



Associazione
nazionale
cooperative
di produzione
lavoro e servizi

legacoop

**PRODUZIONE
& SERVIZI**



BluEnergy Revolution

H2 in COOP

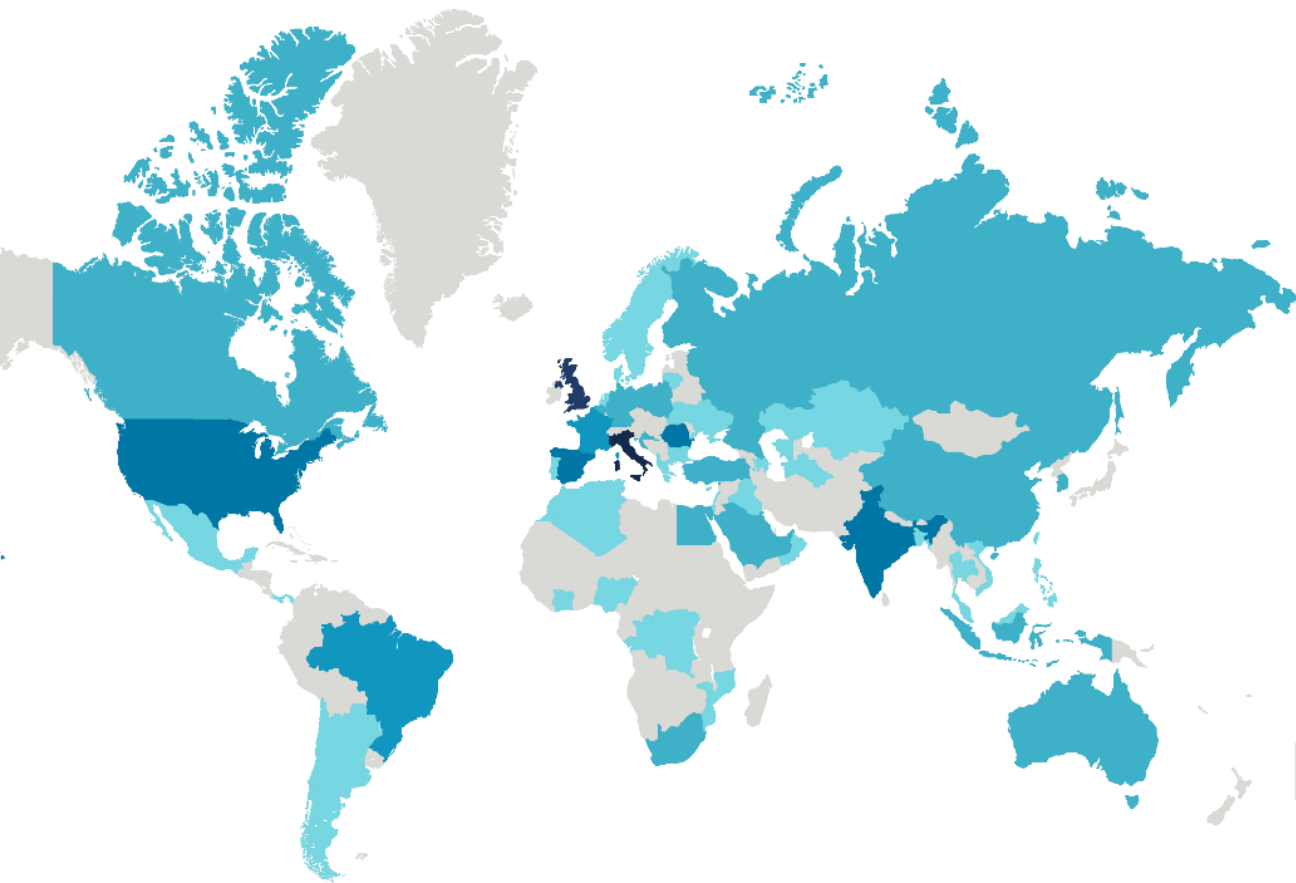
La catena del Valore

dell'idrogeno per il sistema cooperativo



***Idrogeno EVERYWHERE – Come promuovere la
hydrogen economy in diversi settori e mercati***

RINA today



~ 4.000 People

200+ Offices

70+ Countries

LEVEL OF RINA PRESENCE:



