

HYDROGEN TECHNOLOGIES

Hydrogen Knowledge Exchange Program ready, set, go.

H2 value chain in Piedmont

SMARTENERGY WEBINAR



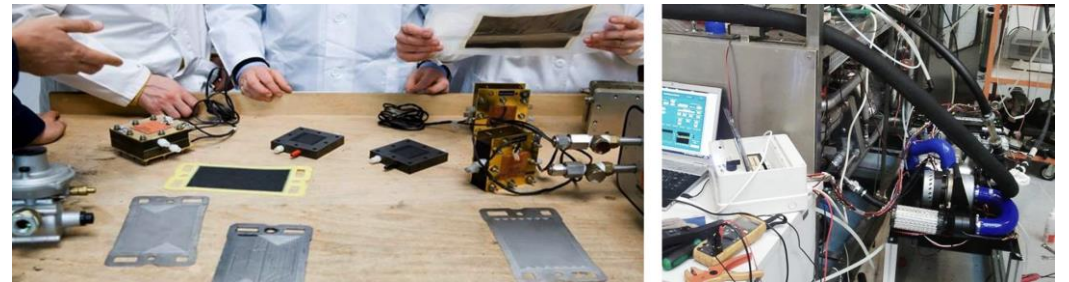
Open labs for H2 based applications at Environment Park

