Applicazioni dell'idrogeno a livello Europeo

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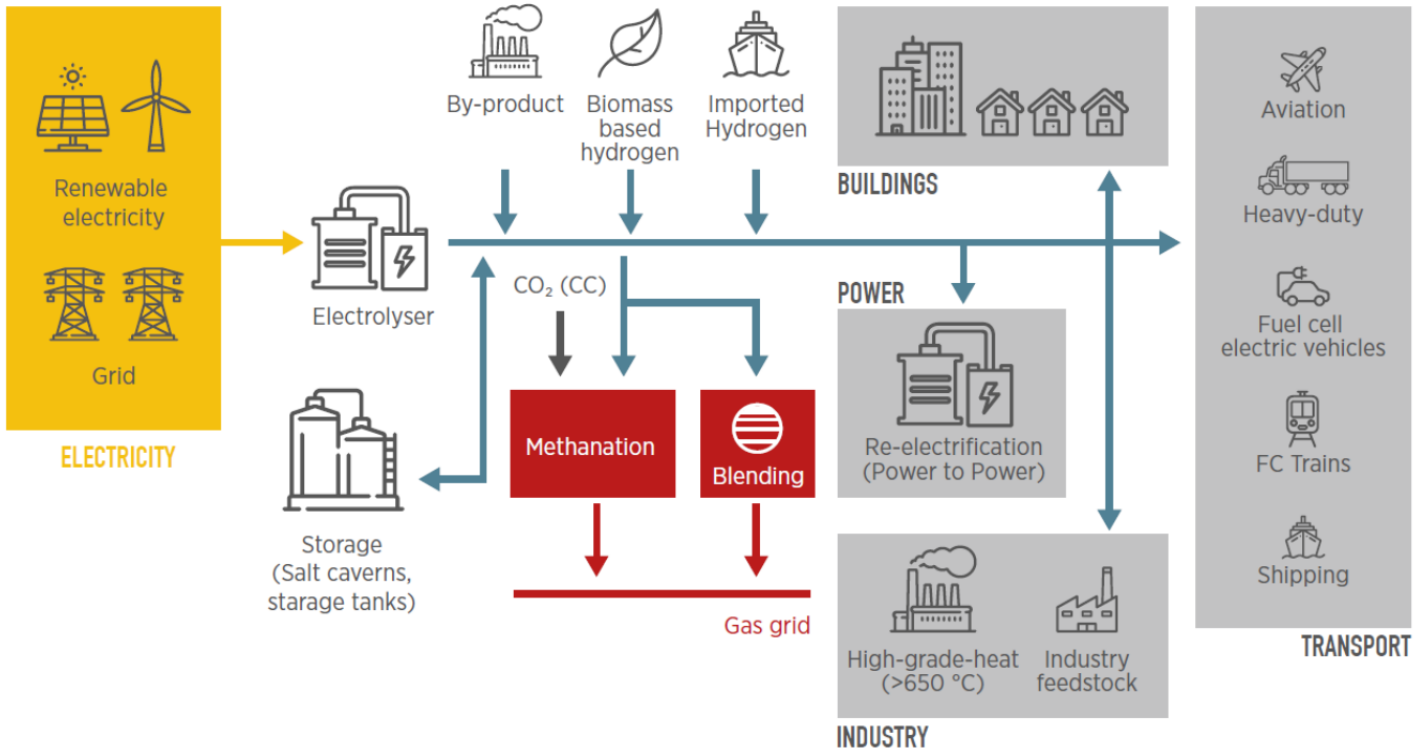
WEBINAR LE2C «LE APPLICAZIONI DELL'IDROGENO E GLI SCENARI FUTURI» 22 aprile 2021