RINA R&D&I

A spotlight on Innovation



- **210+** Industrial Innovation related Regional, National and EU **funded projects**, delivered in the past 10 years
- **300+ M€ Global Value** of Industrial Innovation related **EU funded projects**, delivered in the past 10 years
- **4th Top Industrial Participant in FP7** across EU based on the number of Participations *
- **2nd Top Industrial Participant in H2020** across EU based on the number of Participations **
- **187 H2020 Participations** and **47+ M€ Net EU Contribution**
- **5000+** Partners in Industrial Innovation related funded projects ***

* Final FP7 Monitoring Report

** <https://webgate.ec.europa.eu/dashboard/hub/>

*** www.researchranking.org

RINA R&D&I

Our main R&D Areas



Sustainability, energy efficiency and low carbon energy

Strong commitment to Decarbonization and Clean Energy Transition - Promotion of the use of Hydrogen (H2) as an energy vector - Digitalization at the core



Infrastructure protection and climate change adaptation

Resilience Engineering, Critical Infrastructures - Digitalization at the core



Industrial technologies and Materials

Composite materials, Nanotechnologies, Digitalization at the core



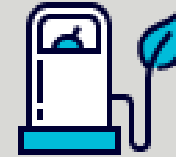
Smart cities and Communities

Circular Economy, Nature-Based Solutions, Citizens engagement, Energy Efficiency in buildings, Digitalization at the core



Space technologies

Technology Transfer, Monitoring, Security, Digitalization at the core



Sustainable transportation

Energy Efficiency, Security, Lightweighting, Batteries, alternative fuels and biofuels, Digitalization at the core



Maritime and Blue economy

Emissions reduction, Alternative fuels, batteries, offshore energy, bioeconomy, Vessels Traffic Management Digitalization at the core



Circular economy and Bio-Based industry

New Business Models, stakeholder's engagement, Digitalization at the core



Artificial intelligence and Digitalization

Big Data, automation, cyber-security, Digitalization at the core

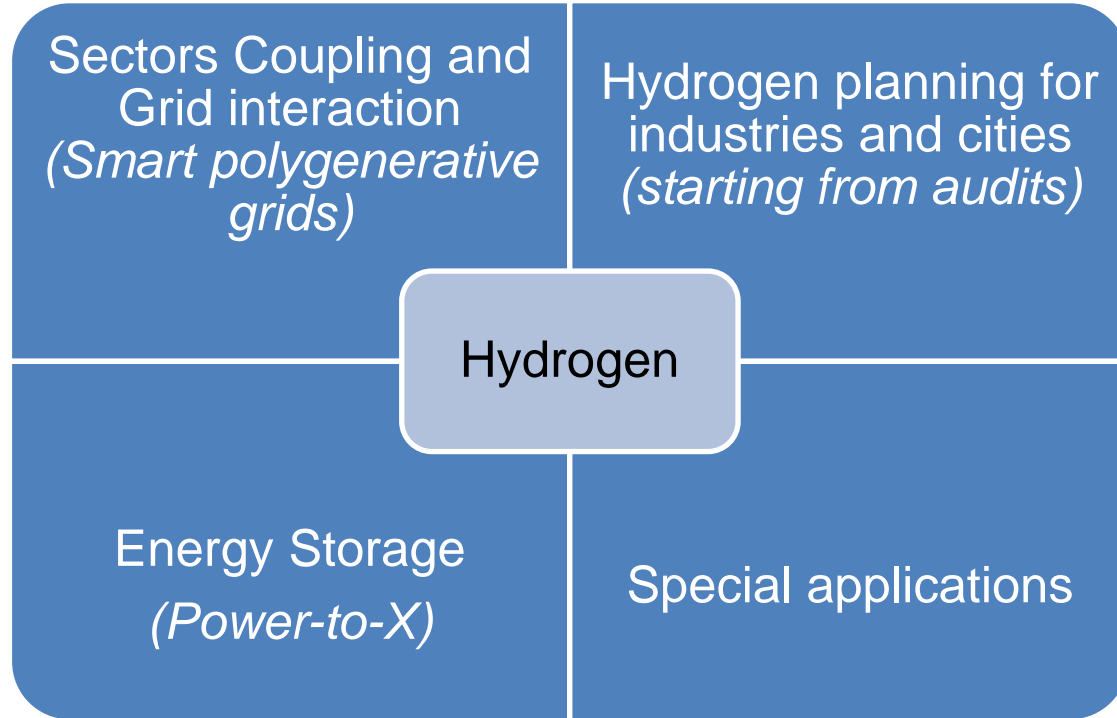
RINA covers the whole Hydrogen Value Chain