23/02/2021

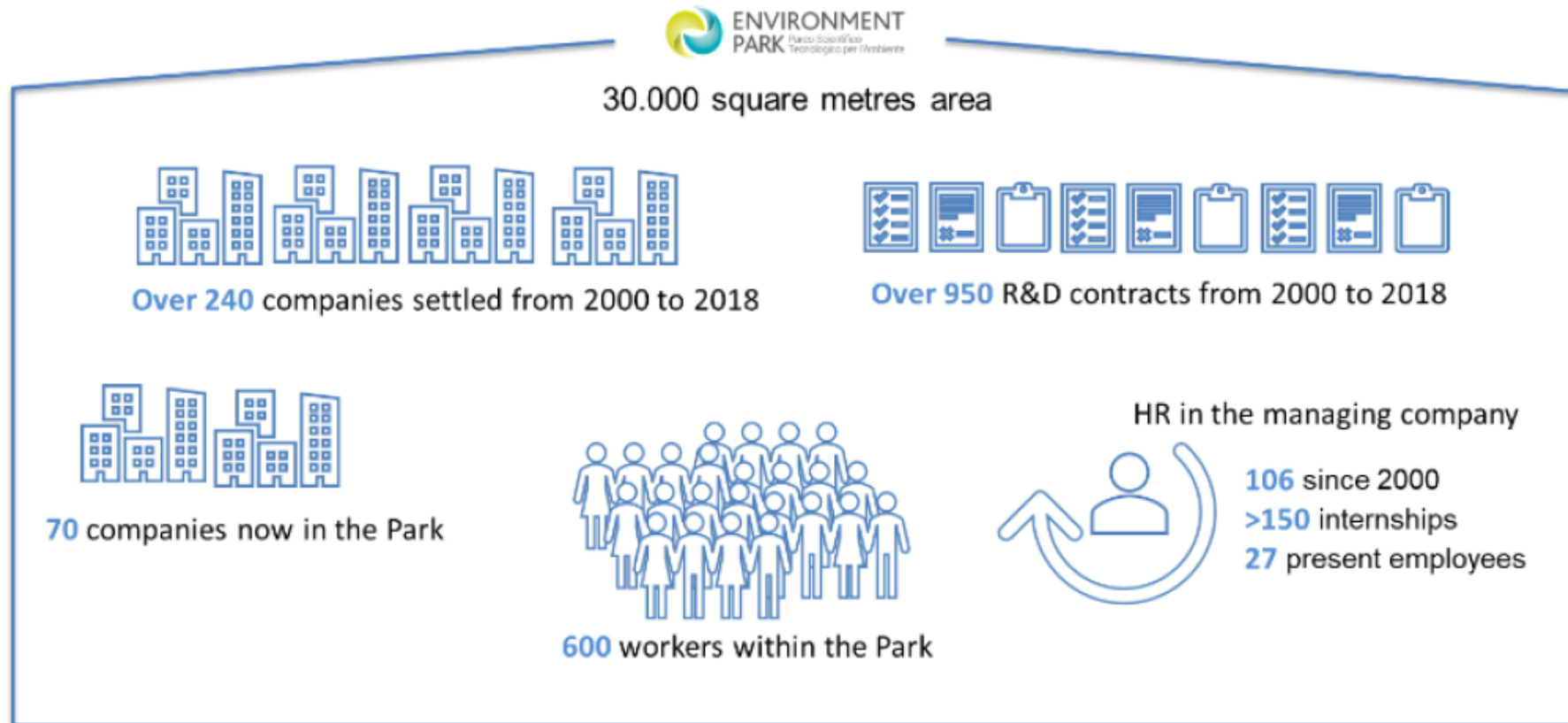
Sabina Fiorot
Environment Park-Torino

The Park

- Environment Park is the cleantech techno-park based in Torino, active since 2000 in the domain of clean innovation, providing location and support services to companies and research institutions.
- The company managing the techno-park is owned by local institutions and utility companies operating in cleantech areas.
- Since 2002 the techno-park is offering services in the hydrogen and fuel cells sector, through a dedicated laboratory able to provide tests and support services to several stakeholders: since 2019 the lab facility is operated in partnership with Politecnico di Torino.
- Besides laboratory services, Envipark provides customers and partners with technology intelligence activities including scouting and evaluation of systems and components in the hydrogen and fuel cells value chain.



Environment Park – facts and figures



+ Open access laboratory infrastructures

Envipark – The Ecosite

Park's energy demand is covered for around 65% by renewable energies generated on its site, and in particular by:

- A district heating and cooling network fed by two biomass boilers (1.8 MW power)
- A mini Hydroelectric power plant installed inside the park (Kaplan 450 kW power)
- A Photovoltaic plant of 16 kW of peak power, integrated into the park's energy grid
- Solar thermal energy solutions integrated into heating and DHW systems .
- All generation plants and grids (Power, Heating and cooling, water and ICT infrastructures) are owned and managed by the company.
- Real estate management is ISO 14:001 certified.