Idrogeno in rete

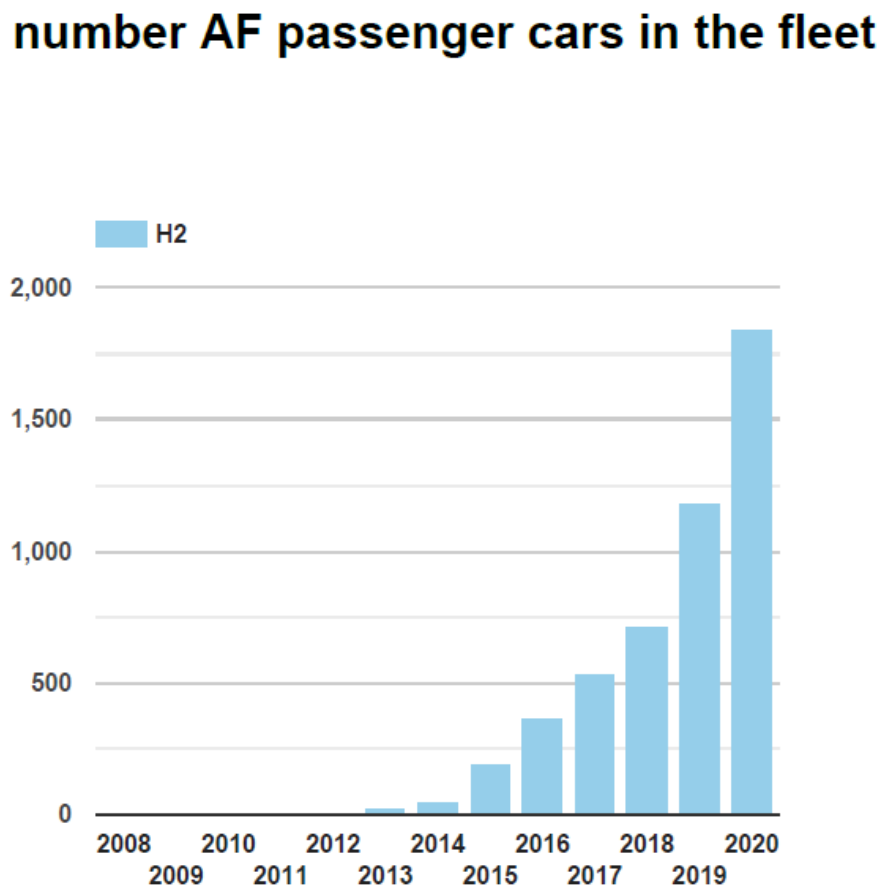
The share of hydrogen in Europe's energy mix is projected to grow from the current less than 2% to 13-14% by 2050

(Moya et al. 2019, JRC116452)



- Aumento produzione sostenibile, basso costo;
- Stoccaggio/trasporto efficienti, durevoli, economici, sicuri;
- Materie Prime (critiche) necessarie;
- Infrastrutture;
- Sfide tecnologiche;
- Mercato;
- Legislazione.

Stazioni di rifornimento H_2 e auto FCEV (2020)