Your strategic partner offering different services and capabilities

- Engineering and Strategic Consulting
- Material and Testing Facilities
- Marine Sector
- HSE and Permitting Operability
- Research and Development
- Support in Project Financing Setup (Green Finance)

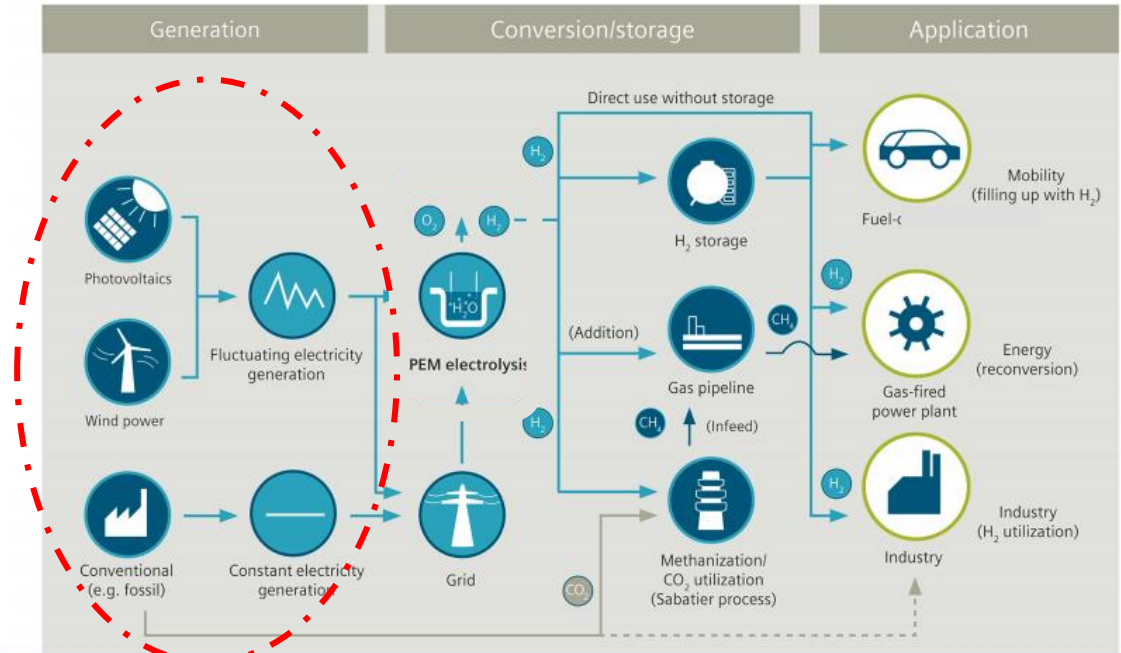
Make hydrogen technologies ready to be integrated today in EU Energy system



Consulting Services to integrate FCH technologies in existing energy systems, assets and grids

