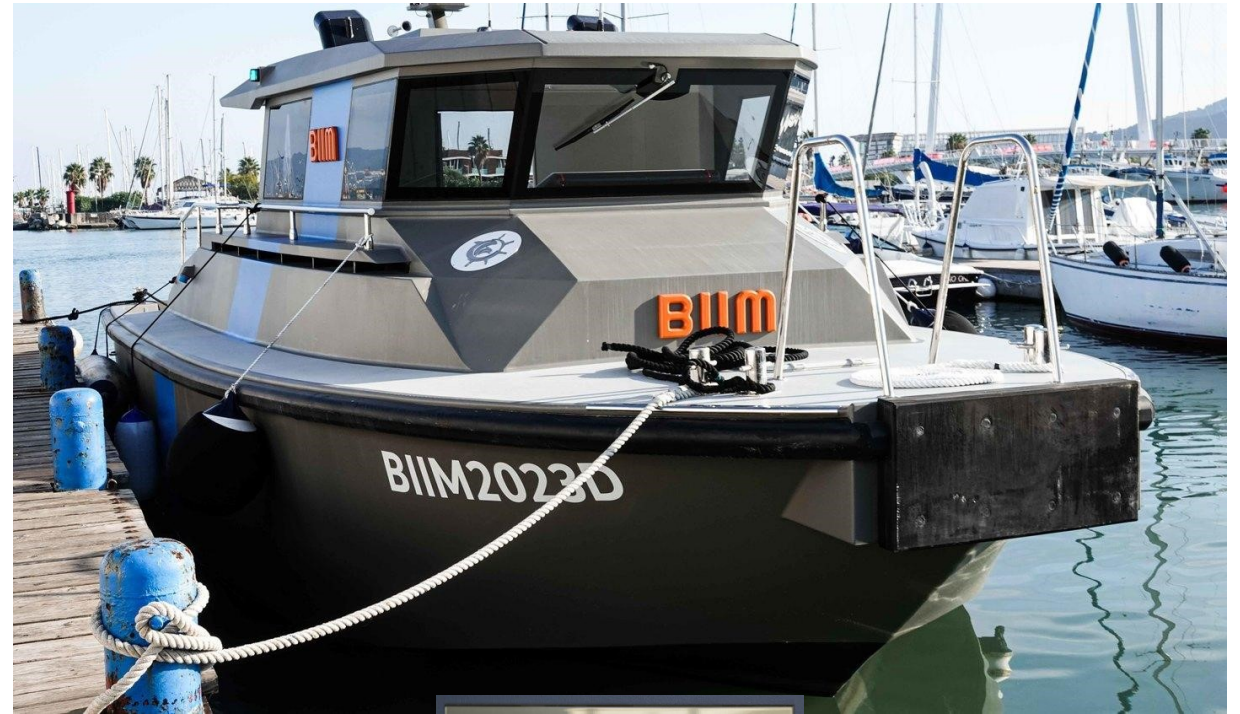


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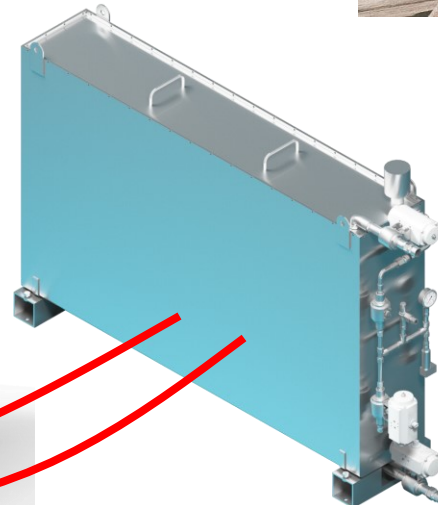
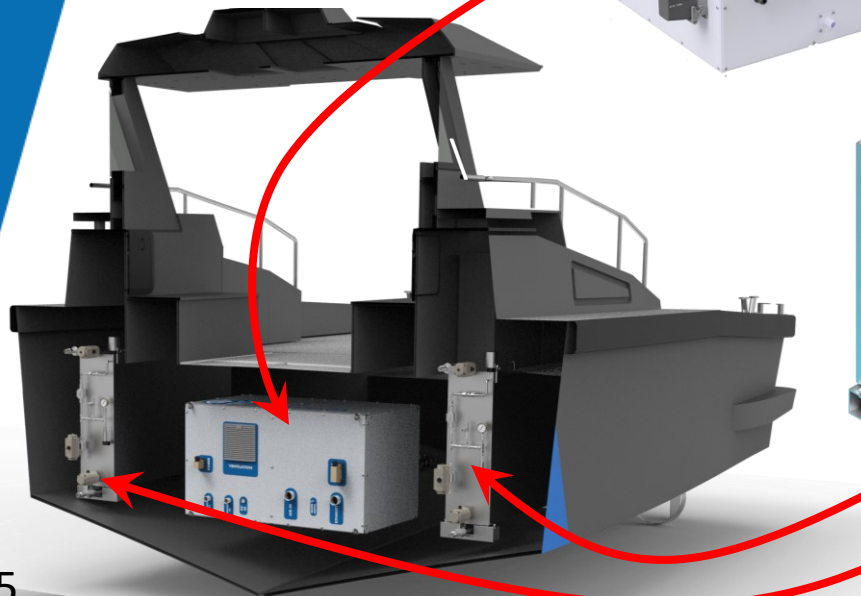
for the BIIM project