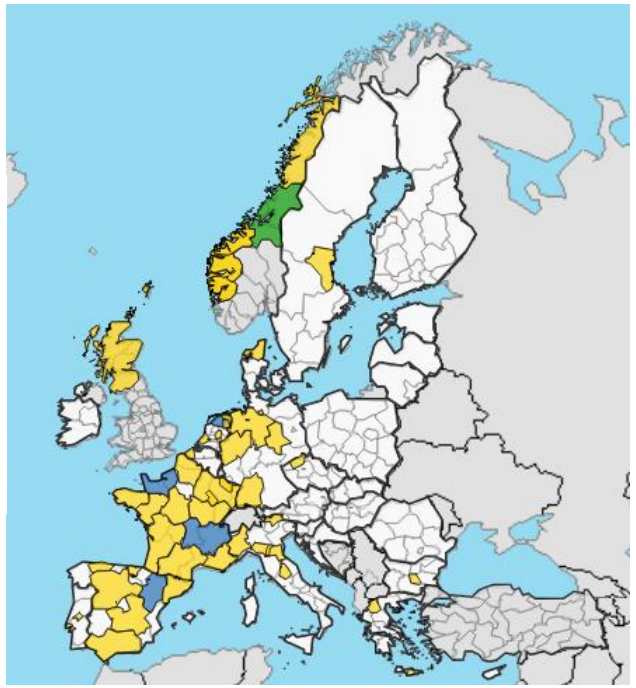


https://www.eafo.eu/

European Alternative Fuels Observatory

European approach, clustering

EUROPEAN HYDROGEN VALLEYS PARTNERSHIP



European Clean Hydrogen Alliance

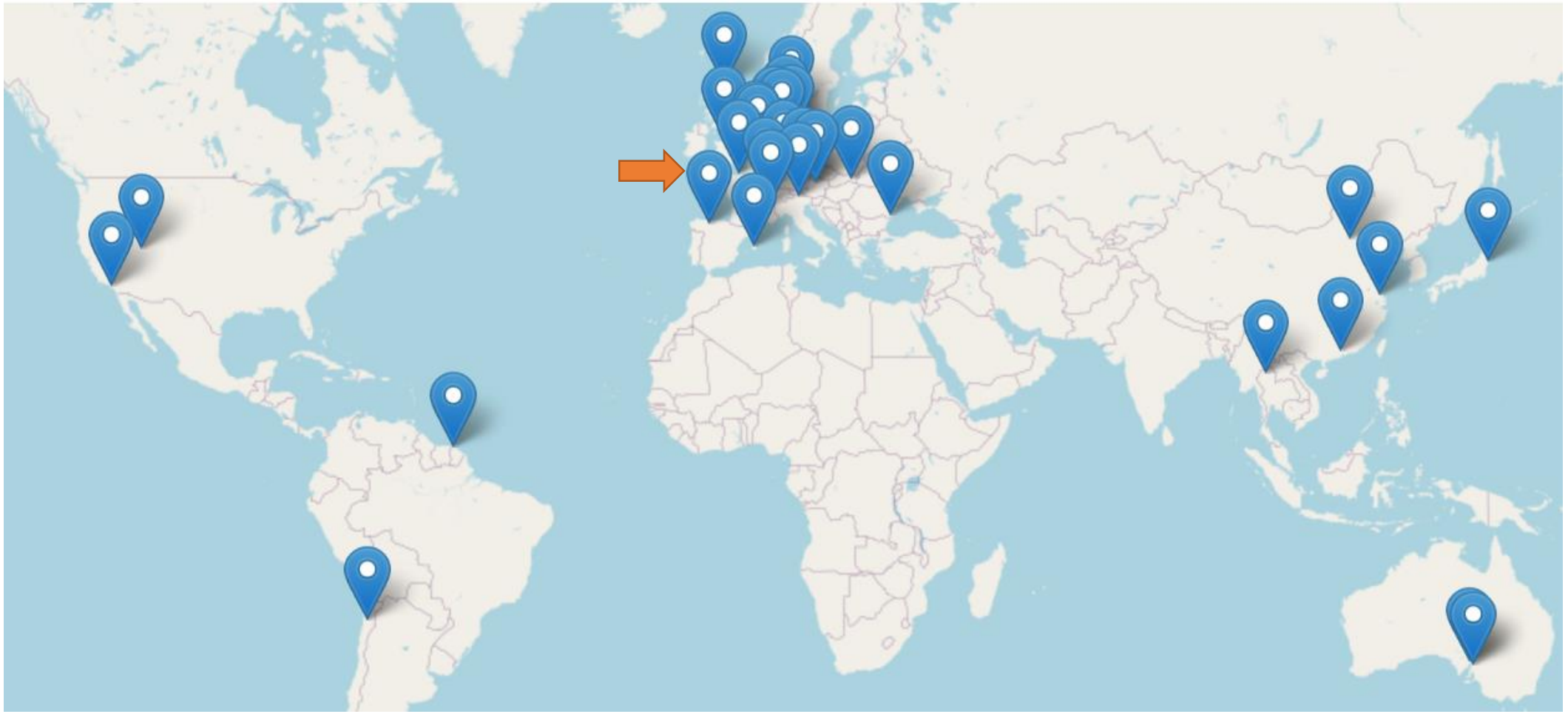
- Develop the technological readiness and the commercial availability of FCH applications;
- Overcome the lack of access to information and expertise between European regions;
- Strengthen the value chain for FCH technologies via interregional cooperation;
- Contribute to the decarbonisation of the EU's economy;
- Green the production of Hydrogen;
- Be an active stakeholder on EU policy making and Hydrogen.