Grid Integration of FCH technologies

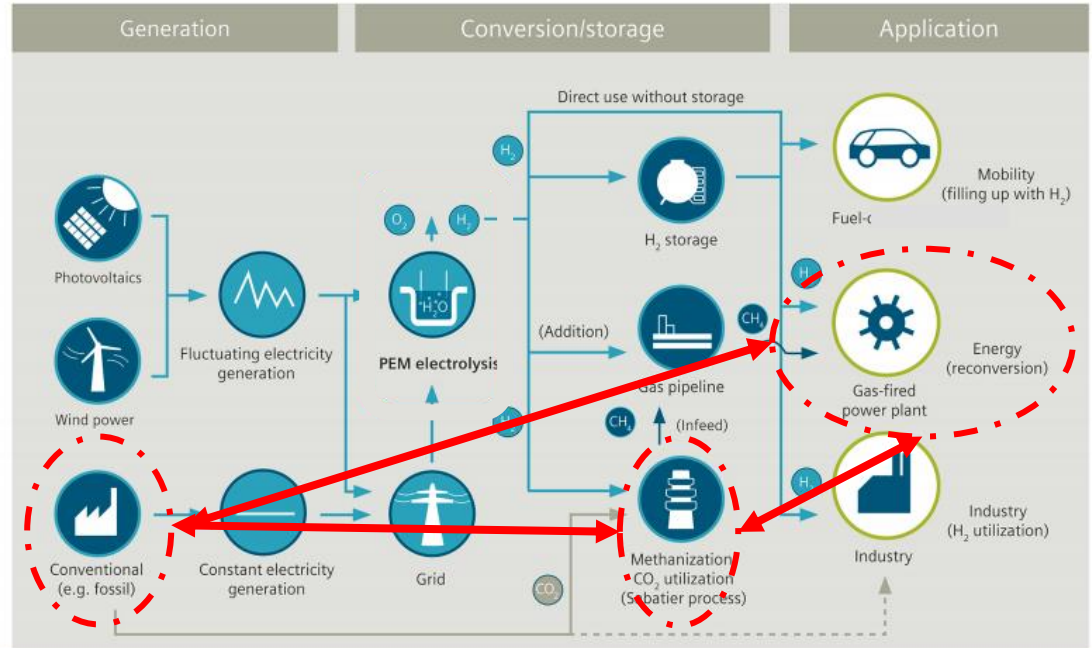
- Electric grid compatibility and **integration of electrolyzers** and **Fuel Cell** solutions on the existing grid **also to propose grid retrofitting**
- **Grid compliancy** and power architecture for Fuel Cells and electrolyzers
- Electric Market role of electrolyzers and development of dedicated **“grid flexibles”** schemes (SEU, UVAM, energy communities etc.)
- **Regulatory analysis**
- Hydrogen hybridized fossil-based power plants role on the market
- **Digital solutions** for a smart monitoring of gas grids where H₂ is injected but sensing is based on NG



H₂ enables the coupling between energy, mobility & industry markets

Power-to-X (-to-power) solutions

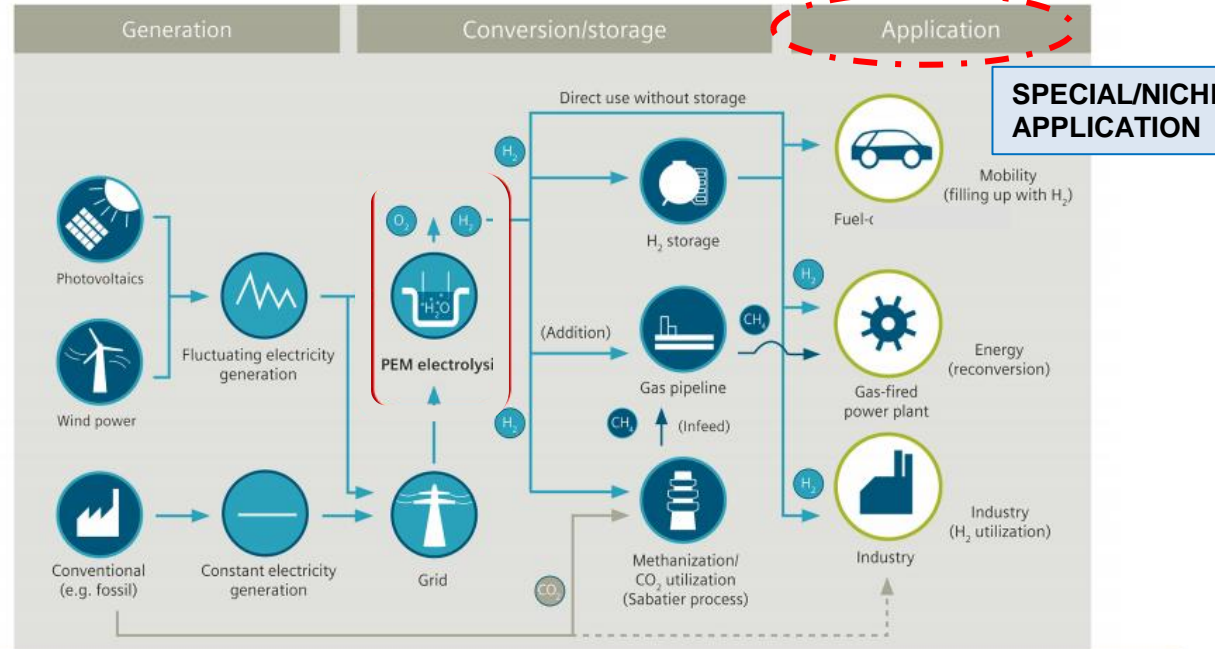
- **Flexibilization of NG driven power plants via electrolysers** (FLEXNCONFU and PUMPHEAT project) for **power-to-X-to-power**
- **Grid compliancy** and **power architecture** for such type of “grid flexible” **NG+ H2 driven plants**
- **Electric Market role** of such plants to **provide ancillary services**
- **CCUS solutions** also for the valorisation of captured CO2 (advanced catalytic processes like methanation and methanolisation)
- Design of turbomachinery able to operate in **NG+H2 (or NH3)**



