FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

EHSP

European Hydrogen Safety Panel

Workshop on Safety of Electrolysis

Iñaki Azkarate

18 November 2020

Background

European Hydrogen Safety Panel (EHSP)

A brief timeline

- In 2006 and 2009 NoE HySafe was suggesting an activity for **sharing lessons learned and hydrogen safety experience across project boundaries** and to **maintain this expertise eventually even beyond program terms.**
- In 2014 the International Association for Hydrogen Safety HySafe proposed the installation of a safety panel to the Executive Director and Governing Board of the FCH JU.
- After several discussions about formal aspects, terms of reference, vision, mission, mandates, etc. the European Hydrogen Safety Panel was launched by the FCH 2 JU in 2017.

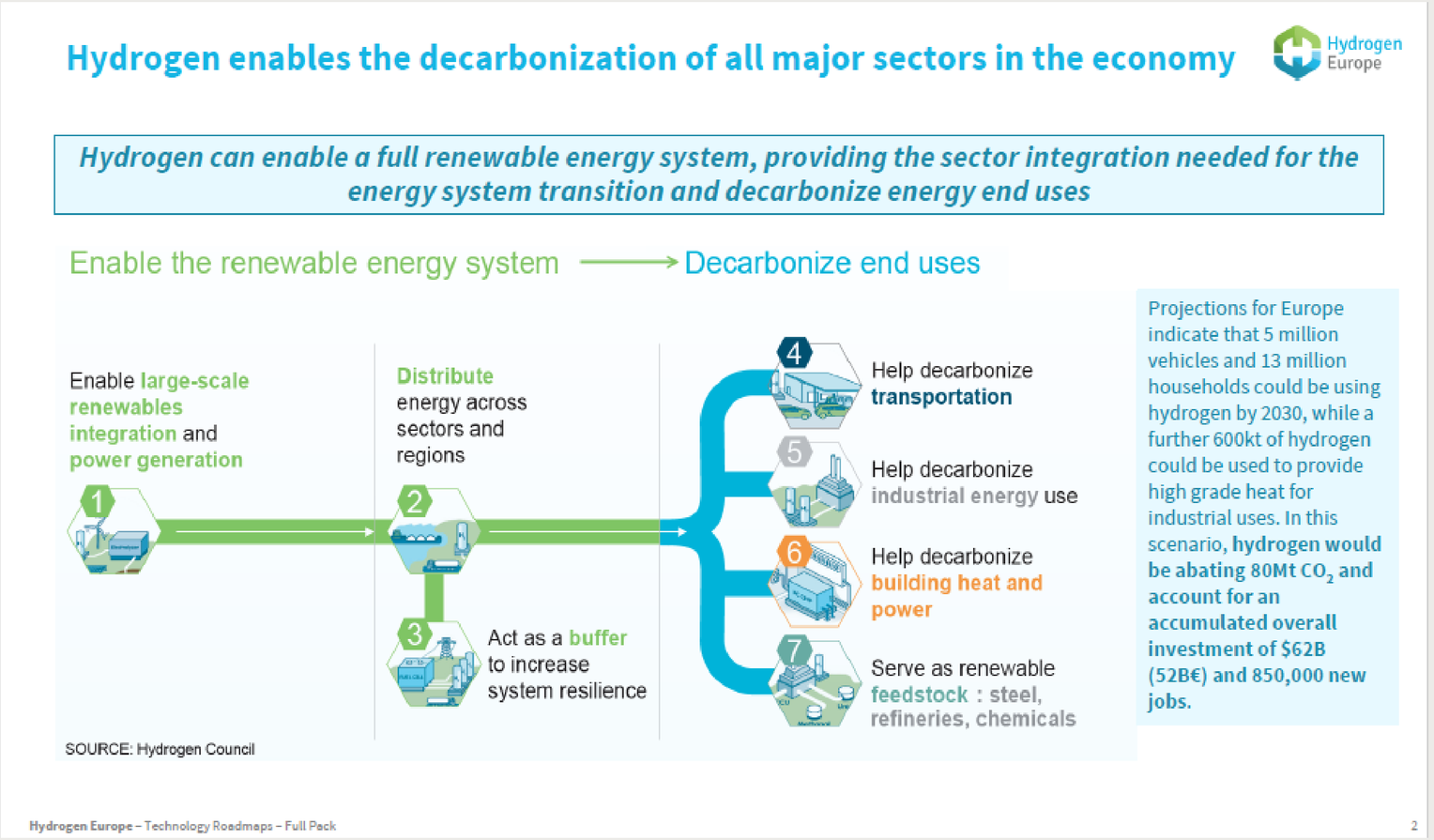
Vision

European Hydrogen Safety Panel (EHSP)

Reflecting the FCH 2 JU vision

- Hydrogen plays a key role in the Energy System constituting a **safe** and sustainable Energy Carrier.