2021-2024: BIIM project

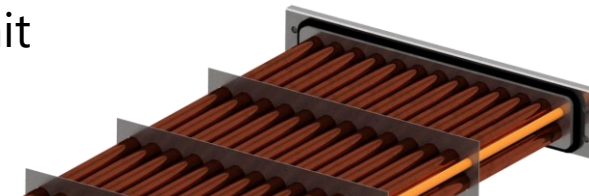
Battello Ibrido ad Idrogeno Modulare



45 kW Fuel Cell



2 x Metal hydride Storage unit
(7 kg H₂ storage)



12/09/24 IDROGENO SICURO E SOSTENIBILE





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BAGLIETTO
1854

2022-2024: Baglietto

Electrolyzers and H₂ Storage system integration



12/09/24 IDROGENO SICURO E SOSTENIBILE



2023-2024: SITAV

Fuel Cell Power system for the railway sector



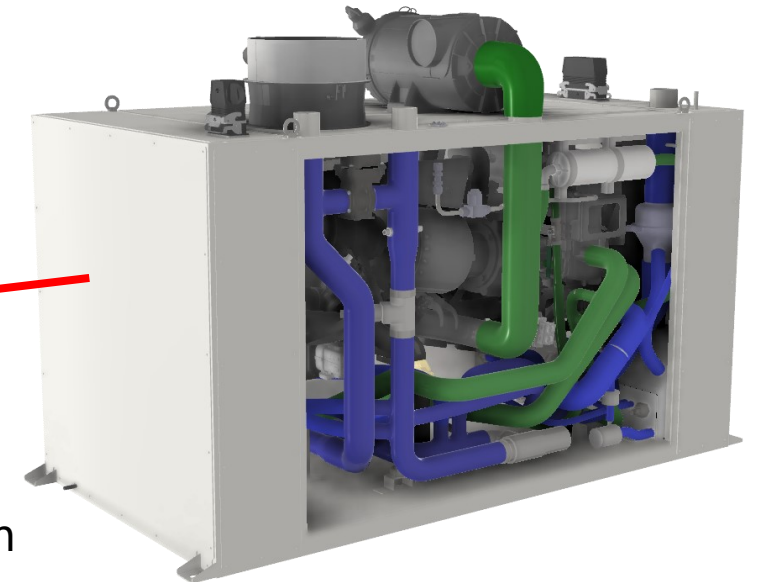
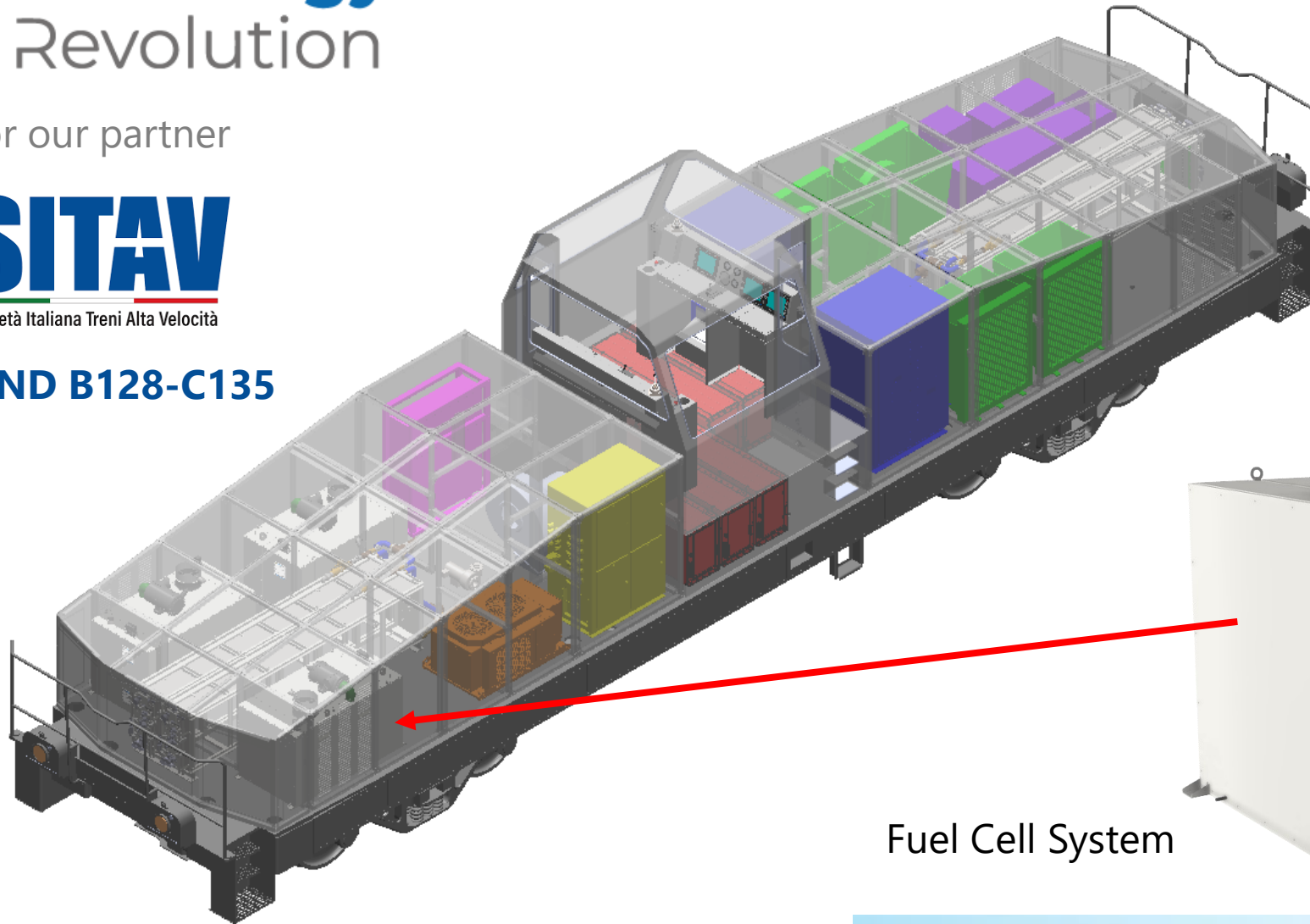
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SITAV

Società Italiana Treni Alta Velocità

STAND B128-C135



Fuel Cell System

7 Shunting locomotive equipped with H₂ technologies

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2021-2024: MOSE 7 kW PEM Electrolyzer prototyping, design and product development

👉 CE marking ongoing!



