Social impacts of hydrogen technologies and application
Addressing research gaps for sustainable policies design

Results from the stakeholder engagement activity

1. Overview

This document summarizes the key outcomes of the expert round table convened by the EERA Joint Programme on clean Energy tranSition for Sustainable Society (JP e3s) in collaboration with Ecoinnovazione on 8th May 2026. The event marked the first step of a three-phase research pathway aimed at developing a robust social assessment framework for the hydrogen sector, leading to the publication of a position paper in the first half of 2027.

The round table brought together experts to refine the research scope and collectively address a central question: ***What types of social impacts are most likely to emerge from the development of a sustainable hydrogen sector, and how can they be meaningfully defined and measured?***

Participants:

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3	Alessandro Arrigoni	European Commission
4	Alessandro Sciullo	University of Turin
5	Beata Kviatek	Hanze University
6	Daniel Fraile	Hydrogen Europe
7	Daniel Garraín Cordero	CIEMAT
8	Federica Viganò	University of Bolzano
9	Gerd Schumacher	Uliech
10	Giuseppe Cecere	Ecoinnovazione
11	Giuseppe Pellegrini Masini	ENEA
12	Lee Yi-Ching	KIT
13	Marta Maroño	AIRBUS
14	Paola Rizzi	UNITO
15	Pedro Mendes	European Commission
16	Raffaele Albanese	CNR
17	René Schutte	HyNorth
18	Witold-Roger Poganietz	KIT

2. The Three-Step Research Pathway

The round table is embedded in a broader, structured research process:

- **Step 1 — Expert Round Table (current):** Narrow the research scope and refine the design through structured expert dialogue.
- **Step 2 — EU-Wide Survey:** Map social challenges and opportunities across the hydrogen value chain, capturing the specificity of locations and contexts across Europe.
- **Step 3 — Participatory Workshop:** Engage industry leaders, policymakers, civil society groups, and local communities to co-develop inclusive and responsive governance models.

3. Social Topics Identified

Through moderated discussion, participants identified a comprehensive set **of social dimensions relevant to the hydrogen sector**, spanning economic, institutional, and environmental domains.

At the economic level, the conversation centered on the **wide range of effects, both positive and negative, that hydrogen development may generate**, with particular attention to **employment dynamics** and the **quality and quantity of jobs** created through skills development, upskilling and reskilling. Closely related to these economic concerns are questions of **affordability and accessibility**, especially for low-income regions and countries where the costs and benefits of the hydrogen transition risk being distributed unequally.

Safety emerged as a multifaceted dimension, encompassing both **objective risks to the general population** and the more subjective **safety perception and trust**, a distinction that is very important to take into account when designing communication strategies and stakeholder engagement processes. Trust in institutions and technology is further shaped by the **regulatory environment**, which participants identified as a powerful determinant of how social effects unfold over time. The **maturity level of hydrogen technologies** was also recognized as a key variable: early-stage deployment carries different social implications than mature, large-scale infrastructure, and this trajectory must be factored into any assessment framework.

Social acceptance was understood not as a static condition but as an **ongoing, participatory process**. Participants noted that acceptance of hydrogen is rarely standalone, it tends to follow and depend on prior societal acceptance of renewable energies more broadly. **Local participation and community engagement** are therefore important prerequisites. This connects to a recurring concern about **knowledge gaps** and the disconnect between civil society and hydrogen technology: finding the right narrative, one that is honest, accessible, and contextually sensitive — was seen as a challenge for the sector.

The discussion also highlighted a set of **systemic and territorial dimensions. Resource competition and trade-offs**, including pressures on **land use and water consumption**, were flagged as concrete sources of social tension, particularly in contexts where multiple demands already converge. The **delocalization of impacts** raises questions of **territorial justice**: the communities that host hydrogen infrastructure may not be the same ones that reap its benefits. This intersects with concerns about **local and regional identity**, which can be materially and symbolically affected by landscape changes and industrial transformation. **Energy security**, understood as the resilience and strategic autonomy afforded by hydrogen systems, was seen as a key societal benefit, though one whose distribution across territories requires careful attention. Finally, the **flexibility of hydrogen technologies** and their capacity to leverage existing infrastructure were recognized as factors with significant social implications for employment continuity, community disruption, and the pace of transition.

4. Identification of geographic dimensions of the topics and relation to the technology and energy system

A recurring theme throughout the discussion was the importance of scale in shaping the social dimensions of hydrogen development. Participants emphasized that social impacts cannot be understood through a single level of analysis, as many of the issues identified unfold simultaneously across **geographical scales**, local, national, and global, and different analytical levels, from **specific technologies** to broader **energy systems**.

Safety perception and trust emerged as particularly scale-sensitive dimensions. At the technology level, concerns are often highly localized and linked to the direct presence of infrastructure, storage facilities, transport networks, or industrial installations. In these contexts, public perception is shaped not only by objective safety conditions but also by **proximity, familiarity, and trust in local institutions and operators.** At the same time, participants noted that trust also operates at the energy-system level, where broader confidence in the **energy transition, governance structures, and industrial actors** influence how hydrogen is perceived socially.

