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REVIEW

Evidence synthesis: Public perceptions of hydrogen and fuel cell technologies in the European Union

[version 1; peer review: 3 approved with reservations]

Aaron M Jensen[1], Eric A. Jensen[1], Daniela Martin[1], Brady Wagoner[2,3]

[1]Institute for Methods Innovation, Dublin, Ireland
[2]Department of Psychology, University of Copenhagen, Copenhagen, Denmark
[3]Aalborg University, Esbjerg, Region Syddanmark, Denmark

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Abstract

This study examines public perceptions and responses to hydrogen and fuel cell technologies across the EU27, focusing on patterns of awareness, acceptance, and perceived risks and benefits. Through a rapid, but systematic, literature review of the 2023 *Gallup International Awareness of Hydrogen Technologies Survey*, we explore how demographic, regional, and attitudinal factors shape public opinion. Findings indicate that while awareness of hydrogen is widespread, familiarity is limited and uneven across countries and groups. Support for hydrogen is strongest when linked to environmental sustainability and energy independence, but it remains contingent on trust in institutions, clarity about hydrogen production types, and reassurance around safety and cost. Differences by age, gender, and national policy context highlight the need for tailored communication and engagement strategies. These insights provide actionable guidance for policymakers and stakeholders working to align public engagement with the EU's hydrogen and climate ambitions.

Plain language summary

This study looks at how people across the European Union feel about using hydrogen as a future energy source. It combines insights from past research from all 27 EU countries. While most people have heard of hydrogen, only a smaller number say they understand it well. The way people think about hydrogen depends on their age, gender, and where they live. Men and younger people are more likely to say they're familiar with hydrogen. People who care about the environment and trust science tend to support hydrogen energy, especially when it's presented as safe and clean. However, concerns about safety, cost, and how hydrogen is produced still affect people's views. The study shows that to gain stronger public support, governments and organisations need to communicate more clearly

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1. **Dimitrios Tzioutzios**, Norwegian University of Science and Technology, Trondheim, Norway
2. **Cristiana Tudor**, Bucharest University of Economic Studies, Bucharest, Romania
3. **Andrea Morone**, University of Bari Aldo Moro, Bari, Italy

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and address different groups in ways that match their needs and concerns.

Keywords
hydrogen technology, public perception, energy sustainability, environmental attitudes, European Union, public engagement, renewable energy transition



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Corresponding author: Eric A. Jensen (eric@methodsinnovation.org)

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Introduction

Hydrogen technology is central to the European Union's strategy for achieving climate neutrality by 2050 (European Commission, 2020). It offers a low-carbon solution for hard-to-decarbonise sectors such as heavy industry, long-haul transport, and domestic heating. The EU Hydrogen Strategy sets an ambitious goal: to install at least 40 GW of hydrogen electrolyzers by 2030. This target is supported by substantial investment and policy incentives to develop hydrogen infrastructure and integrate hydrogen into national energy systems.

Alongside technical progress, public perception has become a key factor shaping the future of hydrogen technologies. Acceptance depends not only on awareness and knowledge but also on perceived risks, benefits, environmental values, and trust in institutions (Huijts *et al.*, 2012). While attitudes across Europe are generally favourable, especially for applications like clean energy storage and fuel cell vehicles, support varies by country and context, often reflecting policy environments and levels of public understanding (Clean Air Task Force, 2023; HYACINTH Project, 2017).

Misconceptions about hydrogen types, unclear sectoral priorities, and concerns over safety, costs, and energy dependency continue to shape opinion (Gordon *et al.*, 2024; Plank *et al.*, 2023). Emotional responses and perceived personal impact also influence acceptance more than technical details (Scovell, 2022). These patterns highlight the need for more targeted public engagement and clear communication to ensure hydrogen's role in the EU's climate strategy is both technically viable and socially supported (Wolf & Zander, 2021).

This article contributes to the growing body of research on hydrogen acceptance by analysing EU-wide survey data and synthesising key findings from existing literature. As part of the Horizon Europe-funded HYdrogen Public Opinion and accePtance (HYPOP) project, we offer a comprehensive examination of how demographic, regional, and cultural factors shape public attitudes toward hydrogen technologies. By exploring both broad attitudes and specific concerns, such as safety, affordability, and environmental performance, we aim to generate actionable insights for policymakers, communicators, and researchers working to align public engagement strategies with the EU's hydrogen and climate ambitions.

Literature review on public perceptions of hydrogen technology

This literature review was conducted to synthesise peer-reviewed and grey literature examining public and stakeholder perceptions of hydrogen and fuel cell technologies within the European Union. It aimed to identify recurring patterns, knowledge gaps, and contextual drivers of acceptance, with a view to informing public engagement strategies and supporting the EU's hydrogen deployment and climate transition objectives. The review focused on survey-based studies offering analytical insights into awareness, acceptance, and the socio-cultural factors influencing support for hydrogen technologies across the EU27.

Literature review methodology

A rapid evidence assessment was conducted, broadly following established PRISMA guidelines (Page *et al.*, 2021) and established good practices (e.g., Jensen & Laurie, 2016). The review incorporated systematic Google Scholar queries using combinations of country names with keywords such as *hydrogen*, *public opinion*, *perception*, and *survey*. The top ten results per country (plus 10 pan-European entries) were screened by title and abstract. A total of 153 unique entries were identified, of which 28 studies met the inclusion criteria: EU focus, survey-based data, and relevance to public perception. Additional hand searches yielded two more relevant sources. All selected texts were reviewed in full and summarised. To further characterise the findings, a sentiment analysis was applied to all included studies, categorising each as reflecting predominantly positive, negative, or mixed public attitudes toward hydrogen technologies. Detailed summaries of reviewed studies and their analytical categorisation are available as supplementary material with the published open dataset (Jensen & Jensen, 2025) (Figure 1).

Sources

Here is an overview of relevant sources identified by the literature review of survey data with analytical relevance to public understanding and acceptance of hydrogen technology in the EU27 (Table 1). Each identified relevant source is summarised in the following section.

The review covered the representation of EU countries in studies on public perceptions of hydrogen technologies (Table 2). Of the EU27 countries, 24 were represented, with Malta, Cyprus, and Sweden absent due to not meeting the inclusion criteria (i.e., written in English, survey data, EU-based, and focused on public perceptions of hydrogen). Germany contributed to the most studies (n=12), followed by the Netherlands and Spain. Most countries were represented in one or two studies, with some studies including opinions from multiple countries, indicating broad yet uneven coverage. Studies summarised according to the location are shown in Table 2.

Data spanned from 2005 to 2024, showing an increase in studies post-2015. The earliest studies (2005–2010) focused predominantly on Germany, the Netherlands, Luxembourg, and Spain. While many studies had large sample sizes (1,000 or more respondents per country), some featured smaller samples, raising concerns about representativeness. Notably, the most recent study, with relatively low respondent numbers, served as the sole source for viewpoints from eight countries, including six from the EU13, highlighting the need for more comprehensive data from these nations.