MOSE

⚡ MODULAR
SMART
ELECTROLYZER



STAND D192

Product preseries launch: April 2023

First product installation: November 2024

12/09/24 IDROGENO SICURO E SOSTENIBILE





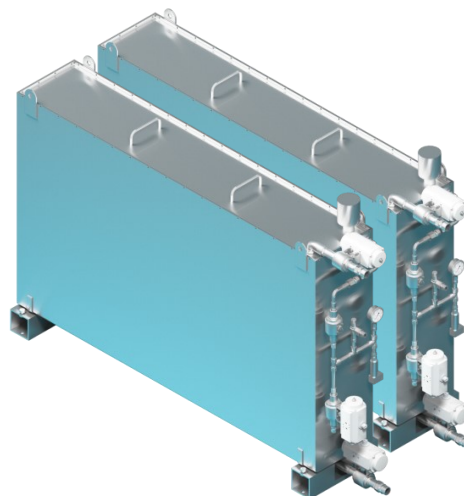
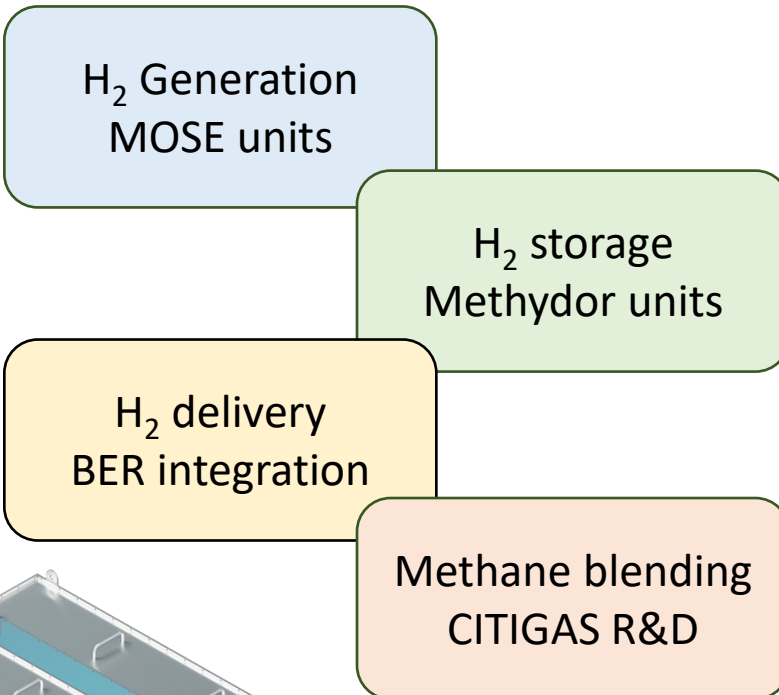
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2024: 2x MOSE 1x BLUDEMI installation + 20 kg H2 storage

Installation planned for November 2024!



Sostenibilità



LA NOSTRA SCELTA

Presentazione

Primo Bilancio di Sostenibilità Citigas Coop

26 LUGLIO 2024 | GIULIANOVA



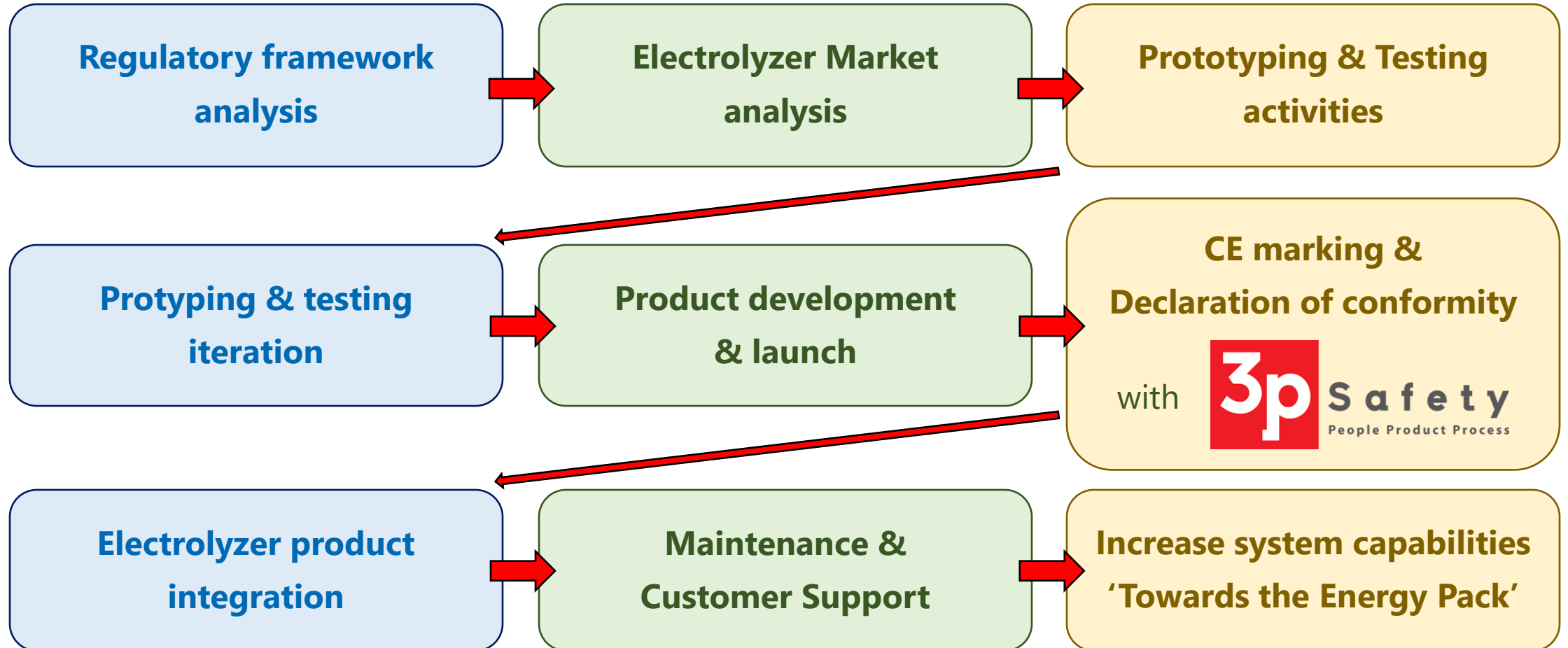
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Electrolyzer product development