Deployment of hydrogen technologies by 2030, bringing together renewable and low-carbon hydrogen production, demand in industry, mobility and other sectors, and hydrogen transmission and distribution.
EU wants to build its global leadership in this domain, to support the EU's commitment to reach carbon neutrality by 2050.

https://www.ech2a.eu/

https://s3platform.jrc.ec.europa.eu/hydrogen-valleys

FCH JU Mission Innovation H2 Valleys



https://www.h2v.eu/hydrogen-valleys

Green Crane (Western route)

- Pave the way for **South to North green hydrogen flows** in Europe and **boosting local demand in Spain and Italy**. Cross-border routes aim to connect with The Netherlands and France.

MAIN LOCATION
La Robla (Spain)

OTHER LOCATIONS
Gijón (Spain), Rotterdam (The Netherlands), Avilés (Spain), Zaragoza (Spain), Bilbao (Spain), Huelva (Spain)

LEAD DEVELOPER
Enagás Renovable

PROJECT PARTNERS
Hydrogenious LOHC Technologies, Vopak, Térega, Petronor, Arcelor-Mittal I+D, Bosch, McPhy, Vestas, Falck Renewables, IGNIS Energía, H2V, Gransolar

MAIN POLITICAL SPONSORS
National authorities: Ministerio de Industria, Comercio y Turismo; Regional Energy Entities: EREN (Castilla y León), FAEN (Principado de Asturias), EVE (País Vasco), DGA (Aragón)

KEY SUCCESS FACTORS

PROJECT DEVELOPMENT PHASE

- ✓ **Business model/business case development**
  Having a robust business model that can bring benefits and retain competitiveness for all parties along the value chain is paramount
- ✓ **Political backing and buy-in**
  Political backing is essential for removing regulatory barriers, ensuring alignment with national plans and securing an adequate level of economic support
- ✓ **Experienced staff**
- ✓ **Local public acceptance**
- ✓ **Stakeholder cooperation**
- ✓ **Risk sharing mechanisms between project partners**

COMMERCIAL AND FINANCING PHASE

- ✓ **Applying for public subsidy/grant schemes**
  Until renewable hydrogen becomes competitive securing grants and subsidies will be essential
- ✓ **Securing public financial support (subsidy/grant)**
  Until renewable hydrogen becomes competitive securing grants and subsidies will be essential
- ✓ **Securing customer commitments to de-risk the financial model**
  This is one of the key elements for the success of the project

INVESTMENT VOLUME [M€]:
1,470.00 (EU, Nat.l, Private)

PROJECT TIMELINE

2014 — 2019 Start of project development — 2024 Project finalisation — 2035

CURRENT STATUS: Concrete project plan agreed by main stakeholders

VALUE CHAIN COVERAGE

PRIMARY ENERGY SOURCING

- Electricity from solar PV
- Electricity from onshore wind
- Other

H2 PRODUCTION

- Water electrolysis with PEM electrolyser
- Water electrolysis with ALK electrolyser
- Byproduct

H2 STORAGE

- Cylinder - LOHC

H2 TRANSPORT

- Pipeline - Compressed H2
- Ship - LOHC

H2 DISTRIBUTION FOR MOBILITY

- HRS 350 bar

PROJECT DETAILS

H2 PRODUCTION VOLUME [T/day]:

80.00

END USES

MOBILITY

- Buses
- Trucks

ENERGY

- Stationary fuel cells for distributed generations - CHP
- Hydrogen supply for injection into gas grid