Summaries of relevant research studies

Source 1. Unknowing but supportive? Predispositions, knowledge, and support for hydrogen technology in the Netherlands (2010). The study investigates the Dutch public's knowledge of and support for hydrogen technology, revealing a generally low level of hydrogen knowledge yet high support for its

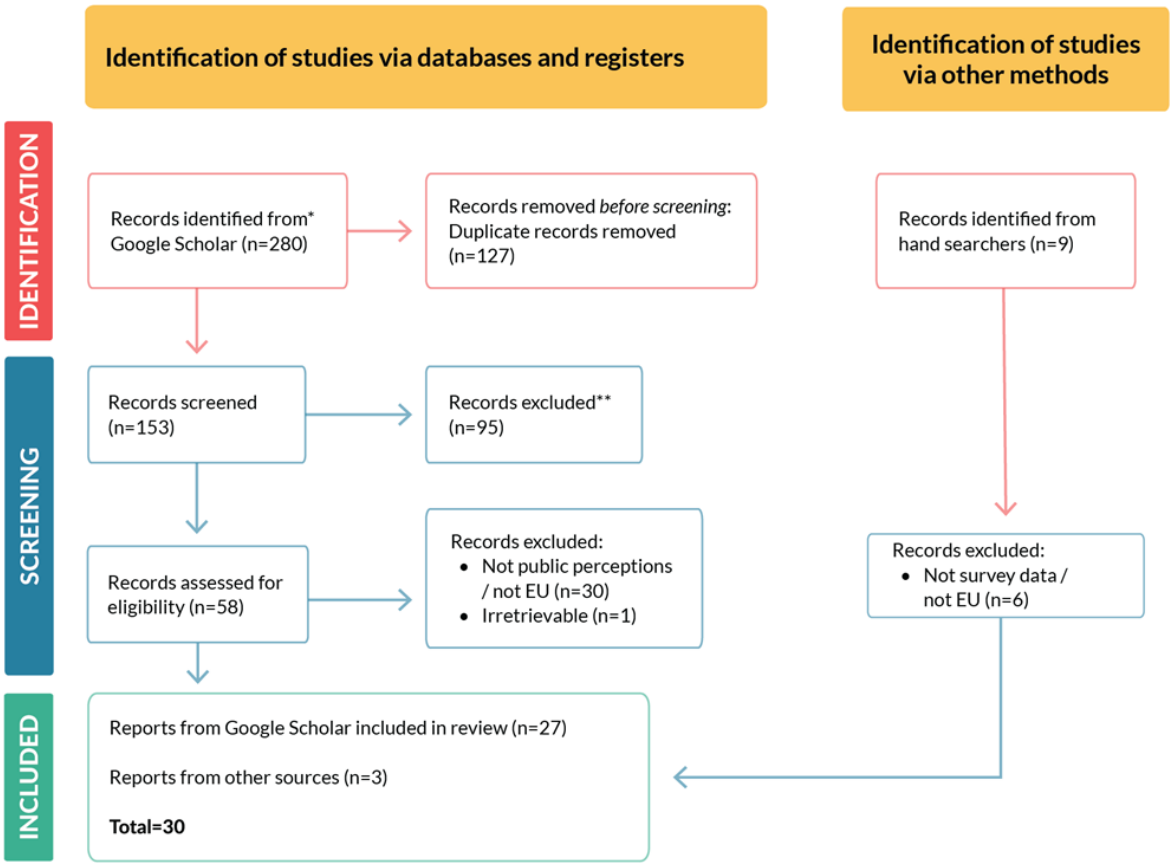

Figure 1. Flow chart detailing text selection following PRISMA guidelines.

implementation. This paradox prompts exploration into the role of cultural predispositions—such as environmental concern and trust in technology—in shaping public opinion towards hydrogen technology. Drawing on a representative survey conducted in 2008 (N = 2121), the research uncovers that while factual knowledge about hydrogen positively influences support, cultural predispositions hold more sway in determining public acceptance. Specifically, individuals with high trust in technology and environmental concerns exhibit stronger support for hydrogen technology. Furthermore, the study finds that the impact of cultural predispositions on hydrogen technology support intensifies with an increase in relevant knowledge, highlighting the nuanced interplay between information, predispositions, and public support.

Source 2. The role of attitudes in technology acceptance management: reflections on the case of hydrogen fuel cells in Europe (2018). The study explores the impact of public attitudes on the acceptance of hydrogen fuel cell technologies across seven European countries (Belgium, France, Germany, Norway, Slovenia, Spain and the United Kingdom). The survey results (N = +/- 1000 per country) highlight a general positivity towards hydrogen technologies but underline the low strength and stability of these attitudes due to limited public knowledge and awareness. The research suggests that at the early stages of technology diffusion, public attitudes are not yet strong enough to significantly influence reactions to communication campaigns to increase social acceptance or merely inform the public about hydrogen fuel cells.

Source 3. Dynamic effects on the acceptance of hydrogen technologies—an international comparison (2008). The study, conducted across eight cities (Amsterdam, Barcelona, Berlin, Hamburg, London, Luxembourg, Madrid and Reykjavik) with 3352 respondents, explores public acceptance of hydrogen technologies. It reveals 68% of respondents are supportive, while 31% show volatile attitudes. Interestingly, 77% preferred hydrogen buses over conventional ones under identical conditions, yet 21% remained indifferent. This discrepancy highlights that acceptance can shift based on new information or incidents. The research suggests that significant events could either boost support to 97% or increase opposition to 32%, emphasising the need for ongoing public engagement to stabilise and enhance acceptance of hydrogen technologies. Overall, the research shows that people who are neutral about hydrogen technologies and seek more information are easier to educate and persuade than those who are already opposed. Indifference and a desire for more knowledge create an opportunity for effective communication, whereas opposition requires overcoming preconceived negative attitudes.

Table 1. Relevant sources of survey data with analytical relevance.