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Electrolyzer product development 2021-2022 activities

Regulatory framework analysis

2006/42/EU
LVD 2014/35/EU
EMC 2014/30/EU
ISO 22739
ATEX 2014/34/EU
PED 2014/68/EU
ISO/TR 15916
ISO 16110-1:2007

Electrolyzer Market analysis

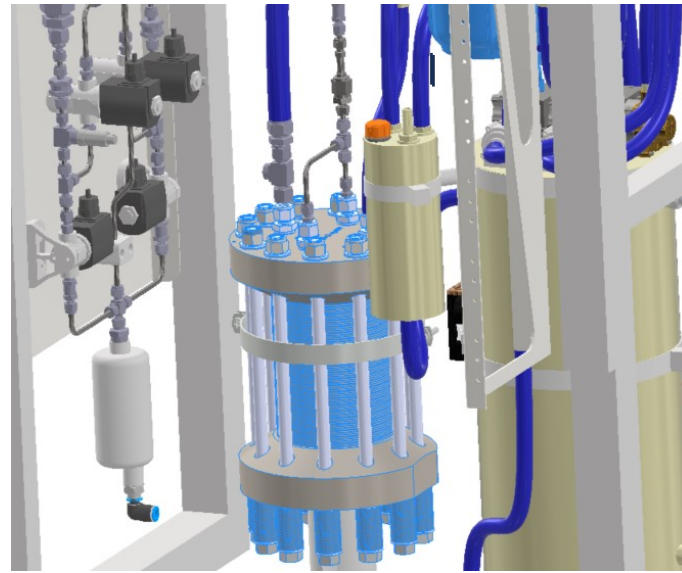
Market niches
PEM vs AEM
Easy integration
Component quality
Safety
Modularity
Maintenance friendly
Flexible & remote control

Prototyping & Testing activities

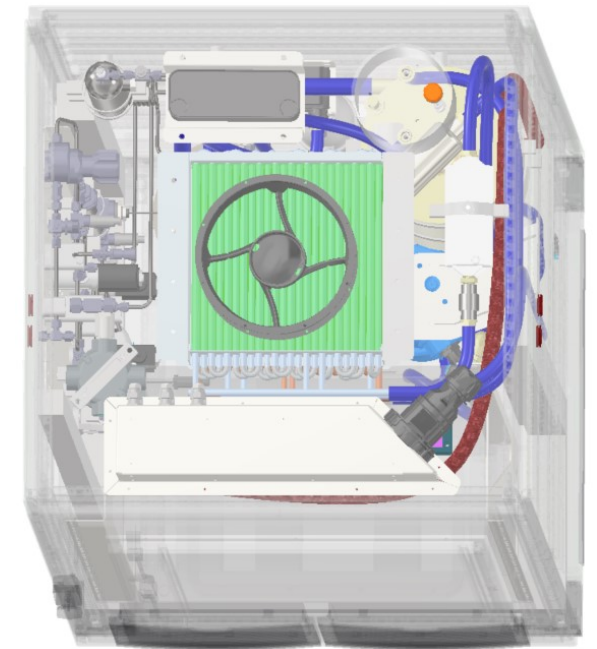
Stack supplier evaluation
Electrolyte management
H₂ treatment (dryer!)
Electrolyzer enclosure
Pressure management
System ventilation
Software design, control logics
Sensors evaluation