The managing company's business model

Two main business units

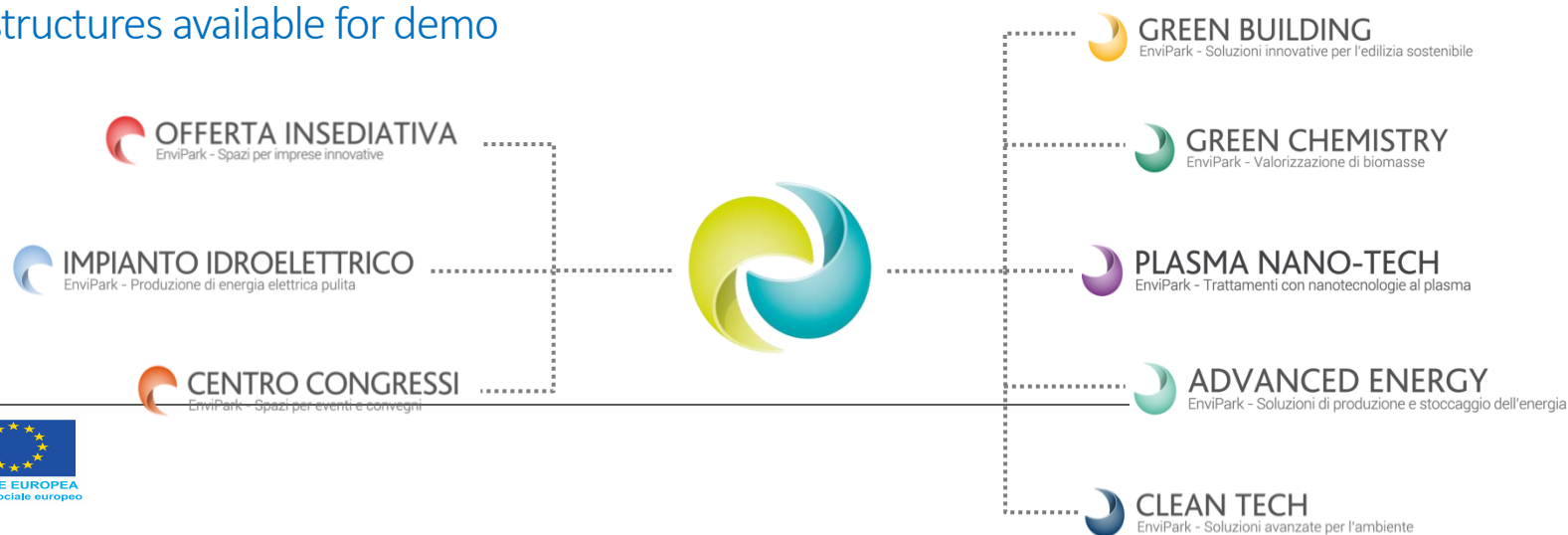
Infrastructures/Real Estate services

include all the activities related to the management of the Park as a campus

- ✓ 30.000+ mq for tenants (firms and R&D centres)
- ✓ Portfolio of services for tenants
- ✓ A community counting 70+ entities
- ✓ A conference center
- ✓ A mini-hydropower plant providing clean power
- ✓ Technological infrastructures available for demo projects

Innovation services

- ✓ Consultancy
- ✓ Project design e management
- ✓ Open laboratory facilities for experimental activities
- ✓ Management of the **Cleantech Regional Innovation Cluster (CLEVER)**, a 150+ companies network cooperating on industrial research
- ✓ include all the knowledge based activities and services related to clean innovation; this unit covers several thematic sectors Green Building, Plasma Nano Tech, Green Chemistry, **Advanced Energy** e Clean Tech.



- Joint initiative among public institutions and private companies to focus the opportunities of H₂ as a storage mean and as a carrier in mobile and stationary fuel cell systems;
- Operated by Environment Park S.p.A. since 15 years
- Devoted to the production and storage of electrical energy using alternative, high-efficiency technologies;
- A centre for the development and testing of the latest generation batteries and hydrogen-based fuel cells

R&D laboratory

TESTING laboratory




TRAINING LABORATORY
for technicians involved in
H₂ business

COMPETENCE CENTRE
for the development of
pilot projects in our region



Laboratory facility – an open research lab



Safe area for BOP components testing with hydrogen sensors and active protection system for fire prevention

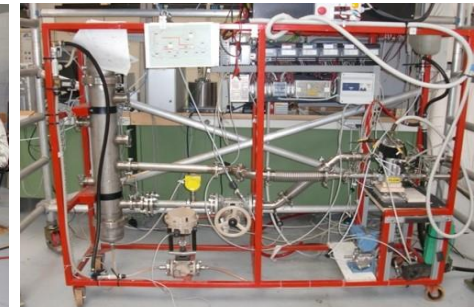
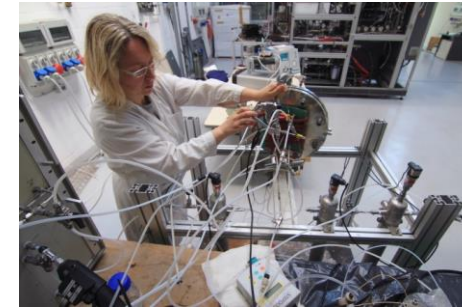
Force ventilation and depressurized area

Able to manage hydrogen leakage for prototype test

Laboratory facility – an open research lab



Useful area of 270m²
with a total volume of
1300m³, equipped with
11 test stations