- Hydrogen is an enabler of the Energy Transition towards a decarbonized system.



From Vision to the Strategic EHSP Role

European Hydrogen Safety Panel (EHSP)

FC and H2 technology developments having a direct impact on safety:

- **Quantitative growth across "established" applications** in mature markets **increases the demand for hydrogen**, and hence increases the number and size of H2 supply units, i.e. HFS
- **Qualitative change**, new applications building on the success of established applications. (50-100 kg H2 for trucks, 200-500 kg for rail, and potentially tons of hydrogen for marine)

The inevitable consequence of this increase in consumption will be the requirement for an **increasingly large and competent workforce** […] technicians, engineers, manufacturers, regulatory authorities etc. on a **very steep hydrogen learning curve.**

EHSP ROLE: to provide **independent safety expertise**, **objective information**, **education and training** in different forms for various groups of stakeholders and support the anticipated upscaling of hydrogen energy application.

Mission, Objectives and Corresponding Activities

European Hydrogen Safety Panel (EHSP)

The EHSP assist the FCH 2 JU both at programme and **at project level**

- in **assuring that hydrogen safety is adequately managed**, and
- to **promote and disseminate hydrogen safety culture**

Activities structured in
4 Task Forces

TF1
Project level

TF2
Program level

TF3
Data Collection

TF4
Public Outreach

Scope of Activities

European Hydrogen Safety Panel (EHSP)

Activities are grouped in the 4 pillars and organised in Task Forces (TF)

TF1 Support at Project level

- Coordination of a package of measures to avoid any accident by integrating safety learning, expertise and planning into FCH2 JU funded project.
- e.g. Safety plans review, in-situ reviews, courses, data collection/ monitoring …

TF2 Support at Programme level

- answering urgent questions, short introductions to hydrogen safety
- provision of specific guidelines (collecting inputs from projects)
- …

TF3 Data collection and assessment

- Support to HIAD - Hydrogen Incidents and Accidents Database
- Analysis of existing events, derive lessons learned and provide recommendations, collaboration with similar activities of the US DoE and EIGA…

TF4 Public Outreach

- Development of a comprehensive outreach, education and training programme for the safety component of FCH2 JU projects
- Newsletter and website, containing the lessons learned and links

Scope of Activities

European Hydrogen Safety Panel (EHSP)

Contributions of the EHSP

TF1 Support at Project level

Safety Planning

TF2 Support at Programme level

Emergency/crisis management

TF3 Data collection and assessment

Lessons learnt and recommendations

TF4 Public Outreach

Communication, web, FAQ

FUEL CELLS and HYDROGEN 2 JOINT UNDERTAKING
(FCH 2 JU)

SAFETY PLANNING FOR HYDROGEN AND FUEL CELL PROJECTS

FUEL CELLS and HYDROGEN 2 JOINT UNDERTAKING
(FCH 2 JU)

Assessment and lessons learnt from HIAD 2.0 –
Hydrogen Incidents and Accidents Database

20 September 2019

EHSP & FCH 2 JU CONFIDENTIAL

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European Hydrogen Safety Panel (EHSP)

Communication strategy 2020–2024

24 April 2020

Task Force 4 –

TF4 D4.4: FAQs – Lea

FAQs

Q1: Is hydrogen more or le

Q2: Are specific hydrogen t

Q3: What are the requirements for testing equipment and components used in hydrogen systems?

How are components used in hydrogen systems certified and tested? Which regulations, codes and standards apply? How can event frequencies for emerging hydrogen technologies be estimated, what are the uncertainties in such estimates, and what are the implications for risk assessments?