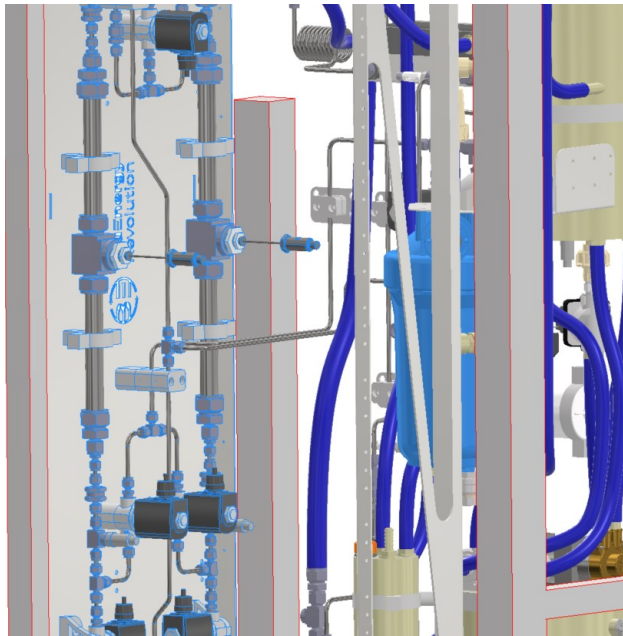
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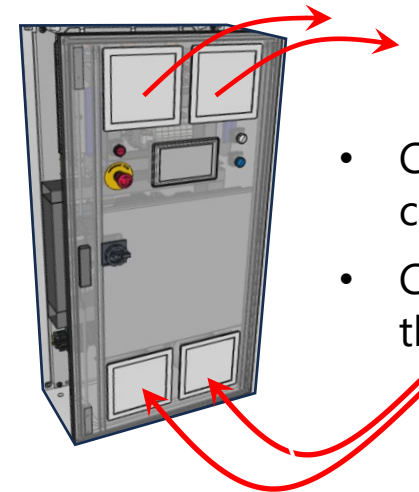
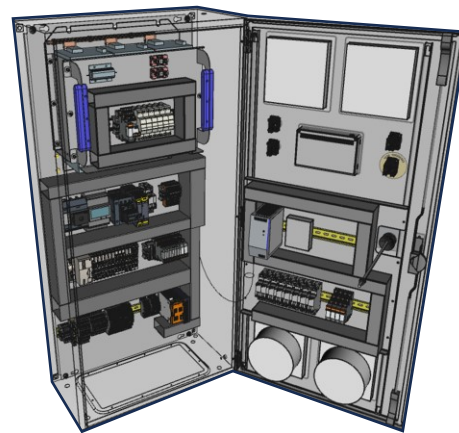
- PEM Stack
- Custom design of tanks and separators



- 1400 m³/h ventilation



- Proprietary dryer integrated
- Ultrapure water production (< 0,1 uS/cm)



- Custom electrical & control cabinet
- Cooling air draw separated from the process



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Electrolyzer product development 2023-2024 activities

Prototyping & testing iteration

- Prolonged Stack operation
- Optimized electrolyte manag.
- Optimized H₂ treatment
- Analysis of failures
- Pressure stress tests
- CFD analysis of ventilation
- Software Optimization
- Minimization of sensors

Product development & launch

- Supply chain agreements
- International events & fairs
- Workshop organization
- Set-up of digital platforms
- Enterprise modernization
- Quality assurance
- Safety assurance**
- Branding

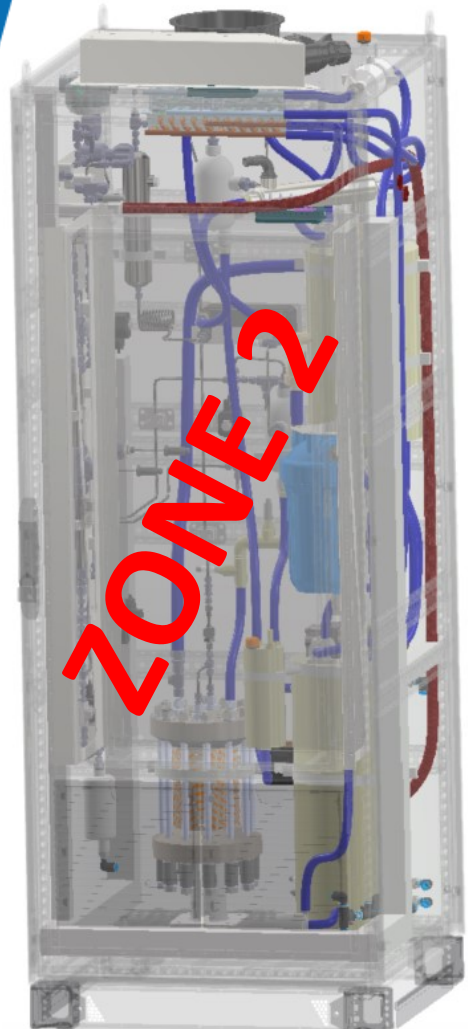
CE marking & Declaration of conformity

with  **S a f e t y**
People Product Process

- Regulatory framework assessm.
- Risk assessment (HAZOP)
- ATEX zone classification
- GAP analysis
- Engineering validation
- Technical Book
- User's manual