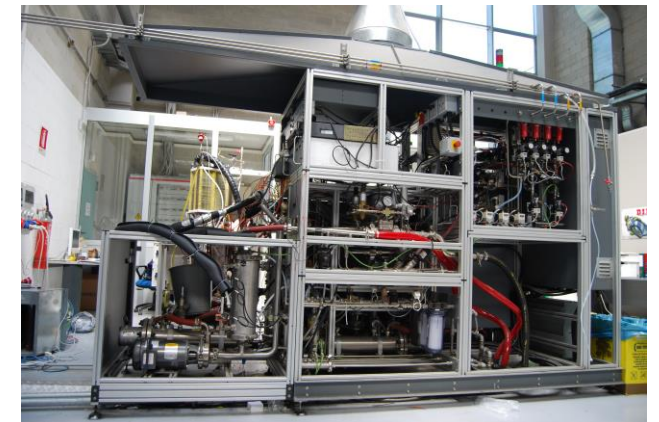
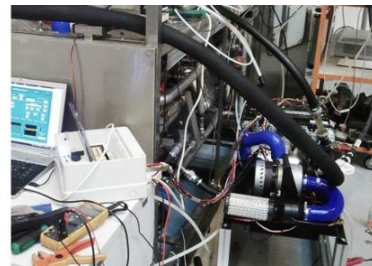
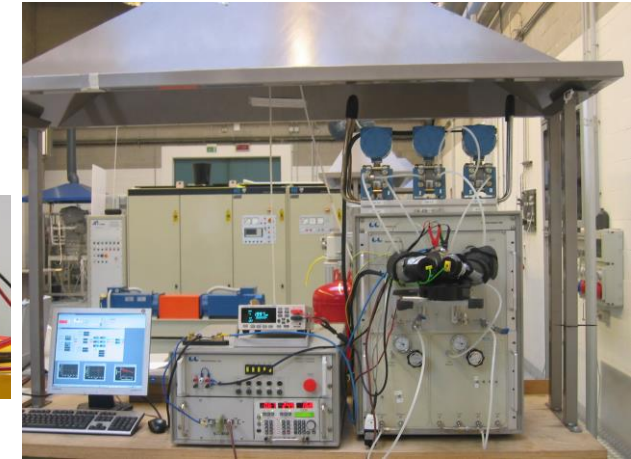
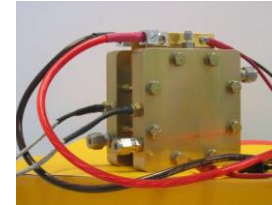
FC power systems components