#	Source type	Title	Link
1	**Journal article**	Unknowing but supportive? Predispositions, knowledge, and support for hydrogen technology in the Netherlands	https://doi.org/10.1016/j.ijhydene.2010.03.091
2	**Journal article**	The role of attitudes in technology acceptance management: Reflections on the case of hydrogen fuel cells in Europe	https://doi.org/10.1016/j.jclepro.2018.03.266
3	**Journal article**	Dynamic effects on the acceptance of hydrogen technologies—an international comparison	https://doi.org/10.1016/j.ijhydene.2008.02.068
4	**Journal article**	Are French people ready to accept hydrogen underground storage? An answer through the distance from object model	https://doi.org/10.1016/j.ijhydene.2023.02.077
5	**Journal article**	Hydrogen in future energy systems: Social acceptance of the technology and its large-scale infrastructure	https://doi.org/10.1016/j.ijhydene.2021.05.160
6	**Journal article**	Let's go green with hydrogen! The general public's perspective	https://doi.org/10.1016/j.ijhydene.2012.02.126
7	**Journal article**	Knowing hydrogen and loving it too? Information provision, cultural predispositions, and support for hydrogen technology among the Dutch.	https://doi.org/10.1177/0963662512453117
8	**Journal article**	Public acceptance of hydrogen in the Netherlands: Two surveys that demystify public views on a hydrogen economy	https://doi.org/10.1177/0270467606290308
9	**Journal article**	A survey of Finnish energy engineering students' knowledge and perception of hydrogen technology	https://doi.org/10.1016/j.ijhydene.2018.04.098
10	**Journal article**	Assessing the social acceptance of hydrogen for transportation in Spain: An unintentional focus on target population for a potential hydrogen economy	https://doi.org/10.1016/j.ijhydene.2016.01.139
11	**Conference paper**	Forecasting the passenger car demand split from public perceptions of electric, hybrid, and hydrogen-fuelled cars in Greece	https://doi.org/10.1007/978-3-031-23721-8_6
12	**Journal article**	Is the public willing to pay for hydrogen buses? A comparative study of preferences in four cities	https://doi.org/10.1016/j.enpol.2006.12.031
13	**Journal article**	Social acceptance of green hydrogen in Germany: building trust through responsible innovation	https://doi.org/10.1186/s13705-023-00394-4
14	**Journal article**	The changing face of public support for hydrogen technology explaining declining support among the Dutch (2008–2013)	https://doi.org/10.1016/j.ijhydene.2014.08.053
15	**Journal article**	Willingness to pay and public acceptance for hydrogen buses: A case study of Perugia	https://doi.org/10.3390/su71013270
16	**Journal article**	A positive shift in the public acceptability of a low-carbon energy project after implementation: The case of a hydrogen fuel station	https://doi.org/10.3390/su11082220
17	**Journal article**	Hydrogen as Energy Source – Challenges for Regions in Latvia (Results of Public Opinion Survey)	https://doi.org/10.15544/mts.2014.014
18	**Journal article**	Hydrogen energy as a catalyst for sustainable development: A comparative analysis of policies, strategies, and implementation in Poland and Germany	http://dx.doi.org/10.29119/1641-3466.2023.179.37
19	**Conference proceedings**	Opportunities for hydrogen marketing - Public opinion analysis (New challenges of economic and business development – 2012, Latvia)	ISBN 978-9984-45-519-78

#	Source type	Title	Link
20	**Journal article**	People's attitude to energy from hydrogen—from the point of view of modern energy technologies and social responsibility	https://doi.org/10.3390/en13246495
21	**Journal article**	Prospects of the hydrogen-based mobility in the private vehicle market. A social perspective in Denmark	https://doi.org/10.1016/j.ijhydene.2020.11.167
22	**Master's degree dissertation**	Public perceptions of hydrogen as an energy vector and aid to decarbonisation in the Republic of Ireland	https://sword.cit.ie/cgi/viewcontent.cgi?article=1009&context=busmas
23	**Journal article**	Risk assessment for hydrogen fuelling stations: Public perception versus reality	https://doi.org/10.3303/CET23105024
24	**Journal article**	Stakeholders' perceptions of hydrogen and reflections on energy transition governance	https://doi.org/10.1186/s13705-023-00429-w
25	**Journal article**	Assessing the social acceptance of key technologies for the German energy transition	https://doi.org/10.1186/s13705-021-00329-x
26	**Journal article**	Toward low-carbon European Union society: Young Poles' perception of climate neutrality	https://doi.org/10.3390/en14165107
27	**Journal article**	Public acceptance of biofuels in the transport sector in Finland	https://doi.org/10.1016/j.ijsbe.2017.07.008
28	**Journal article**	Public acceptance of emerging energy technologies in context of the German energy transition	https://doi.org/10.1016/j.enpol.2020.111516
29	**Project report**	Accept H2: public perception of hydrogen buses in five countries	https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=c5b4e2e26f96e8d5a6ca3be46f39087fff0ebb4a
30	**European Commission project deliverable**	Hydrogen acceptance in the transition phase (HYACINTH) D5.2: General findings on public acceptance	https://hyacinthproject.eu/wp-content/uploads/2017/12/HYACINTH-D5_2-General-findings-on-public-acceptance_DEF.pdf

Table 2. Countries represented by the relevant articles/reports identified by the literature review.

Country	No. of studies	Reference
EU27 general	1	19
Germany	12	2, 3, 5, 6, 11, 13, 18, 24, 25, 28, 29, 30
Netherlands	6	1, 3, 7, 8, 14, 16
Spain	6	2, 3, 10, 23, 24, 30
Poland	4	18, 20, 24, 26
Luxembourg	3	3, 11, 29
France	3	2,4, 30
Belgium	2	2, 30
Czechia	2	20, 24
Finland	2	9, 27
Greece	2	11, 24
Slovakia	2	20, 24
Slovenia	2	2, 24, 30
Austria	1	24
Bulgaria	1	24
Croatia	1	24
Denmark	1	21
Estonia	1	24
Hungary	1	24
Ireland	1	22
Italy	1	15
Latvia	1	17
Lithuania	1	24
Portugal	1	24
Romania	1	24
Cyprus	0	0
Malta	0	0
Sweden	0	0

Source 4. Are French people ready to accept hydrogen underground storage? An answer through the distance from object model (2023). The article explores the social acceptability of underground hydrogen storage in France. It focuses on how public perceptions are influenced by knowledge, experience, and personal involvement. A survey of 157 French respondents highlights generally positive attitudes toward hydrogen storage and believes it could protect the environment, considering environmental and fossil fuel issues important. Those with higher knowledge of hydrogen saw it as more beneficial for the environment, while those with lower knowledge perceived greater problems with fossil fuels. Key findings suggest that increasing knowledge about hydrogen's environmental impact and emphasising the importance of environmental issues can enhance public acceptance of hydrogen storage.

Source 5. Hydrogen in future energy systems: Social acceptance of the technology and its large-scale infrastructure (2021). This study, part of the ELEGANCY project, examines the social acceptance of hydrogen technology and its infrastructure in Germany. Survey data from 1,438 Germans reveal a generally positive view of hydrogen (65%), but acceptance drops when infrastructure, such as pipelines, is proposed locally. Younger respondents show more tendencies for Not-In-My-Back-Yard (NIMBY) than older respondents. Trust in stakeholders, particularly political and scientific entities, boosts acceptance levels, while low trust, especially in environmental NGOs, correlates with NIMBY attitudes.

Source 6. Let's go green with hydrogen! The general public's perspective (2012). This study examines German public acceptance of hydrogen technology in the mobility sector, revealing that nearly 80% of Germans support the introduction of hydrogen vehicles. This positive outlook is contingent on hydrogen being produced in an environmentally friendly manner. The study, part of the HyTrust project (NOW GmbH, n.d.) and funded by the German Federal Ministry of Transport, employed interviews (N = 30), focus groups (N = 3), and a representative survey (N = 1011) to gauge public opinion. Despite high awareness and favourable attitudes towards hydrogen-powered cars, the public lacks detailed knowledge about hydrogen and fuel cell technology. The study indicates safety concerns are minimal, emphasizing the importance of renewable energy in hydrogen production for public support.