Current EHSP Members – the Pool of Experts

European Hydrogen Safety Panel (EHSP)


Inaki Azkarate


Stuart Hawksworth


Thomas Jordan


Georg Wilfried Mair


Marta Maroño


Vladimir Molkov


Ernst-Arndt Reinecke


Pratap Sathiah


Ulrich Schmidtchen


Etienne Studer


Trygve Skjold


Tom Van Esbroeck


Elena Vyazmina

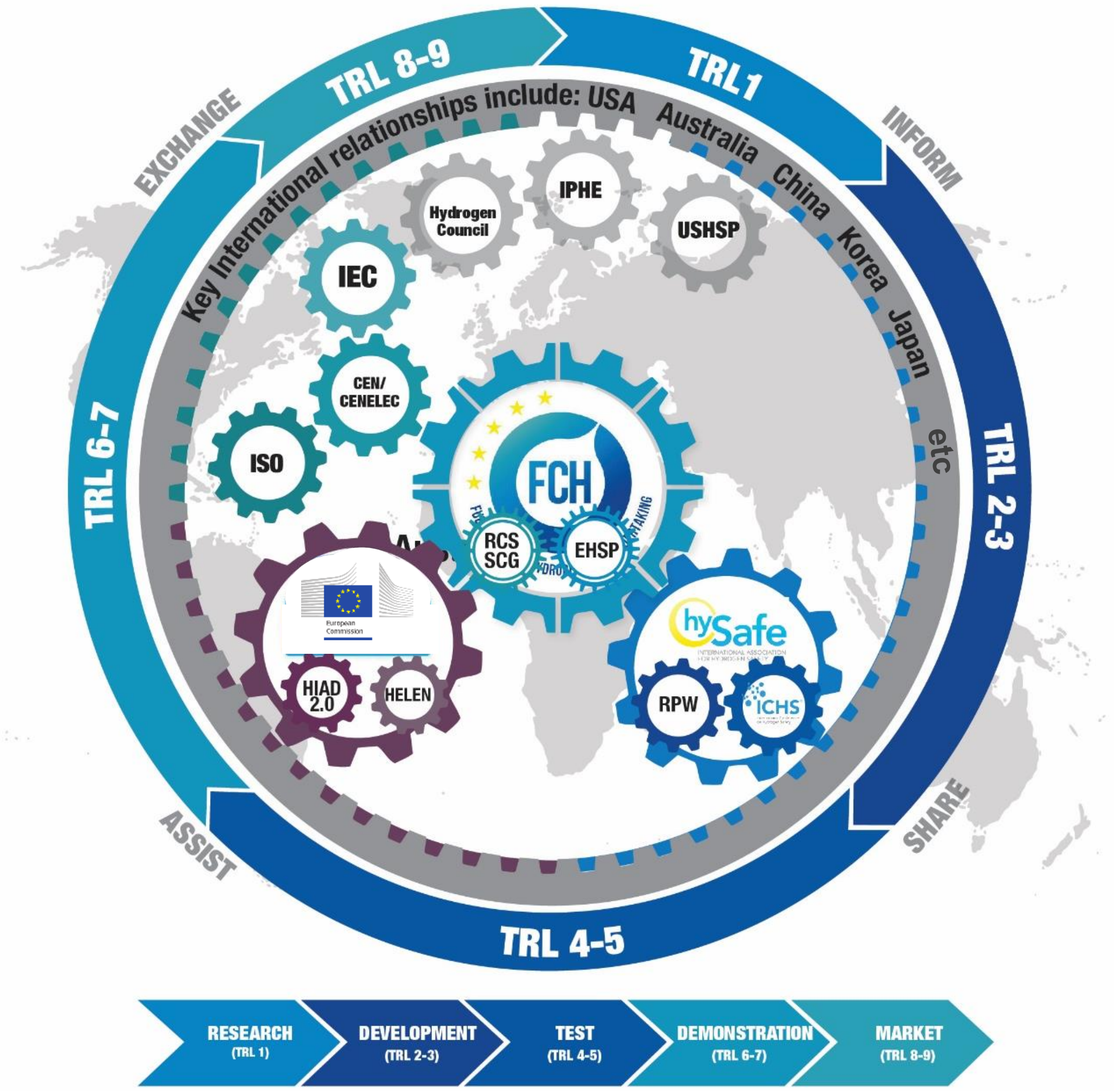

Jennifer Wen

For more information see Members of the EHSP : https://www.fch.europa.eu/page/european-hydrogen-safety-panel

EHSP in the „Big Picture“

International relations for strategic orientation

- Ensure appropriate engagement for hydrogen safety at program level.
- Identify and prioritise gaps with respect to hydrogen safety in close cooperation with RCS SCG, JRC and HySafe.
- Share information and coordinate with similar international activities.
- Support demonstrations of safety.
- Ensure safe implementation and operations for a broader roll-out.