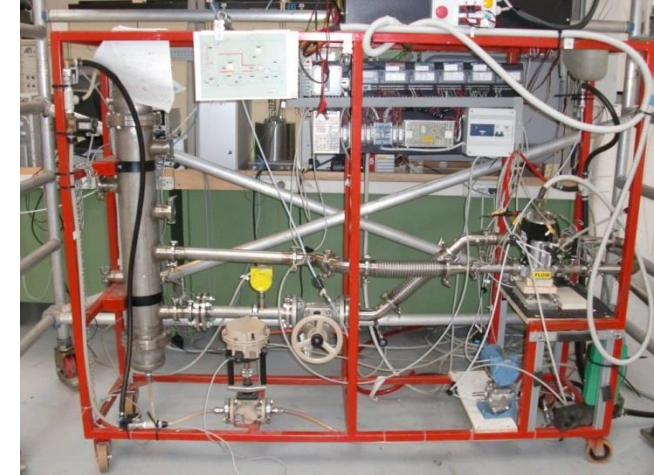
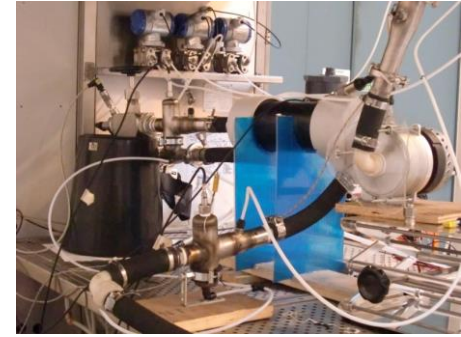
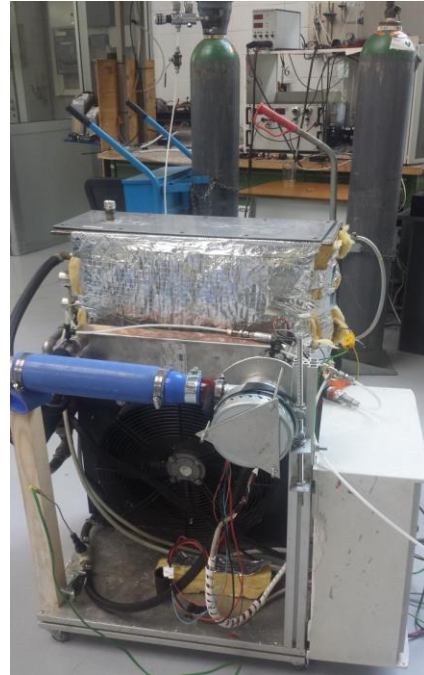
- PEMFC single cells and MEA
- PEMFC stacks for the following stationary applications
 - ✓ Back up power systems
 - ✓ Micro-CHP
 - ✓ Space applications
- PEMFC stacks for the following transport applications:
 - ✓ Scooters
 - ✓ Cars and vans
 - ✓ Tractors and Non Road Mobile Machineries
 - ✓ Minibus
 - ✓ Boats
 - ✓ Drones
 - ✓ Light aircrafts

Test of BoP FC components

- Hydrogen Compressor Test Bench
 - Air Blower for FCS Test Bench
 - Humidification system Test Bench Facilities
 - Ageing tests on BoP components
 - Humidification systems
- Experience in defining test protocols and implementing dedicated test benches.
 - **TRAINING AND DEMONSTRATION:** Training on hydrogen technologies for technicians, teachers, students

Results





Results

Background on FCH-JU

TITLE	STARTING YEAR	APPLICATION	ENVIPARK ROLE
HY TRAN	2004	HYDROGEN APU FPR TRUCKS	DISSEMINATION, TECH TRANSFER
PEM TOOL	2005	MEA DESIGN	TEST
HY TETRA	2006	INDUSTRIAL ENGAGEMENT	TECH TRANSFER, INDUSTRY ENGAGEMENT
HYPROFESSIONALS	2011	TRAINING	COURSE DEVELOPMENT, TRAINING IN ITALY
FITUP	2010	BACKUP POWER SUPPLY	TESTING
FLUMABACK	2012	BACKUP POWER SUPPLY	TESTING
ENEFIELD	2012	STATIONARY CHP	STAKEHOLDERS ANALYSIS
KNOWHY	2015	TRAINING	COURSE DEVELOPMENT, TRAINING IN ITALY
HYTECHCYCLING	2016	CROSS CUTTING, FCH EoL	NORMATIVE ANALYSIS, STAKEHOLDERS ENGAGEMENT
BIOROBURplus	2017	Advanced direct biogas fuel processor for H2 production	Third party of ACEA, TESTING in anaerobic digester
EVERYWH2ERE	2018	PORTABLE GENSETS	TEST, LEADER OF DEMONSTRATION
REFLEX	2018	R-SOC	DEMO SITE, TEST ACTIVITY
HyCARE	2019	Hydrogen Carrier for Renewable Energy Storage	Third party of UNITO on dissemination
BEST4HY	2021	RECOVERY OF CRITICAL RAW MATERIALS	COORDINATOR

Making Hydrogen affordable to sustainably operate Everywhere in European Cities



MISSION

Temporary diesel gensets are used everywhere in our cities (fairs, markets, construction sites, temporary events and concerts...) and Non-road diesel engines account for 5-10% of fine-particle pollution in urban environment. **Fuel cell (FC) can easily replace these technologies promoting 0 noise, 0 emission temporary generation.** The main objective of EVERYWH2ERE project is to demonstrate at TRL8 easy to transport “plug and play” FC gensets. Demonstration results will be capitalized for replication, business model, environmental and logistic analysis.