Source 7. Knowing hydrogen and loving it too? Information provision, cultural predispositions, and support for hydrogen technology among the Dutch (2012). The study investigates how information and cultural predispositions in the Netherlands shape public perceptions of hydrogen technology. The study explores the framing effects on public support by using 1,012 respondents provided with varying information about hydrogen technology. Findings suggest that for individuals with high trust in science and technology, positive information enhances support for hydrogen technology, whereas negative information diminishes it. Conversely, for those with low trust in science and technology, providing positive or negative information does not significantly influence their evaluation of hydrogen technology. This reveals a nuanced interaction between information provision and pre-existing cultural predispositions towards science and technology. This suggests that "providing positive information fails to evoke a more favourable evaluation" among those inherently sceptical of science and technology.

Source 8. Public acceptance of Hydrogen in the Netherlands: Two surveys that demystify public views on a hydrogen economy (2006). The journal article examines the Dutch public's (n=612) acceptance of hydrogen technology through two surveys. The findings indicate a generally positive attitude towards hydrogen, albeit with significant variability based on the type of information presented to participants. Specifically, the study finds that 87% of respondents showed a favourable attitude towards using hydrogen combined with natural gas for home heating when exposed to positively skewed information about hydrogen. However, acceptance rates differed when participants were provided with negative or neutral information, demonstrating the impact of media framing on public perception. The surveys also addressed the public's willingness to accept trade-offs while transitioning to a hydrogen economy. For example, while a significant majority (87%) would support the use of hydrogen if it produced 10% less carbon dioxide than natural gas and maintained the same level of service, this support dropped to 67% if a 100-euro switch cost was involved, and to less than a third if safety was perceived to be slightly compromised.

Source 9. A survey of Finnish energy engineering students' knowledge and perception of hydrogen technology (2018). The study, involving 93 students from Aalto University, assessed changes in their understanding and attitudes before and after a specific learning assignment focused on hydrogen technology. Key findings include significant improvements in students' knowledge, particularly regarding hydrogen safety, with an average increase of 1.74 points on a 6-point scale post-assignment. Additionally, students' willingness to adopt home hydrogen systems showed notable growth, highlighted by an increase from 2.78 to 4.06 on the same scale. This shift suggests a robust positive response to the educational content provided.

Source 10. Assessing the social acceptance of hydrogen for transportation in Spain (2016). The study surveyed 1005 Spanish residents to evaluate public perception and acceptance of hydrogen as a potential energy carrier in the transportation sector. The respondents demonstrated a high level of awareness (>70%) about hydrogen and a favourable opinion on its implementation, with nearly 80% supporting hydrogen technologies in public transport and 75% endorsing its environmental benefits. The survey revealed strong public backing for establishing local hydrogen refuelling stations, although there was a preference for these to be located away from residential areas. The findings suggest that, while there is substantial support for

hydrogen technologies, considerable work remains to address economic and infrastructural challenges to facilitate broader adoption.

Source 11. Forecasting the passenger car demand split from public perceptions of electric, hybrid, and hydrogen-fuelled cars in Greece (2022). The study aims to explore the feasibility of mechanic learning techniques to forecast the demand for passenger cars with motor units other than internal combustion engines (ICE). The authors used a multilayer perceptron and an adaptive neural fuzzy inference system (machine learning techniques) to forecast the demand split from public perceptions, captured through an online survey. The survey data was collected in March 2022 (n=453) to measure respondents' intent to buy a passenger car, including hydrogen electric vehicles. Researchers found less than 5% of respondents intended to buy a new or used hydrogen electric vehicle.

Source 12. Is the public willing to pay for hydrogen buses? A comparative study of preferences in four cities (2007). Using the contingent valuation method, the study evaluates the public's willingness to pay for hydrogen fuel cell buses across Berlin, London, Luxembourg, and Perth. This survey research took place between July 2003 and February 2004 and forms part of the AcceptH2 project and investigates public acceptance and preferences for this environmentally friendly transportation technology (n=1358 total; n=344 in Berlin; n=300 in Luxembourg). Findings show that the public in all surveyed cities is positively willing to pay for the air pollution reductions associated with hydrogen buses, with an adjusted willingness to pay extra, ranging from €0.29 to €0.35 per single bus fare. The study reveals that this willingness spans different geographic locations, indicating a generally positive reception towards hydrogen buses, irrespective of the specific urban context.

Source 13. Social acceptance of green hydrogen in Germany: Building trust through responsible innovation (2023). The study delves into the public's perception and acceptance of green hydrogen technology in Germany. The research used a comprehensive mixed-method approach comprising semi-structured interviews (n=24), participatory workshops (n=51), and a representative survey (n=2054) to gauge social attitudes and derive generalisable conclusions about green hydrogen. The study unearthed a critical mix of limited knowledge yet considerable openness towards green hydrogen within the general population. It shows that acceptance hinges significantly on trust in scientific, governmental, and media institutions, which are key in upholding distributive justice. Additionally, the research identified methodologically sound participatory processes as catalysts for enhancing trust and acceptance, suggesting that positive experiences within these engagements are crucial for fostering social trust.

Source 14. The changing face of public support for hydrogen technology: Explaining declining support among the Dutch (2008–2013) (2014). Using data from two surveys conducted in 2008 (n=2121) and 2013 (n=1982), the study found that while initially high, public support for hydrogen technology significantly declined by 2013. The decline in support was quantified through a series of F-tests revealing decreases in agreement with several statements about hydrogen technology: support for investment dropped from 84.8% to 79.2%, belief in its application in public transportation fell from 86.4% to 77.1%, agreement that it is good for the environment declined from 78.9% to 73.4%, and urgency for its adoption decreased from 45.7% to 35.6%. The research attributes this decline primarily to a corresponding drop in trust in science and technology over the same period. This shift is viewed through the lens of modern societal trends, suggesting that increased awareness of the risks associated with science and technology among the educated may undermine support for technological advancements such as hydrogen technology.

Source 15. Willingness to pay and public acceptance for hydrogen buses: A case study of Perugia (2015). The study assessed public perception among local public transport users in Perugia, Italy, concerning air pollution reduction through hydrogen buses from the end of January to March 2013 (n=587). A significant portion of the survey sample expressed a willingness to pay a premium for hydrogen buses, highlighting the public's recognition of the environmental benefits these buses could offer. The findings indicate that 81% of respondents supported the trial of hydrogen buses, and 88% were willing to pay more for public transportation if it involved hydrogen technology. This reflects a public acceptance of hydrogen buses, predicated on the potential environmental benefits.