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Result of
the traditional approach:

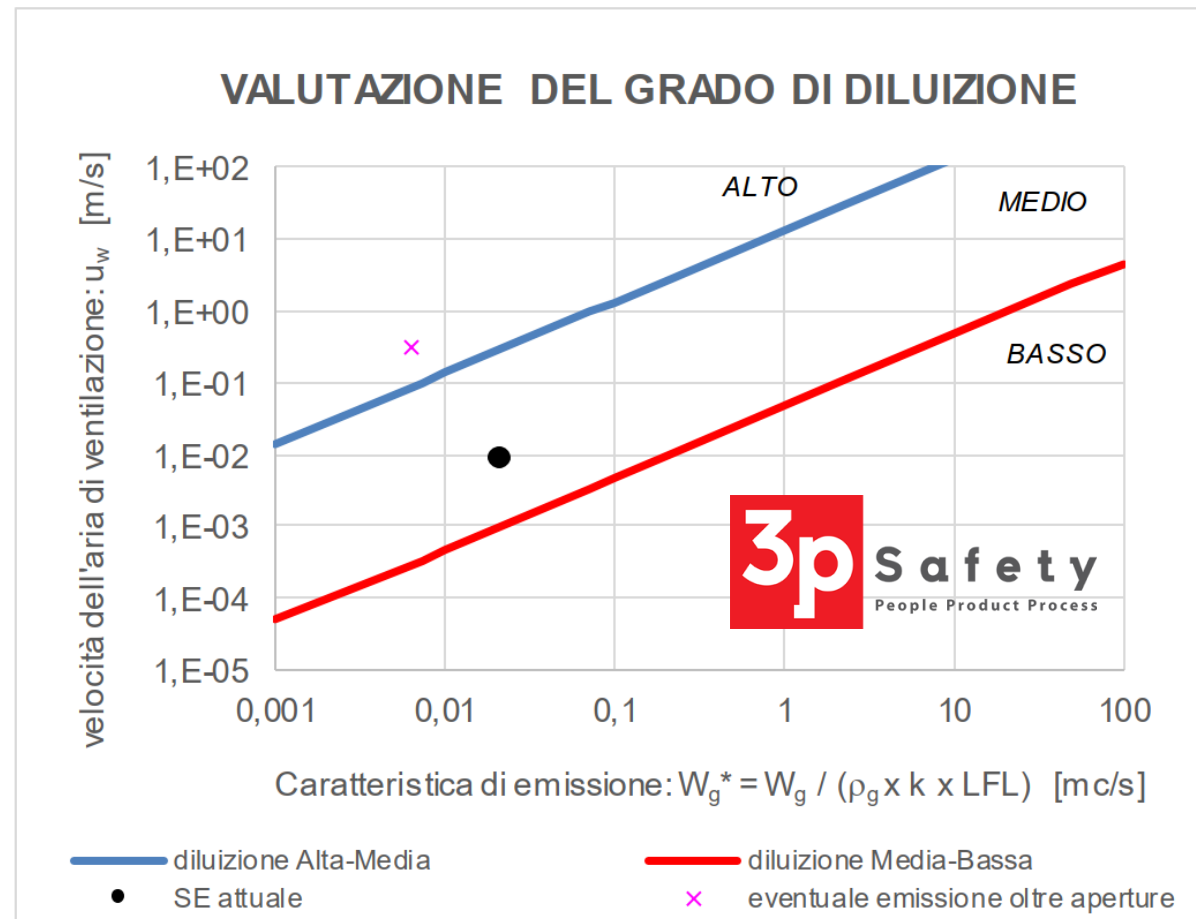


All components should
necessarily respect the
category:

3G IIC T1 -Gc

Hazardous Zone classification:

TRADITIONAL APPROACH: stationary emission





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Hazardous Zone classification:

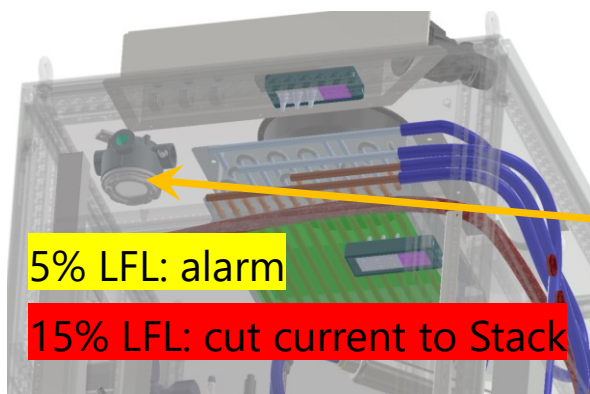
OUR APPROACH: simulation of conc. over time



Result of
the simulation approach:



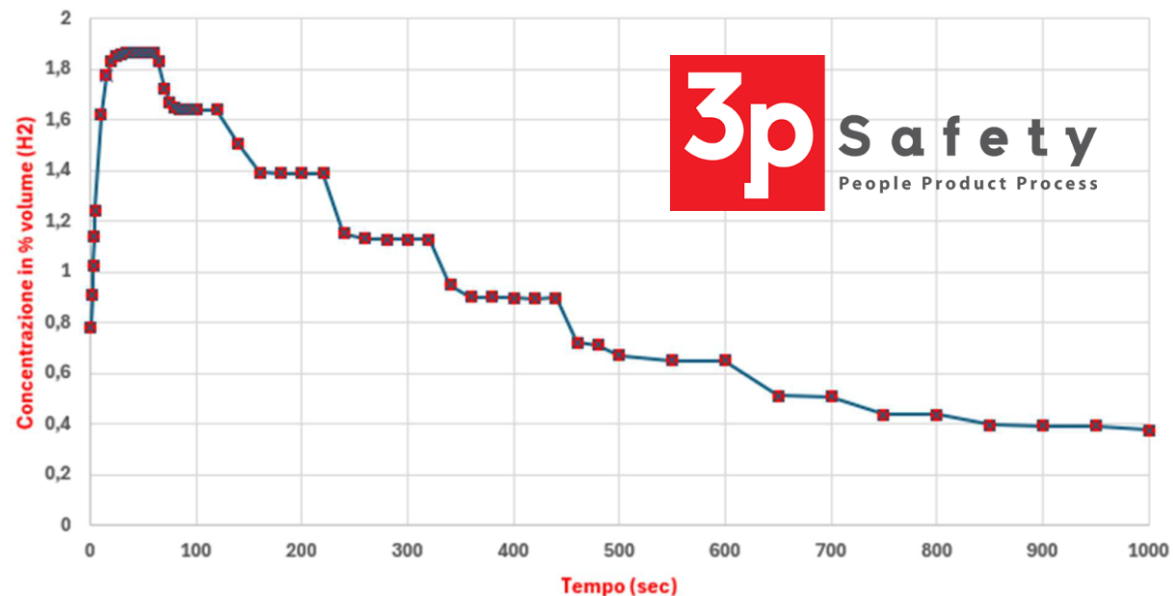
Neglegible zone



5% LFL: alarm

15% LFL: cut current to Stack

Andamento della concentrazione di H2 all'interno dell'armadio



Andamento della concentrazione di H2 in volume su un intervallo di 1000 sec

H₂ source: 0,25 mm²
H₂ volume: 80 NI
Ventilation: 1400 m³/h

Initial pressure: 35 bar
H₂ sensor intercepts the leak
Current to the Stack is cut



Electrolyzer product development

Next steps

Electrolyzer product On-site integration

- Vent disposal (Indoor/Outdoor)
- Indoor forced ventilation
- Outdoor air drawing
- Nearby systems positioning
- Safety of people, barriers**
- Hot weather derating
- Freezing weather protection
- Connect to grid/renewables

Maintenance & Customer Support

- Early warning of faults
- Ordinary maintenance plan
- Extraordinary maintenance
- H2 Analysis station
- Stack replacement at EOL
- H2 production optimization
- Replacement of components
- Predictive maintenance

Increase system capabilities 'Towards the Energy Pack'

- Add up more MOSE units
(up to 5 units – 35 kW)
- Green H2 via renewables
- Methane blending
- Add batteries
- Add H2 storage units
- Add a Fuel Cell (45 - 60 kW)
- Refuel vehicles



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- ***System integrators***
- ***Hydrogen projects***
- ***Product developers***
- ***Hydrogen tech specialists***
- ***Hydrogen R&D***

Thank you for your attention!



We are fully committed to a H₂ mission since 2015