PROJECT PARTNERS



GENSETS CHARACTERISTICS

- Two gensets sizes manufactured (25 kW and 100 kW)
- “Plug and Play”
- Pre-industrial prototypes
- Transportable gensets
- Based on H₂ Fuel cell
- H₂ storage control
- Safety devices

Two boxes solution:

- H₂ tanks @350 bar
- FCPS 10 ft ISO-container



EVERY
WHERE

DEMONSTRATION

Construction Demosites managed by ACCIONA

Music Festivals: more than 25 LoS collected by DI

Public Temporary Events: in Italy and Spain from 2021

Port Environment: Port of Tenerife tests in early 2021



DEMONSTRATION WILL START in 2021

The prototypes (4x25 kW and 4x100 kW) will be tested in **construction sites, music festivals and urban public events all around EU**. These events will be important showcases to promote FC potential to a large audience in order to increase their social acceptance and public awareness. An active involvement of public authorities and industrial stakeholders will foster the spreading of FC gensets opening a potential market doorway towards viable EU cities and Hydrogen economy.

WE ARE SEARCHING NEW EVENTS and OPPORTUNITIES TO TEST OUR GENSETS!



Contact us for more details if you want to host the gensets!

Reversible solid oxide Electrolyzer and Fuel cell for optimized Local Energy miX



Developing an innovative renewable energies storage solution, so-called “Smart Energy Hub”,

- based on reversible rSOC technology
- completed with an electrochemical storage solution allowing fast response to the electrical energy needs

Demonstrate, in-field, the high power-to-power (P2P) round-trip efficiency of this technology (as compared to other H2 based solutions) and its flexibility and durability in dynamic operation (power transient and switch between electrolysis and fuel cell mode)

- Application and market area targeted: ecobuildings/ecodistricts with maximised renewable energies autoconsumption