H₂ enables the coupling between energy, mobility & industry markets

Special applications of FCH technologies

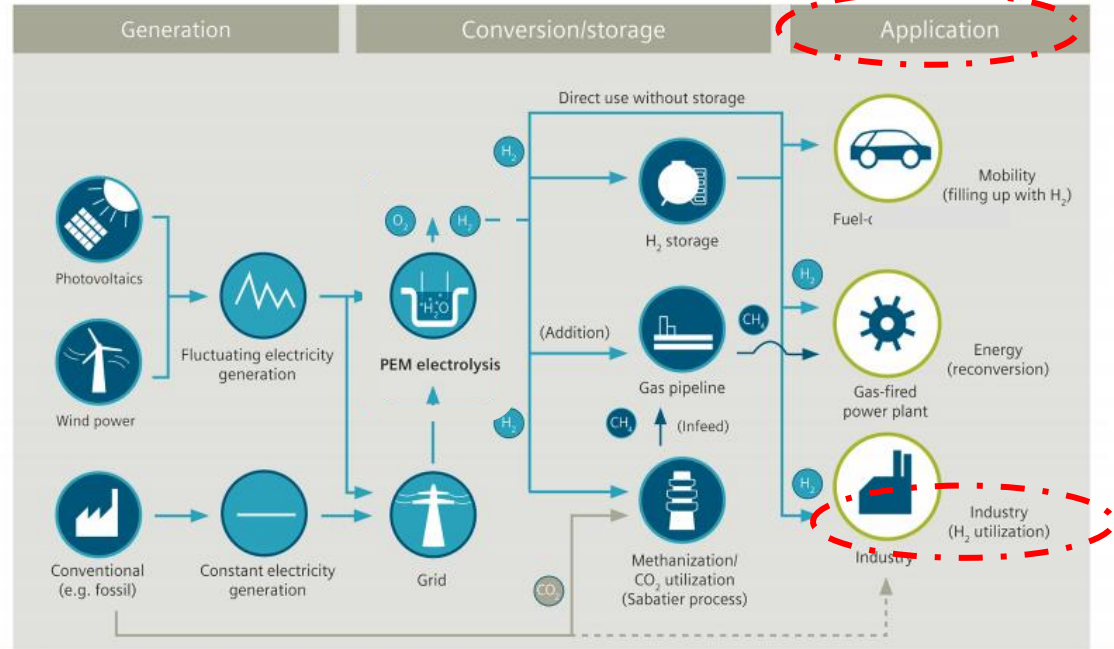
- **FC based Gensets** (EVERYWHERE)
- **Industrial processes driven by FC** (Cogeneration units and steam production)
- **UPS/dedicated systems** for Edge Servers and server farms
- **Vessels** and operating machines **in ports**



H₂ enables the coupling between energy, mobility & industry markets

Industrial and district/community “hydrogen audits”

- Starting from industrial/local energy and resource audits, understand **how the industrial process can be “hydrogenized”** also to promote a new role for industries as **“grid flexibility services provider”** and industrial symbiosis with other local industries
- **Regulatory and HSE** analysis of the industrial environment to be “hydrogenized”
- **Hydrogen action plans** for corporates and public authorities (cities, regions etc.)