Source 16. A positive shift in the public acceptability of a low-carbon energy project after implementation: The case of a hydrogen fuel station (2019). The article investigates the changes in public acceptance of a hydrogen fuel station in Arnhem, Netherlands, before and after its implementation. The data collection (n=280) took place around the official opening of the hydrogen fuel station on December 3, 2010. The study reveals that residents living near the station showed a significant increase in acceptability post-implementation, contrary to those living farther away, who showed no significant change. This phenomenon is attributed to psychological mechanisms such as loss aversion and cognitive dissonance reduction.

Source 17. Hydrogen as Energy Source – Challenges for Regions in Latvia (Results of Public Opinion Survey) (2014). The research explores the public's perception and acceptance of hydrogen energy across different regions of Latvia. Conducted in the first half of 2013, the study involved a comprehensive survey targeting various demographic groups, with a total of 1299 respondents, comprising 51.7% females and 48.3% males. The findings indicate a significant lack of public awareness and information about hydrogen energy, with average ratings on various aspects of hydrogen technology knowledge and acceptance falling on the lower end of the scale. Key results reveal that while there is widespread support for hydrogen technology, with 70.1% of respondents showing favourability, the public's detailed understanding of hydrogen energy applications in the economy and transport sector is notably low.

Source 18. Hydrogen energy as a catalyst for sustainable development: A comparative analysis of policies, strategies, and implementation in Poland and Germany (2023). The study presents a comparative analysis by reviewing literature, policy

frameworks, and stakeholder surveys, highlighting how hydrogen is integrated into Poland and Germany's energy strategy. The survey component of this research took place in 2021 and involved a sample size of 898 people from Poland and 924 from Germany. In Poland, the implementation of hydrogen technology is still evolving, with a strong emphasis on research and development aimed at integrating hydrogen with renewable energy sources. The Polish government's proactive stance includes ambitious goals to make Poland a leader in hydrogen energy in Europe by 2030. Conversely, Germany is already a global leader in hydrogen technology, backed by a well-established and comprehensive strategy promoting commercialising hydrogen technologies across various sectors. Despite these advancements, both countries face high production costs and infrastructural demands.

Source 19. Opportunities for hydrogen marketing – Public opinion analysis (2012). The article explores public receptiveness to hydrogen energy, focusing on the European market. The study surveyed 1200 participants across various demographics. The key findings include that 62% of respondents know hydrogen as an energy source, yet only 28% can clearly articulate its potential uses or benefits. Public support for hydrogen energy is moderate, with 48% expressing tentative support contingent on further information about environmental impacts and safety. The study highlights a gap in effective communication, as demonstrated by the fact that 72% of respondents were uncertain about hydrogen's safety, pointing to a need for targeted educational campaigns.

Source 20. People's attitude to energy from hydrogen—from the point of view of modern energy technologies and social responsibility (2020). The journal article provides a comprehensive analysis of public opinion on hydrogen energy, particularly focusing on its safety and environmental impacts. The study involved surveying (n=749) individuals in countries where hydrogen technology is underdeveloped and infrastructure is sparse (Poland (n=247), Czech Republic (n=223), and Slovakia (n=199). The data collection period spanned from October 2019 to February 2020. The survey results indicate a significant lack of knowledge and familiarity with hydrogen energy among the public. Notably, while there is a foundational understanding that hydrogen can be an eco-friendly energy source, 78% of respondents expressed concerns about its safety. This scepticism highlights a significant barrier to wider acceptance and adoption of hydrogen energy technologies.

Source 21. Prospects of hydrogen-based mobility in the private vehicle market. A social perspective in Denmark (2021). The article focuses on the social acceptance and market prospects of hydrogen-based mobility in Denmark. It reports a considerable awareness and interest in hydrogen vehicles, revealing that knowledge about hydrogen technology and environmental awareness significantly influence the public's willingness to adopt such vehicles. The survey (n=158) found that 20% of respondents are ready to consider hydrogen fuel cell electric vehicles (FCEVs) as a viable alternative to conventional cars, given the proper infrastructure and cost considerations. A pivotal finding is the public's sensitivity to the high initial costs and the lack of refuelling infrastructure, which are major barriers to adoption.

Source 22. Public perceptions of hydrogen as an energy vector and aid to decarbonisation in the Republic of Ireland (2021). This master's degree dissertation examines how the public perceives hydrogen as an energy vector in the Republic of Ireland, outlining potential obstacles to its acceptance. The sample size for the quantitative survey component of this research was 115 respondents. Semi-structured qualitative interviews with eight participants followed this to gather more detailed data and insights into public perceptions. The survey found that public perceptions of hydrogen as an energy vector are not entirely hostile, with broad acceptance evident, although some opposition to a transition was observed. The two overarching themes of this study are safety and cost. Safety is viewed as a prerequisite to any transition, with the public trusting that hydrogen safety will be demonstrated before a transition and that a competent authority will act with safety in mind. The cost of transitioning to hydrogen as an energy vector is vital to its acceptance by the public. Increased costs to consumers can result in the widespread rejection of conversion as concerns regarding cost far outweigh the environmental benefits of hydrogen among the public.

Source 23. Risk assessment for hydrogen fuelling stations: Public perception versus reality (2023). The article addresses the discrepancy between public perceptions and the empirical risks associated with Hydrogen Fuelling Stations (HFSs) in Japan (n=1000), Spain (n=1000), and Norway (n=500). The study was conducted in December 2022 and explored perceptions of risk regarding the operations of HFSs—namely hydrogen production, transportation, storage, and dispensing. The findings reveal a notable gap in public understanding: participants often overestimate the risks associated with transportation and underestimate those related to production and storage. The empirical data from event tree analysis highlighted that incidents like ruptures or leaks at HFSs are less frequent than the public perceives. Despite the lower empirical risk, the perception of danger is significantly higher, particularly for transportation processes.

Source 24. Stakeholders' perceptions of hydrogen and reflections on energy transition governance (2024). The research on stakeholders' perceptions of hydrogen and reflections on energy transition governance was conducted under the European Union-funded 112CO2 Project. It involved semi-structured interviews and a questionnaire survey (n=73) with stakeholders across various countries, largely within Europe (Germany, South Africa, Austria, Bulgaria, Czech Republic, Croatia, Slovakia, Slovenia, Spain, Estonia, Greece, Hungary, India, Lithuania, Poland, Portugal, Qatar, Romania, Serbia). The interviews were conducted from January to June 2022, while the questionnaire survey took place between July and December 2022. The findings reveal a strong preference for renewable hydrogen over non-renewable sources. Specifically, all respondent groups shared this preference, highlighting a consensus on the sustainability

priorities within the hydrogen production debate. Key findings from the questionnaire indicate that 76.7% of stakeholders believe hydrogen must be produced from exclusively renewable sources, even if this results in higher costs. Conversely, nearly half of the participants are against hydrogen production from non-renewable sources, even if mixed with renewable sources to reduce costs.