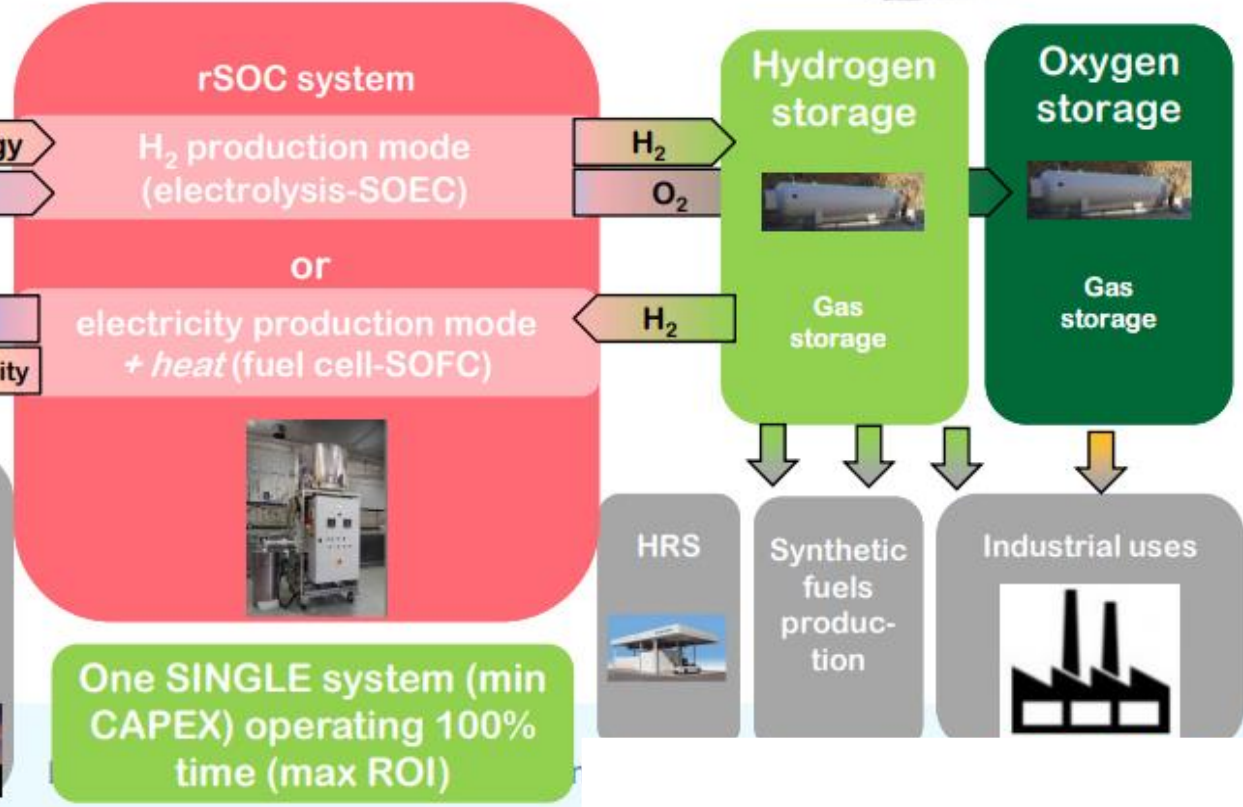


Introduction: rSOC technology

Market addressed:
• Intermittent energies storage



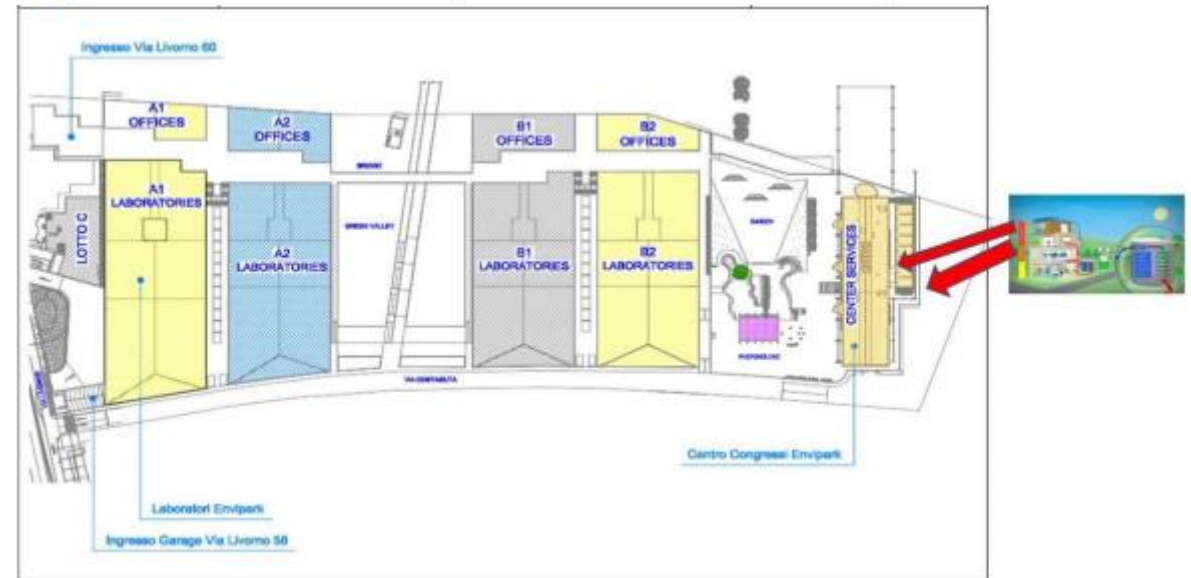
Versatile system that can produce either hydrogen or electricity, upon request