The role of **regulation** was similarly understood as operating across multiple scales and analytical levels. Regulatory frameworks at the local and national levels shape permitting procedures, safety standards, land-use decisions, and opportunities for participation, directly influencing **community experiences and acceptance**. At the same time, international and global regulatory dynamics, including **certification schemes, trade rules, and sustainability standards**, influence the broader development trajectory of hydrogen systems. Participants stressed that regulation therefore affects both the **deployment of specific technologies** and the configuration of **energy systems** more broadly.

The **maturity level of hydrogen technologies** was also discussed as a scale-dependent issue. At the technology level, early-stage deployment tends to generate higher uncertainty, lower familiarity, and stronger concerns regarding **risks, costs, and reliability**. However, maturity was also framed at the system level, since the integration of hydrogen into wider energy infrastructures depends on long-term **institutional, industrial, and societal development processes**. Participants noted that perceptions of maturity can differ significantly between local contexts and global narratives, technologies promoted internationally as mature may still appear experimental or uncertain within local communities experiencing first deployments.

Social acceptance was consistently described as both technology-specific and systemic. Acceptance may concern a particular project or infrastructure at the local scale, where issues such as **landscape transformation, safety perception, or community benefits** become central. At the same time, participants highlighted that hydrogen acceptance is also embedded within broader societal debates surrounding **energy transitions and competing technological pathways**. In this sense, acceptance operates at the energy-system level when hydrogen is evaluated alongside alternative decarbonization options, and it evolves across both local and global scales through **public discourse, policy narratives, and previous experiences with renewable energy deployment**.

Affordability was primarily framed as an energy-system issue rather than a technology-specific one. Participants emphasized that the costs and benefits associated with hydrogen transitions are distributed unevenly across territories and social groups, making affordability relevant at both local and global scales. At the local level, concerns focus on **access to energy, distributional justice, and the potential burden placed on vulnerable**

communities. Globally, affordability intersects with inequalities between countries and regions, particularly regarding **access to infrastructure, investment capacity, and technological capabilities**.

Finally, the **flexibility of hydrogen technologies** was identified as a dimension that strongly connects technological characteristics with broader energy-system implications. Participants noted that hydrogen's capacity to integrate with existing infrastructures and adapt to different industrial and territorial contexts may reduce social disruption and facilitate transition processes. These implications emerge locally, where infrastructure adaptation affects **employment continuity and community stability**, but also nationally and globally, where flexibility influences **energy security, industrial competitiveness, and the pace of systemic transformation**.

5. Priority Topics for the Research Agenda

Following the mapping exercise, participants ranked the topics by urgency and strategic relevance. The six priorities below will anchor the EU-wide survey and subsequent phases of the research:

1. **Regulation** – the role of regulatory frameworks in shaping social outcomes
2. **Economic effects** – impacts on employment, income distribution, and regional economies
3. **Resource competition and trade-offs** – land use, water consumption, and ecosystem pressures
4. **Geopolitical issues** – supply chain dependencies, energy sovereignty, and international equity
5. **Delocalization of impacts** – how benefits and burdens are distributed across territories
6. **Energy security** – resilience, reliability, and strategic autonomy of hydrogen-based systems

6. Key Insights from the Discussion

Drivers and Impacts

A takeaway emerging from the discussion is the **strong interconnection between social impacts and the drivers that shape them**. **Regulation** plays a decisive role in shaping how hydrogen systems are deployed and governed, while **social acceptance** and **local participation** influence the legitimacy and long-term viability of projects. **Accessibility**, both in economic and infrastructural terms, was recognized as another critical factor determining who benefits from the transition. The discussion also pointed to the importance of **addressing knowledge gaps** and **improving hydrogen literacy**, since limited public understanding may reinforce uncertainty and resistance. More broadly, acceptance of hydrogen was seen as connected to wider societal attitudes toward green technologies and energy transitions in general.

Participants further emphasized the importance of considering the **delocalization of impacts**, since the territories hosting infrastructures and resource extraction may not necessarily coincide with those receiving the main economic or strategic benefits. In this context, the **flexibility of hydrogen technologies** was regarded as a potentially important mitigating factor, capable of supporting infrastructure adaptation, reducing disruption, and facilitating integration within existing industrial and energy systems.

Territorial dimension and just transition

Social impacts do not materialize uniformly across space. The discussion highlighted that **regional disparities and just transition concerns must be explicitly incorporated into any assessment framework**. The territorial level at which impacts are felt – whether local, regional, or national – significantly shapes both the nature and magnitude of social effects.

The narrative gap

A recurring theme was the disconnect between civil society and hydrogen technology. Participants underscored the importance of **finding appropriate narratives and communication strategies** to bridge this gap — not only as a matter of public relations, but as a prerequisite for democratic legitimacy and informed participation.

Sequencing social acceptance

Acceptance of hydrogen is not standalone; it follows and **depends on broader societal acceptance** of renewable energies. This sequencing has important implications for stakeholder engagement strategies and timeline planning.

Next Steps

Building on the outcomes of this round table, the research team will:

- Finalize the working definition of social impacts for use across all three research phases in line with the Driver Pressure State Impact Response (DPSIR) model
- Design the EU-wide survey instrument, structured around the six priority topics
- Identify and engage target respondents across the hydrogen value chain in diverse European contexts
- Launch the survey in the coming months, with results feeding into the participatory workshop and ultimately the position paper