Source 25. Assessing the social acceptance of key technologies for the German energy transition (2022). The study evaluates public attitudes towards three energy technologies: stationary battery storage, biofuel production plants, and hydrogen refuelling stations (n=1247). Conducted as part of the German energy transition initiative, the survey reveals nuanced insights into general and local acceptance levels, trust in stakeholders, and financial support attitudes among the German public. General acceptance for hydrogen refuelling stations was comparatively high, reflecting broad support for this technology as part of Germany's energy transition. However, while still positive, local acceptance was slightly lower than general acceptance, demonstrating the common "general-local gap" where public support wanes when installation near residential areas is proposed.

Source 26. Toward low-carbon European Union society: Young Poles' perception of climate neutrality (2021). The journal article explores young Polish students' perspectives on energy and environmental awareness, specifically emphasising hydrogen as a renewable energy source. The survey was conducted (n=1106) from January to May 2021. The findings reveal a significant interest among the youth in embracing hydrogen technologies. Specifically, the study finds that hydrogen is regarded as a promising energy carrier due to its high energy content and versatility in applications ranging from power generation to transportation. The article suggests the critical role of hydrogen in achieving the European Union's climate neutrality goals, reflecting a strong alignment between technological potential and policy aspirations.

Source 27. Public acceptance of biofuels in the transport sector in Finland (2017). The research on public acceptance of biofuels in the transport sector in Finland was conducted in the capital region, specifically in Helsinki, Espoo, and Vantaa (n=90). Data collection took place from April to June 2016. It highlights that despite a significant governmental push towards biofuels, public knowledge and acceptance are crucial for broader adoption. The study's findings indicate that 63% of car owners prefer ideal future fuel to be non-biofuel based: 60% favour electricity, 20% hydrogen, and another 20% prefer hybrid solutions.

Source 28. Public acceptance of emerging energy technologies in context of the German energy transition (2020). The study (n=1247) investigates public acceptance of hydrogen fuel stations, among other technologies. It leverages a socio-psychological factor model to explore how trust in industry and municipalities, perceived problems of the current energy system, and environmental self-identity impact acceptance generally and when these technologies are implemented locally. Specifically, hydrogen fuel stations (HFS) were one of the technologies studied for their potential to replace fossil fuels. The findings indicate varying degrees of acceptance influenced by several factors, including trust and perceived risks and benefits. The study reveals that the general acceptance of hydrogen fuel stations hinges significantly on perceived environmental benefits and trust in the industrial stakeholders pushing their development, notably the automotive industry. Additionally, the presence of hydrogen fuel stations in local settings tends to be more acceptable when there is significant trust in local municipalities.

Source 29. Accept H2: public perception of hydrogen buses in five countries (2004). The international study focuses on understanding public perception and acceptance of hydrogen buses within public transport. Conducted across London (UK) (n=414), Luxembourg (n=300), Berlin (Germany) (n=344), Perth (Australia) (n=300), and Oakland (USA) (n = 302) between 2003 and 2005, this study involved both pre- and post-intervention surveys around hydrogen bus projects to gauge changes in public perception. In Luxembourg, the acceptance of hydrogen buses is notably high. The study found that over 50% of respondents in Luxembourg indicated a willingness to pay an extra fee between 0.01 and 0.30 Euros per bus fare to support the implementation of hydrogen buses. Luxembourg's data showed that there is virtually no opposition to the introduction of hydrogen fuel technologies, with a strong curiosity about hydrogen-powered buses observed among the respondents.

Source 30. Hydrogen acceptance in the transition phase (HYACINTH): Deliverable 5.2 - General findings on public acceptance. The HYACINTH project's deliverable D5.2 analyses public acceptance and awareness regarding hydrogen fuel cell (FCH) applications across seven European countries (Belgium, France, Germany, Norway, Slovenia, Spain, and the United Kingdom). The multi-country survey collected responses from nationally representative samples of approximately 1000 adults from each country during April and May 2016. The survey results reveal that approximately 60% of respondents support FCH applications, while 30% remain neutral, and nearly 10% oppose them. Support is higher in Slovenia, Spain, and Germany, with lower levels observed in the UK, France, and Belgium.

Hydrogen public opinion results by valence

The literature summaries underwent sentiment analysis, revealing that most studies exhibited positive or mixed valences toward hydrogen (Table 3). Broadly positive opinions were noted,

Table 3. Hydrogen public opinion results by positive, mixed or negative valence.

Hydrogen public opinion results valence	References with findings in each category
Positive	2, 4, 8, 9, 10, 11, 12, 15, 16, 17, 26, 29, 30
Mixed	1, 3, 5, 6, 7, 13, 14, 18, 22, 24, 25, 28
Negative	19, 20, 21, 23, 27

such as increased support for hydrogen technologies following participation in education programmes, a willingness to pay for hydrogen-powered vehicles, and a high percentage of support for hydrogen technologies overall. Mixed responses were also prevalent, indicating broad support for hydrogen technologies but often with caveats, such as support contingent on the technology sourced from renewable sources or concerns regarding safety and costs. Low support percentages primarily characterised negative perspectives compared to other green technologies; for example, one study found that only 20% of respondents would purchase a hydrogen-powered vehicle, contrasting with 60% preferring e-cars (#27).

Notably, despite being classified as generally negative, the studies did not have strongly anti-hydrogen sentiments; concerns primarily revolved around safety, costs, and a lack of awareness about the technology. It is important to acknowledge that valence analysis is subjective, and it could be argued that all studies represent varying degrees of mixed responses to hydrogen.

Discussion of key findings

General attitudes and awareness

The majority of studies report generally favourable public attitudes toward hydrogen, particularly when linked to renewable energy and climate objectives (Achterberg, 2014a; Alanne, 2018; Altmann *et al*., 2004; Christidis *et al*., 2023; Häußermann *et al*., 2023; Huijts *et al.*, 2019; Huan *et al*., 2023; Ingaldi & Klimecka-Tatar, 2020; Wojtaszek, 2023; Zimmer & Welke, 2012). However, this support is often based on limited awareness and shallow knowledge (Achterberg *et al*., 2010; Biruta *et al*., 2014; Delaney, 2021; Dimants *et al*., 2012; Oltra & Sala, 2017; Zimmer & Welke, 2012). Many respondents report having "heard of" hydrogen but not being "familiar with" it, indicating a persistent gap between awareness and informed engagement.

Safety, cost, and infrastructure concerns

Safety and affordability are dominant concerns in shaping public opinion. Misconceptions about the risks associated with hydrogen production and transport frequently lead to inflated risk perceptions (Biruta *et al*., 2014; Delaney, 2021; Dimants *et al*., 2012; Huan *et al.*, 2023). Cost-related hesitations, especially regarding fuel cell vehicles and domestic heating, persist across contexts, and acceptance often drops when respondents consider local implementation, illustrating a recurring NIMBY dynamic (Apostolou & Welcher, 2021; Bigerna & Polinori, 2015; Häußermann *et al*., 2023; Huijts *et al.*, 2019; Oltra & Sala, 2017; Wojtaszek, 2023; Zachariah-Wolff & Hemmes, 2006; Zimmer & Welke, 2012).