Building / massive electricity production

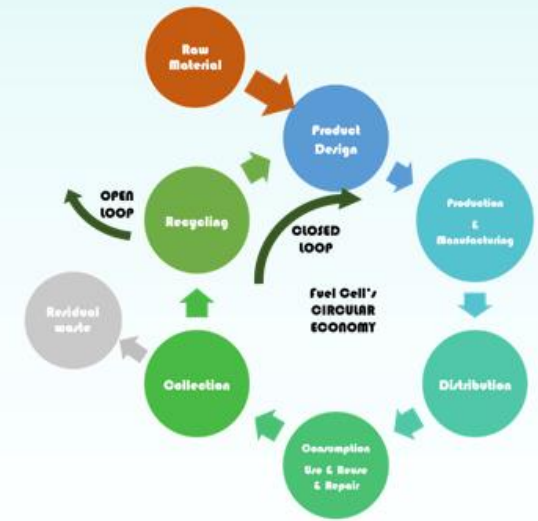
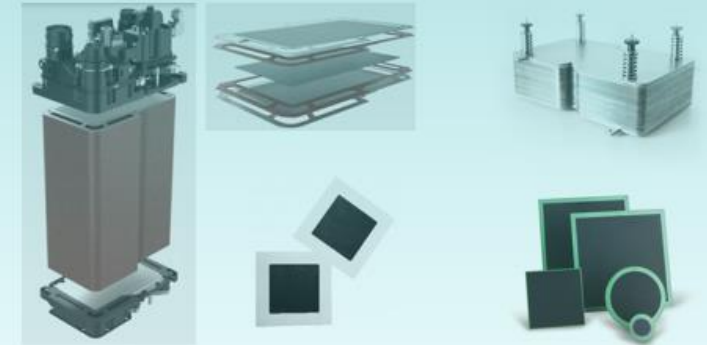
In-field at ENVIPARK in Torino:

- Renewable energies are locally present, including not only solar but also micro-hydro, which in addition offer the opportunity to evaluate the performances of the system with two different types of renewable profiles;
- Electricity and heat are locally needed at the headquarters of ENVIPARK.
- 15 kW SOFC: efficiency > 55% LHV with CH₄ fuel supply;
- 80 kW in electrolysis mode to produce 16 Nm³ /h of H₂: efficiency: > 80% HHV
- Implement it in a real site to provide electricity and heat to commercial buildings
- Explore the electrolyser operational flexibility at the demonstration site via power modulation targeted between 50-100% in SOFC mode and 70-100% in electrolysis mode
- Operate the system for 8000 hours on site with a degradation rate of less than 2% V/1,000 h.
- Evaluate and identify the most promising business cases





SUSTAINABLE
SOLUTIONS FOR
RECYCLING OF
EoL Hydrogen
TECHNOLOGIES
BEST4HY



Best4Hy focuses on the **development and validation of existing and novel recycling processes for 2 key FCH products: PEMFC and SOFC.**

In particular two existing processes will be developed to TRL 5: one on PEMFC and one on SOFC; **two novel recycling techniques** will be developed and validated at TRL 5 on PEMFC precious materials. In addition, **one novel PEM dismantling process will reach TRL5 and one novel SOFC recycling technology will be proved at TRL3.**

At the end of the processes, the materials will be **validated** in terms of **quality and performance when re-used in new components and in new stacks, demonstrating the overall efficiency of recycling.** Re-manufacturing of new cells / stacks will include:

- min 30% of recycled critical raw materials (Ni, YSZ and LSC) in SOFC cells manufacturing,
- min 95% of Pt and 70% of ionomer in the manufacturing of PEMs stacks.

A proof of concept for recovery of Iridium and Palladium from PEMWE with novel technologies developed for PEMS will be investigated





**ENVIRONMENT
PARK** Parco Scientifico
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