INDUSTRIAL FEEDSTOCK

- Supply to refineries
- Supply to steel industry
- Supply to other industries

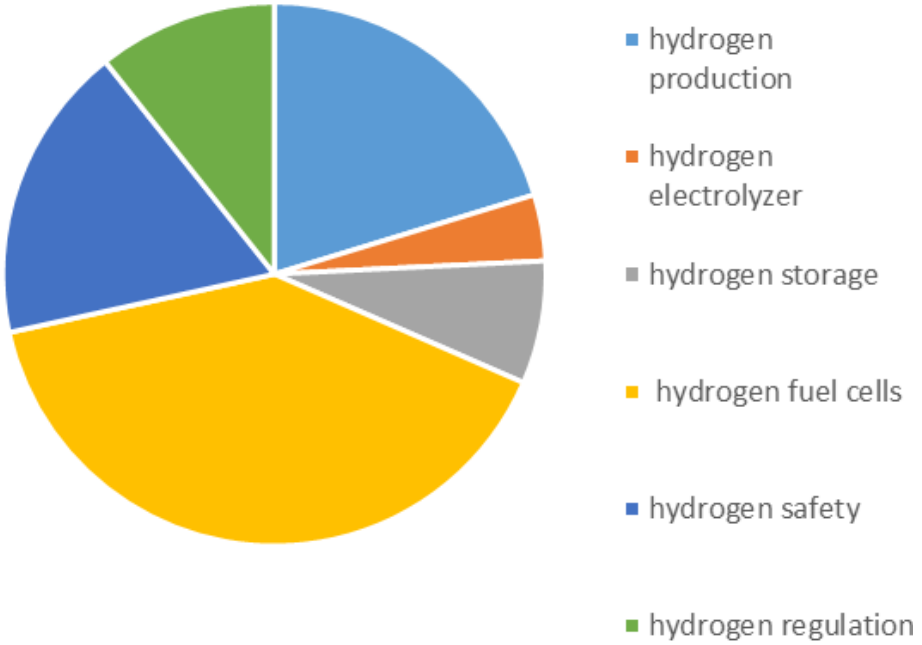
https://www.h2v.eu/hydrogen-valleys/green-crane-western-route

Programme

- [x] H2020
  - [ ] Excellent Science
  - [ ] ERC
  - [ ] FET
  - [ ] MSCA-ITN
  - [ ] MSCA-IF
  - [ ] MSCA-RISE
  - [ ] MSCA-COFUND
  - [ ] MSCA-SUPPORT
  - [ ] INFRA
  - [ ] Industrial Leadership
  - [ ] LEIT-ICT
  - [ ] LEIT-NANO
  - [ ] LEIT-ADVMAT
  - [ ] LEIT-BIOTECH
  - [ ] LEIT-ADVMANU
  - [ ] LEIT-SPACE
  - [ ] RISK-FINANCE
  - [ ] SME
  - [ ] Societal Challenges
  - [ ] HEALTH
  - [ ] FOOD
  - [ ] ENERGY
  - [ ] TRANSPORT
  - [ ] ENVIRONMENT
  - [ ] SOCIETY
  - [ ] SECURITY
  - [ ] Spreading excellence & widening participation
  - [ ] Science with and for Society
  - [ ] Euratom

Progetti H2020 (2017 -)

- 475 results for 'hydrogen‘



- 72 results for 'hydrogen production‘
- 14 results for 'hydrogen electrolyzer'
- 26 results for 'hydrogen storage‘ (4 for 'hydrogen carriers‘)
- 142 results for 'hydrogen fuel cells'
- 63 results for 'hydrogen safety'
- 38 results for 'hydrogen regulation'

Fonte: https://cordis.europa.eu/

Project Information

SWITCH
Grant agreement ID: 875148

Status
Ongoing project

Start date
1 January 2020

End date
31 December 2022

Funded under
H2020-EU.3.3.8.2.