Cultural values, trust, and political context

Support for hydrogen is strongly influenced by cultural predispositions, particularly environmental concern and trust in scientific and technological institutions (Achterberg *et al.,* 2010; Achterberg, 2014b; Delaney, 2021; Häußermann *et al.*, 2023; Parente *et al.*, 2024; Schönauer & Glanz, 2022). Several studies demonstrate that public support does not necessarily depend on factual knowledge but is often shaped by values, emotional reactions, and the perceived alignment of hydrogen technologies with societal goals (Achterberg *et al*., 2010; Achterberg, 2014b; Delaney, 2021; Emmerich *et al.,* 2020; Häußermann *et al.,* 2023; Huijts *et al.*, 2019). Regional differences reflect variations in national hydrogen strategies, government involvement, and public trust in political institutions (Biruta *et al.,* 2014; Häußermann *et al.,* 2023; Oltra & Sala, 2017; Parente *et al.*, 2024; Wojtaszek, 2023).

Demographics and information needs

Demographic patterns are consistent across the literature: men and younger people tend to express higher familiarity and support for hydrogen technologies (Gryz & Kaczmarczyk, 2021; Oltra & Sala, 2017; Schönauer & Glanz, 2022). However, studies also emphasise that public acceptance is malleable and responsive to targeted, transparent communication. Misunderstandings about hydrogen typologies, especially the distinction between green and blue hydrogen, are common, suggesting a need for clearer messaging (Achterberg *et al.,* 2010; Achterberg, 2014b; Dimants *et al.,* 2012; Häußermann *et al.,* 2023; Oltra & Sala, 2017; Parente *et al.*, 2024).

Evidence gaps and geographic distribution

Most EU member states are represented in the literature, though the depth of evidence varies. Germany, the Netherlands, and Spain are the most studied contexts, while others, such as Cyprus, Malta, and Sweden, lack primary data. This uneven distribution limits generalisability across the EU27. Further work is needed to explore longitudinal trends and subgroup-specific dynamics, including attitudes among underrepresented demographics and local stakeholder communities.

In summary, the literature reveals a cautiously optimistic European public perspective on hydrogen technologies, shaped by values, limited awareness, and context-specific concerns. Common themes include widespread support grounded in environmental hopes, tempered by cost, safety, and infrastructure challenges. However, public understanding is often shallow, and acceptance varies by demographic group, country, and political context. These findings underscore the importance of improving public knowledge, addressing misconceptions, and tailoring communication strategies.

Conclusions

Literature review synthesis

This collection of European studies presents a nuanced picture of public opinion regarding hydrogen technologies. For example, although there is significant support for hydrogen as a part of renewable energy initiatives in Latvia, there remains a notable gap in detailed understanding and public awareness. The pattern of favourable public opinion coupled with relatively low informational depth is reflected across several EU countries, including those with advanced hydrogen strategies like Germany and Poland. These findings imply a base of support for hydrogen technologies based on the perceived environmental benefits. Yet, support for hydrogen technologies may be contingent on increasing public awareness and addressing misconceptions about safety and applications.

Indeed, this evidence synthesis highlights the interrelated nature of knowledge, cultural predispositions, and societal acceptance. Findings from the Netherlands, for example, suggest a pattern where public support for hydrogen technologies does not necessarily correlate with a deep understanding of the technology itself. Instead, cultural predispositions such as environmental concern and trust in technology play a more definitive role. This is evidenced by studies indicating that individuals with a pre-existing trust in scientific and technological advancements are more likely to support hydrogen technology, even if their factual knowledge is limited. The Netherlands research elucidates a pivotal finding: as knowledge about hydrogen increases, so does the influence of these cultural predispositions on individual support, suggesting an intertwined relationship between information dissemination and intrinsic values.

Overall, the European public's attitude towards hydrogen technologies is cautiously optimistic but highlights a clear need for strategic educational campaigns and transparent communication about the benefits and safety of hydrogen energy. This necessity is echoed in the research from Ireland, where safety and cost are pivotal to gaining public trust and acceptance for transitioning to hydrogen energy.

European attitudes towards hydrogen technology, especially in terms of its infrastructure and applications like hydrogen fuel cells and buses, exhibit general positivity but face challenges due to the NIMBY (Not in my backyard) phenomenon. This is particularly prominent in Germany, where while the populace may view hydrogen positively, local infrastructure projects such as pipelines meet with decreased acceptance. The volatility in public opinion is marked by a dynamic acceptance pattern, responsiveness to new information, and influence by ongoing communication strategies.

The broader European context shows a gradual increase in awareness and favourability towards hydrogen technologies, underpinned by their potential environmental benefits. Yet, this support is tempered by concerns related to infrastructure and the perceived risks associated with technology. The insights from Spain and Italy, where there is strong backing for hydrogen in public transport, contrast with the cautious approach seen in Germany and the Netherlands concerning hydrogen infrastructure in residential areas.

Despite differing stages of hydrogen technology integration within their respective energy strategies in Poland and Germany, public perception aligns with viewing hydrogen as environmentally friendly and innovative. However, perceptions of the technology's reliability and cost-effectiveness diverge, influenced by national contexts and the extent of governmental and infrastructural commitment to hydrogen. This dichotomy between the two nations reflects broader European trends where public enthusiasm for hydrogen energy is moderated by practical concerns about cost and infrastructure, as also seen in research in Denmark highlighting hesitance regarding hydrogen fuel cell electric vehicles (FCEVs) due to high costs and inadequate refuelling infrastructure.

Public opinion research in the EU27 indicates a skew towards positive views. However, the existing published literature does not cover some countries, namely Malta, Cyprus, and Sweden.

There are some examples of overlap in the data. For instance, studies #12 and #29 use the same data regarding the Accept H2 survey; however, they are written with a slightly different focus and come from various sources. Similarly, studies #25 and #28 appear to use the same survey data but analyse different aspects. The data comprised two reports, one master's thesis, two conference proceedings, and the rest are peer-reviewed journal articles. Most studies were opinion surveys; however, one survey (#15) was a willingness-to-pay study.

The literature review confirms that hydrogen enjoys widespread public support across Europe. Survey respondents consistently endorsed hydrogen as a sustainable alternative to fossil fuels and as a strategic solution for enhancing energy independence. These findings echo prior studies showing that public support tends to be strongest when hydrogen is framed in terms of environmental responsibility and geopolitical resilience (Gordon *et al.*, 2024; Plank *et al.*, 2023; Zimmer & Welke, 2012).

However, this support remains contingent. The data highlight a persistent gap between awareness and familiarity: while most respondents had heard of hydrogen, only a minority considered themselves familiar with the technology. This aligns with earlier research that describes support for hydrogen as unknowing but favourable (Achterberg *et al.*, 2010). The implications are significant: a public that supports hydrogen without deep understanding may be vulnerable to shifts in opinion if safety incidents occur, if costs escalate, or if political narratives change.