H_2 enables the coupling between energy, mobility & industry markets

Process Safety



RINA has a 30+ years experience in developing safety and reliability studies on processes and systems, specifically in the O&G, chemical and petrochemical, energy domains.

The tools and capabilities that have been developed in these domains can be applied to the energy transition issues as well.

HAZID/HAZOP

QRA

CFD Simulations

RAMS

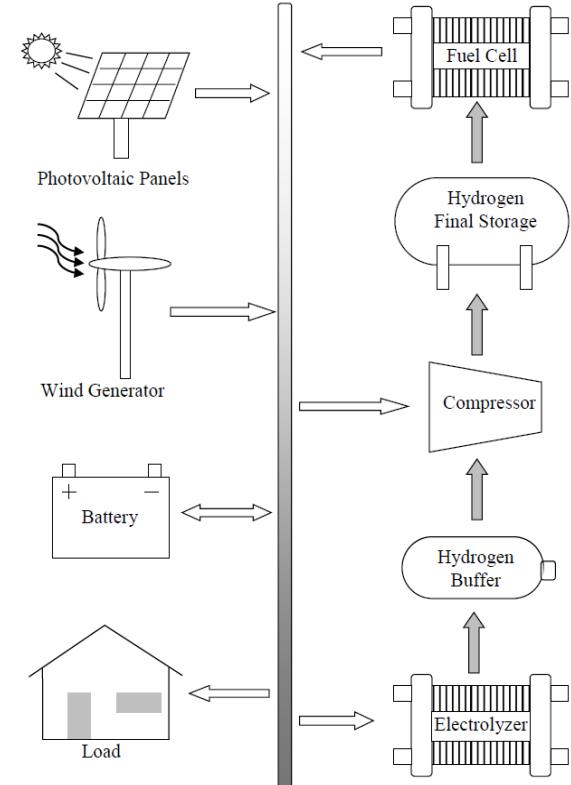
Green Hydrogen – HYDROGLEN Project



The **James Hutton Institute** is developing the **HydroGlen Project** at Glensaugh to be a **grid-autonomous** (micro-grid), **green hydrogen** project satisfying the **triple energy vectors of electricity, heating, and transport fuel** requirements at Glensaugh

The Technical feasibility study has the following objectives:

- to determine **project feasibility** of a renewable hydrogen installation at Glensaugh including **technical, safety, environmental** details for scale, **size**, and **location** of all primary and secondary technologies;
- **review of energy-use reduction and efficiency improvement** measures to maximise HydroGlen project contribution to net-zero;
- to inform an outline **costing/economic** model for HydroGlen project, to include **budgetary capital costs** from key component & service suppliers, outline planning requirements and processes & community engagement actions.



Hard to Abate

HYDRA



Decarbonization of the **steel production processes for Steel Making**

- An Integrated Infrastructure System in order to provide **Energy Intensive Industries feeding large volume hydrogen line**
- An **innovative pilot plant for Iron Direct Reduction** (10.000 tons/year) fed with hydrogen only in Integrated Steel Works

Goals and Services

- **Decarbonise the steel production process** by acquiring knowledge and technologies to better manage the transitional phase
- **Investigate the final steel products properties achieved**



Research

Since '90s RINA is active in EU R&D Funded programmes, now moving from Horizon2020 to Horizon Europe framework.

The Fuel Cells and Hydrogen Joint Undertaking (FCH JU) is a unique public private partnership supporting research, technological development and demonstration (RTD) activities in FCH technologies in EU towards the acceleration of their market introduction.

The three members of the FCH JU are the European Commission, fuel cell and hydrogen industries represented by Hydrogen Europe and the research community represented by Hydrogen Europe Research.