The EHSP: Value of the EHSP role

The members of the EHSP would like to express a strong commitment towards supporting the Hydrogen Community.

With our expertise, we can help research projects,
and in principle all stakeholders, to address matters related to hydrogen safety.

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Workshop on Safety of Electrolysis

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Workshop on Safety of Electrolysis

European Hydrogen Safety Panel (EHSP)

Workshop on Safety of Electrolysers

This Workshop consist of a specific activity of the EHSP, particularly of our TF1, *Support at Project level*.

Electrolysis is the process that splits water into hydrogen and oxygen using electricity.

Hydrogen is produced in the cathode and Oxygen in the anode.

Depending on the materials and temperature of the process, several types of Electrolysers are considered:

- Low Temperature Electrolysis (LTE), including
  - Proton Exchange Membrane Electrolysis (PEME) and
  - Alkaline Electrolysis (AE),
    - conventional or
    - AEME (also known as Alkaline PEM)
- and High Temperature Electrolysis (HTE).
  - Solid Oxide Electrolysis (SOE).

Challenges

Concerning the challenges of the technology, the Research on Electrolysers is focused on overcoming aspects as:

- Reducing the capital cost.
- Improving energy efficiency for converting electricity to hydrogen.
- Resistance to cross-over.
- Integrating compression into the electrolyser.
- Improving the materials resistance, this process is very demanding concerning materials and their improvement against corrosion processes is needed.

Workshop on Safety of Electrolysis

European Hydrogen Safety Panel (EHSP)

Challenges, risks, safety matters

The rate of **H2 and O2 cross-permeation** across the **membrane** and their water solubility both increase with pressure

Electrolyte
defines the technology.
Materials for electrodes, seals and catalysts have to be tuned to the electrolytes

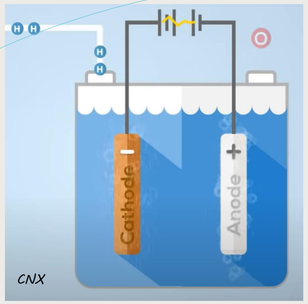
Flammable H2
in close **vicinity to oxydizer O2**

Wet **corrosive** electrochemistry on electrodes

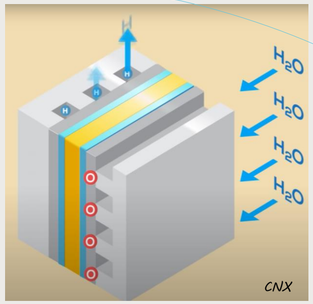
High direct voltage
(~400V) with transients and potential for hot spots

Membrane Electrode Assembly MEA
Thin **membrane seperates** gas spaces and thin **electrodes** transfer electrons to the ion conducting **electrolyte**
Internal electrodes are designed as **bipolar plates** functioning as cathode (H2 generation) on one side and as anode (O2 formation) on the other

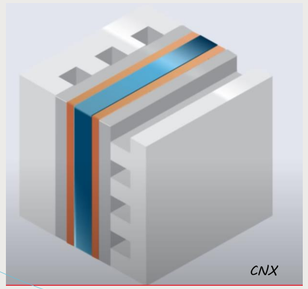
AE



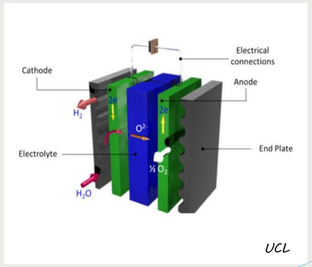
PEME



AEME



SOE



Thank you for your attention

https://www.fch.europa.eu/page/european-hydrogen-safety-panel