Overall budget
€ 3 746 753,75

EU contribution
€ 2 992 521

Coordinated by
FONDAZIONE BRUNO KESSLER
Italy

SWITCH

SMART WAYS FOR IN-SITU TOTALLY INTEGRATED AND CONTINUOUS MULTISOURCE GENERATION OF HYDROGEN

- **Reversible Solid Oxide module (SOFC+SOEC)**, supported by an advanced fuel processing unit able to manage steam generation and methane reforming reactions to guarantee highly pure hydrogen.
- SWITCH project focuses on the **demonstration of a 25kW (SOFC)/75kW (SOEC) system** operating in a relevant industrial environment
- target of the **hydrogen price lower than 5 €/kg**.
- flexible production of **hydrogen, heat and power**.

HYPSTER

Grant agreement ID: 101006751

Status
Ongoing project

Start date
1 January 2021

End date
31 December 2023

Funded under
H2020-EU.3.3.8.3.

Overall budget
€ 13 246 343

EU contribution
€ 4 999 999

Coordinated by
STORENGY SAS

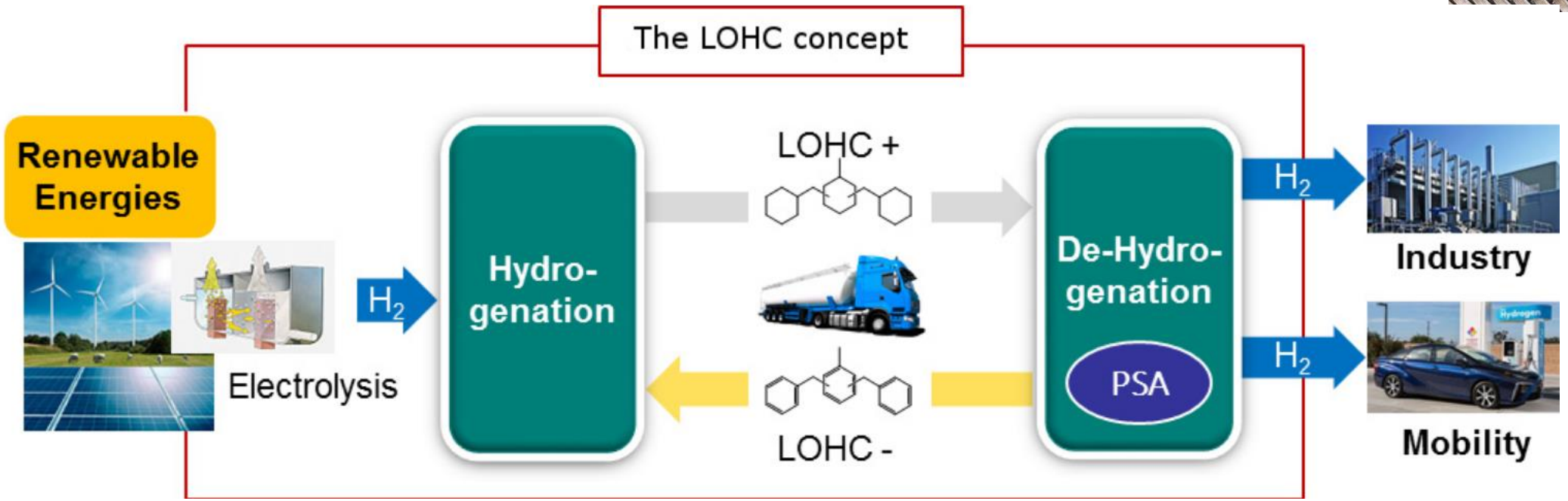
France

HYPSTER

Hydrogen pilot storage for large ecosystem replication

- HYPSTER aims to **demonstrate the industrial-scale operation of cyclic H2 storage in salt caverns** to support the emergence of the hydrogen energy economy in Europe.
- HYPSTER will pave the way towards replication with the **target to go below 1€/kg for H2 storage cost** for the potential **40 TWh salt cavern storage sites** in Europe. Europe's first large-scale, cyclic salt cavern in operation by 2025 and 3 more targeted by 2030.