FCH JU is yearly investing around 100 M€ per year to finance innovation projects aiming to promote FCH technologies showcase and market roll out in energy and transport sector, also fostering initiatives at regulatory and social engagement level.

Following its Multi-Annual Work Programme (2014-2020) latest R&D key topics for FCH JU are the promotion of FCH technologies in industrial premises, in weakly connected scenarios (i.e. islands and valleys), in railway and maritime sector.

Since next 2021 FCH JU will become “**Clean Hydrogen Alliance**”



RINA Role in the FCH JU: participation to FCH-maritime committees and direct link with University of Genova (key member of Hydrogen Europe Research)

Research

In H2020, RINA kept on coordinating projects bringing hydrogen innovation as close to market as possible

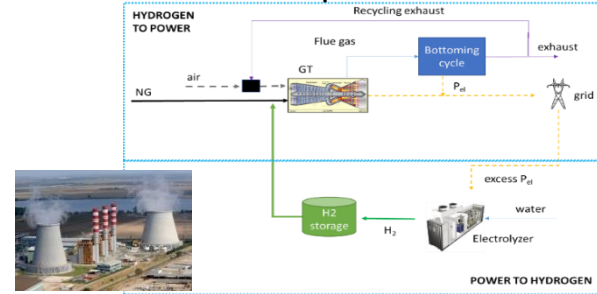


EVERYWH2ERE – H2020 GA 779606 – 2018 -2023

EVERYWH2ERE demonstrates techno-economic viability of replacing diesel gensets with FCs for temporary power applications: 8 FC containerized gensets will be realized and tested all around EU in construction sites, music festivals and events.

www.everywh2ere.eu

SoW for RINA Consulting: overall project coordination, Health and Safety Engineering, permitting aspects, replication roadmap and business modeling



FLEXNCONFU – H2020 GA884157 – 2020 - 2024

FLEXNCONFU will design and demonstrate in a real power plant how to flexibilize a Combined Cycle (in Ribatejo, Portugal, managed by EDP) thanks to Power-to-X-to-Power solutions based on hydrogen and ammonia. Innovative Gas Turbine and management solutions for hydrogen/ammonia operation will be demonstrated as well.

SoW for RINA Consulting: overall project coordination, Health and Safety Engineering, re-design of a micro-GT to enable ammonia operation

Research

We are also looking ...a little bit further! Thinking about the end of life of FCH Technologies and how to use green hydrogen



BEST4HY – H2020 GA 101007216 – 2021-2024

Studying innovative end-of-life and recycling processes for PEM/SO Fuel Cell and Electrolyser Technologies

SPOTLIGHT – H2020 - 101015960 – 2021 - 2024

Producing methane and methanol exploiting captured CO₂ and green hydrogen production via innovative 100% RES driven methanation (solar driven synthesis)

EVERYWH2ERE



Fuel Cell (FC) gensets for temporary power supply in different sectors (construction sites, music festival, temporary events, exhibition centres....)

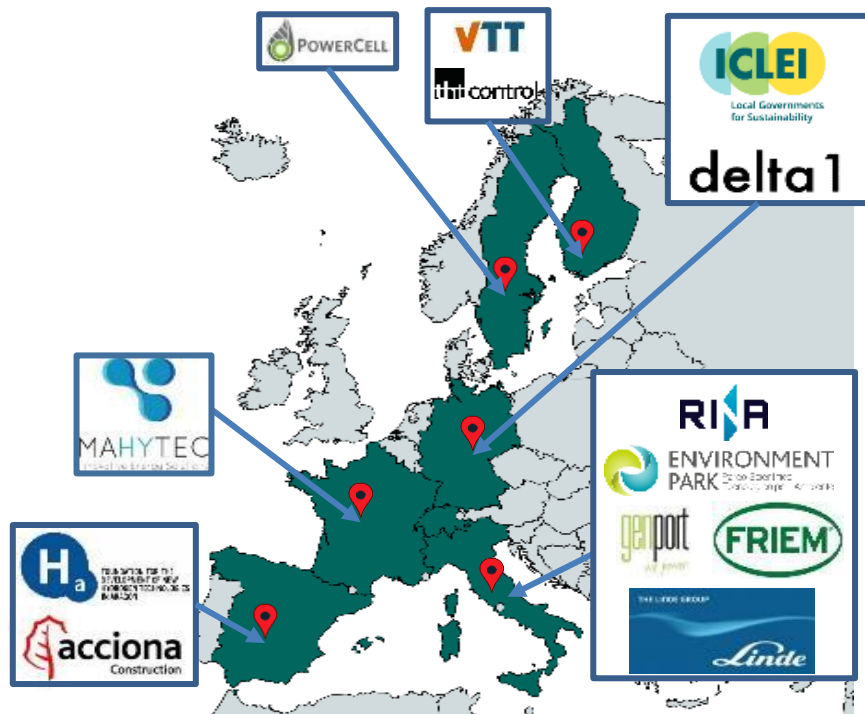
Start Date: 1 February 2018
End Date: 31 October 2023