CHEMICAL H_2 CARRIERS



http://www.hystoc.eu/About/

ALPE: Advanced Low-Platinum hierarchical Electrocatalysts for low-T fuel cells

- Objective: The project ALPE aims at **developing and commercializing a** proton-exchange membrane fuel cell (**PEMFC**) power plant yielding **5 kW**, a durability of 5000 hours, and including **0.5 g of Pt instead of 1 g** or more. This is achieved with radically **new hierarchical nanostructured electrocatalysts** (ECs) promoting the electrochemical processes of the PEMFC.
- The solution (technology): **ALPE will halve the amount of Pt used in a "Fuel Cell".** Thus, the "Fuel Cell" devised in ALPE will be more affordable, and will be durable and powerful enough **to power a small forklift**.
- Partnership: University of Padova (Lead partner), Italy - BRETON S.p.A., Italy - CNRS-INP, France - CNRS-UL, France - C.R.F., Italy - French Alternative Energies and Atomic Energy Commission, France - EIT Raw Materials GmbH, Germany - INPG Enterprise SA, France - INP, France - SYMBIO, France - University of Lorraine (UL), France - University of Warsaw, Poland.
- 2020 –2023

eit RawMaterials
Connecting matters

Funded by the European Union

Progetti e competenze CNR-SCITEC

BIMetallic catalysts Knowledge-based development for Energy applications.

Apr 2019 – Mar 2023 (48M)

10 Beneficiaries + 4 Part. Org.

3,7 M€

TRAINING

14 Early Stage Researchers (all PhD students)

«T shaped» expert in hydrogen technologies

6 networkwide «vertical» courses + 3 «horizontal» courses

RESEARCH

Rational holistic development of catalysts for H_2 production (predictive modeling-preparation-characterization-testing)

3 technologies for blue/green hydrogen:
Steam Reforming of Biogas/methane
Aqueous Phase reforming of light oxigenates
Alkaline Membrane Water Electrolysis

Progetti e competenze CNR-SCITEC

- Progetto **Infrastrutture CNR – AUTOCAT**

2021-2026

150k€

Apparecchiatura automatica per il test di materiali catalitici 7/24 operabile in remoto;

Steam Reforming

Dry Reforming

Fisher-Tropsch

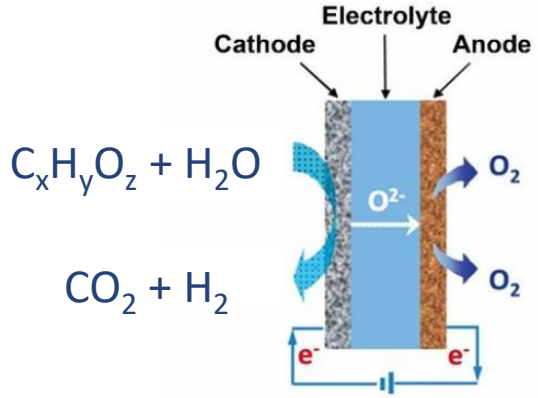
CCU

…

Hydrogen demo Valley

Infrastrutture polifunzionali per la sperimentazione e dimostrazione delle tecnologie dell'idrogeno
Progr. MISE-ENEA Mission Innovation
202? (36 mesi)

- Integrazione di catalizzatori di steam reforming in celle «SOEC» (Solid Oxide Electrochemical Cells)



GRAZIE PER L'ATTENZIONE!