TRL 8 – Plug and Play – Reliable
0 emission – 0 Noise
Interesting for Cities and Events’
Organizers

**A DEMONSTRATION TO
MARKET PROJECT!**

EVERYWH2ERE



EVERYWH2ERE

An Industry Driven Consortium




This guarantees:

- Industrial and Market interest to project outcomes and marketability
- Facility to involve stakeholders
- Strong commitment to genset realization
- A common «project business» to be pursued made by «different actors' business»
- Ability to overcome contingencies

EVERYWH2ERE



The market is currently served by internal **combustion engines** (fed by diesel, compressed natural gas, propane etc.) and **batteries**. Compared with IC generators and batteries, PEMFC systems are:

	 FCs	 Diesel	 Batteries
Reliability	✓	-	✓
Extended run time	✓	✓	-
Emissions	✓	-	✓
Noises	✓	-	✓
Efficiency	✓	-	✓
Ambient condition	✓	✓	-

Key performance indicators

- #zeroemission
- #zeronoise
- #fast start up
- #easy to connect and operate
- #low maintenance
- #efficiency above 50%
- #subzero start (-20°C)
- #reduced installation time
- #ATEX and normative compliancy

EVERYWH2ERE



EVERYWH2ERE GENSETS CHARACTERISTICS

- Different power sizes (**25 kW** and **100 kW**)
- Based on H2 Fuel cell
- H2 storage control
- “Plug and Play” solution
- Transportable gensets
- Safety devices

Compact design
via 2-boxes solution:

**FCPS: 20 ft ISO-
container**



**H2 tanks @350
bar**



EVERYWH2ERE



Fuel Cell SPECIFICS	25 kW GENSET	100 kW GENSET
Rated kVA	25	100
Electric out	230/400 Vac 50Hz	230/400 Vac
DC net out at max cont power	234 A ; 153 V (from the stack)	450 A/300 V
Voltage Regulation Method	Off grid inverter	Off grid inverter
Fuel	Pure Hydrogen (10 bar)	Pure Hydrogen (10 bar)
Fuel Cell System @POWERCELL	PCS MS-25 SuSy, S2 stack with 264 cells	PCS MS-100 SuSy, S3 stack with 455 cells
Maximum Gross Weight of the FCS container/part (kg)	8000 kg	8000 kg
Dimensions L x W x H (mm) of the FCS container/part	2591x1318x4500 mm	2591x1318x4500 mm

H2 STORAGE SPECIFICS@MAYTECH and LINDE integration	25 kW GENSET	100 kW GENSET
Number of tanks in the system	3	9
Total volume of the tank	660L (3 x 220L)	1980 L (9x220 L)
Mass of H2 stored (at 350bar)	15,6kg (3 x 5,2kg) at 15°C	46,8kg (9 x 5,2kg) at 15°C
Maximum refilling pressure	525bar	525bar
Temperature of use	-20°C to +65°C	-20°C to +65°C
Certification	TPED	
Dimensions (single tank)	L 2200mm / diam 488 at the largest	

EVERYWH2ERE



The use of diesel-based portable gen-sets is a standard and common practice in construction sites:

+ 200 diesel gen-sets owned by ACCIONA

+ 100 diesel gen-sets rented by ACCIONA to third parties per year

+ 10.000 Tns CO_{2eq} / year



EVERYWH2ERE for powering an electrical crane!





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