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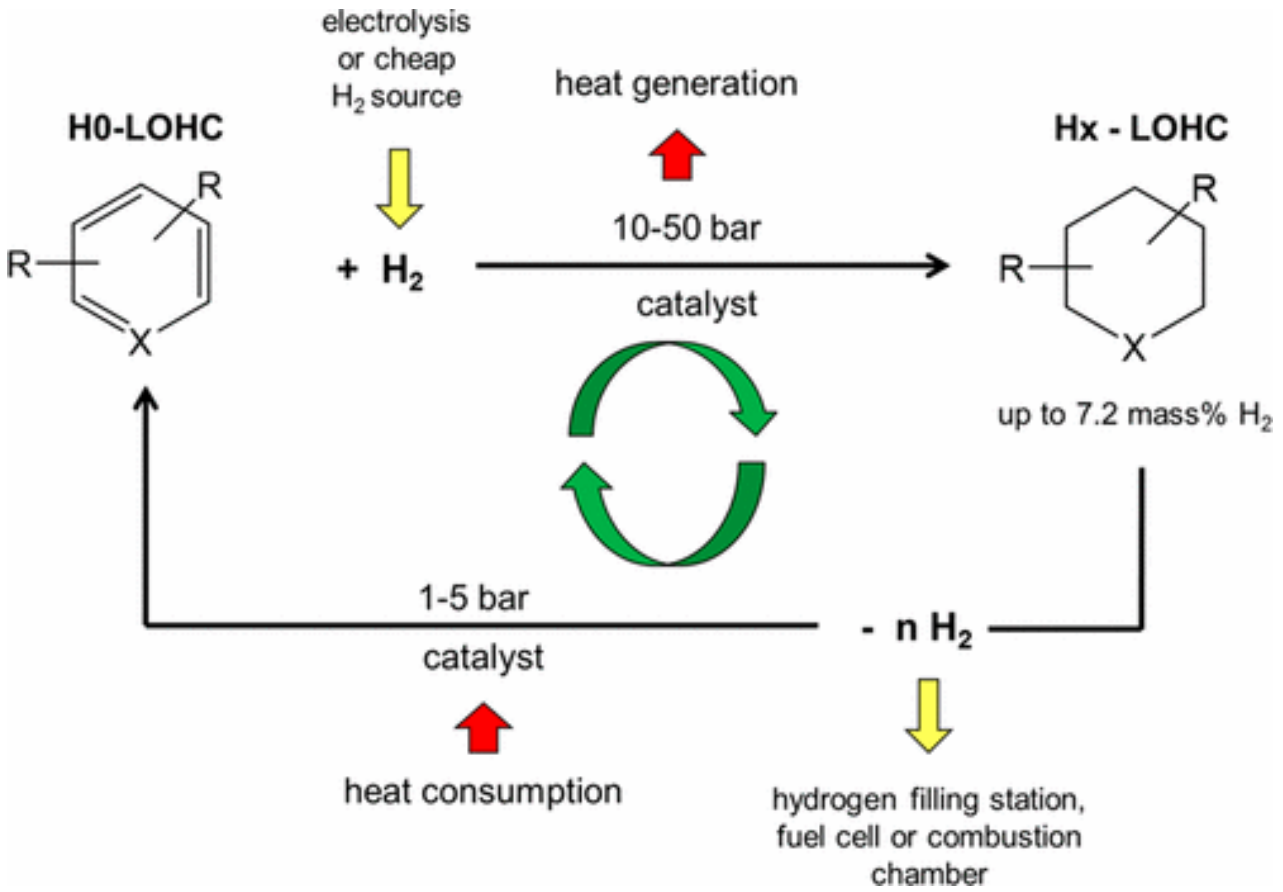
BACK UP SLIDES

hydrogenious
LOHC TECHNOLOGIES

https://www.hydrogenious.net/index.php/en/hydrogen-2-2/



Source:
Accounts of Chemical Research, 2017, 50 (1), pp 74-85
DOI: 10.1021/acs.accounts.6b00474

The LOHC-technology provides several advantages to overcome these issues and therefore to support hydrogen mobility targets within Horizon 2020.

- **High transport capacity**
  Up to 5x higher transport capacity per 40-to truck compared to 200 bar tube trailers and up to 3x higher compared to 500 bar tube trailers
- **Low transport cost**
  LOHC reduces operating costs of hydrogen logistics by up to 80%. Potential use of standard oil tank infrastructure reduces investment costs significantly
- **Easy road transport**
  The LOHC of choice in the HySTOC project is dibenzyltoluene (DBT), which is classified as a non-hazardous good according to ADR. Handling of hydrogen bound to LOHC can be done at ambient conditions.
- **High safety**
  As the hydrogen is chemically bound, no molecular hydrogen has to be stored. The carrier material (DBT) is hardly flammable and non-explosive, allowing storage of large amounts of hydrogen at existing refuelling stations