Although perceptions of safety were generally positive, they were notably less robust than perceptions of sustainability. This finding is consistent with studies showing that safety concerns, often amplified by misconceptions, can undermine local acceptance (Delaney, 2021; Huan *et al.*, 2023). The survey also revealed that the strongest agreement on hydrogen safety was modest compared to other indicators, suggesting a latent unease that could be triggered by high-profile incidents or poor risk communication.

Age-related variation in safety confidence further suggests that different groups may require differentiated messaging strategies. This reinforces calls from the literature for tailored engagement approaches and underscores the importance of trust in institutions as a key mediator of acceptance (Häußermann *et al.,* 2023; Huijts *et al.*, 2012).

In parallel, demographic differences in familiarity and overall confidence were also pronounced. Men and younger respondents reported higher levels of familiarity and stronger agreement across most indicators. This mirrors consistent

demographic patterns observed across the literature (Schönauer & Glanz, 2022), and underlines the need for inclusive engagement strategies that respond to varying informational needs and value frameworks (e.g., Reed *et al.*, 2025).

Geographic variation further reinforces this point. Countries with established hydrogen initiatives and high-profile energy policies, such as Portugal, Italy, and Poland, showed higher levels of support and confidence. In contrast, familiarity was lower in contexts where hydrogen remains politically marginal or less visible in public discourse. These differences highlight the influence of national framing, media coverage, and institutional trust on public opinion.

The findings underscore the importance of moving beyond general awareness campaigns. Engagement must be designed to foster deeper, more confident familiarity with hydrogen technologies. This includes addressing latent risk concerns and adapting strategies to the social and informational realities of lower-familiarity groups.

In addition, communication efforts should clarify the distinctions between hydrogen production types (e.g., green vs. blue), which remain poorly understood. Prior studies have shown that these technical distinctions matter for public acceptability, particularly when linked to climate performance and perceived legitimacy (Achterberg, 2014b; Parente *et al.*, 2024). Transparent, consistent messaging will be essential to maintain public trust, particularly as hydrogen becomes more visible in public infrastructure and daily life.

This study is not without limitations. The secondary dataset was based on self-reported perceptions and does not capture qualitative depth or track changes over time. While the survey is nationally representative, regional or subnational variation may be underreported. Similarly, the rapid evidence assessment that informed the literature review was comprehensive but not exhaustive, and notable evidence gaps remain in several EU member states, particularly in Northern and Southeastern Europe. Furthermore, the absence of longitudinal data means we cannot assess the stability of current public support or predict how perceptions may evolve in response to future developments in policy, media coverage, or public incidents.

Policy implications

To support the EU's hydrogen strategy and climate goals, we identify the following policy implications stemming from our findings:

1. Public communication should not assume that visibility equates to understanding. Engagement efforts should focus on demystifying hydrogen's applications, especially in domestic and transport settings, and ensure that people understand how it contributes to climate and energy goals.
2. Women, older individuals, and residents in countries with less developed hydrogen strategies reported lower familiarity and confidence. Tailored outreach and trusted messengers should be used to close these gaps and ensure inclusive public support.
3. Although hydrogen is widely seen as safe, this view is less strongly held than perceptions of sustainability. Governments and developers should prioritise transparent communication about safety protocols, incident response, and regulatory oversight, particularly in early-stage deployments.
4. Misunderstandings around green, blue, and grey hydrogen persist. EU and national actors should invest in clear, consistent public messaging that aligns technological pathways with environmental ambitions.
5. As hydrogen becomes more visible in public spaces and everyday applications, public attitudes may shift. Ongoing tracking of public perceptions and periodic social impact assessments will be essential to maintaining trust and adjusting communication strategies as needed.

In conclusion, the social acceptability of hydrogen technologies is not a given. It must be actively cultivated through informed, inclusive, and responsive public engagement. Doing so will strengthen the societal foundations for Europe's energy transition and ensure that hydrogen deployment is both technically and socially sustainable.

Ethics and consent

Ethical approval and consent was not required because this is a review of existing research.

Data availability statement

Underlying data supporting the findings of this work are available in Zenodo: https://doi.org/10.5281/zenodo.16879951 (Jensen & Jensen, 2025).

Data are available under the terms of the Creative Commons Attribution 4.0 International

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Andrea Morone
University of Bari Aldo Moro, Bari, Italy

This article addresses a timely and policy-relevant question for the European Union: **what do survey-based sources indicate about public awareness/familiarity, acceptance, and perceived risks/benefits of hydrogen and fuel cell technologies across EU Member States, and how do these patterns vary across demographic groups and national contexts?** The manuscript's aim is valuable, particularly as an evidence map highlighting uneven country coverage and gaps in the available survey literature.
A key point for readers is that the manuscript answers its question **primarily descriptively**. The supplementary materials provide aggregated outputs (counts, percentages, and "mean scores" constructed from ordinal response categories) stratified by country and demographic groups. These summaries are informative for descriptive mapping; however, they do **not** constitute inferential/econometric analysis and do not support causal interpretation. The shared materials do not include respondent-level microdata, do not report regression coefficients, standard errors, confidence intervals, or formal tests, and therefore cannot establish causality or estimate associations in a standard econometric sense. At most, the reported subgroup differences should be interpreted as **descriptive associations** (cross-tabulated patterns), ideally accompanied by uncertainty measures.
To strengthen the paper's scientific soundness and to reduce the risk of over-interpretation, several improvements would be particularly beneficial:

1. **Make the research question and scope explicit and internally consistent.** The paper would benefit from stating the research question(s) in a single clear paragraph and aligning the abstract, methods, and conclusions around the actual design (rapid literature synthesis plus descriptive secondary tables). Where findings derive from different components (review corpus vs secondary analysis), the provenance of each claim should be clearly labelled.
2. **Increase the reproducibility of the evidence synthesis.** Because the review relies on screening top-ranked search results, reproducibility requires transparent reporting of search strings/templates, dates, language handling, deduplication rules, inclusion/exclusion criteria, and (at least) a list of full-text screened records. This would also clarify the degree to which the review can be considered comprehensive.

3. **Improve traceability from claims to sources.** An evidence map table linking major conclusions to specific studies (author-year) and/or to specific secondary-analysis tables would substantially increase auditability—especially for EU-wide statements and cross-country comparisons.
4. **Clarify statistical reporting and avoid inferential language unless supported.** If the manuscript intends to make comparative claims across countries or demographic groups, it should report uncertainty (e.g., 95% confidence intervals) and document survey weighting/design decisions. If such inferential steps cannot be supported with accessible data and replication materials, conclusions should be framed consistently as descriptive patterns rather than effects or associations.
5. **If a valence/sentiment classification is retained, make it defensible.** Any subjective classification of studies as positive/negative/mixed should be supported by a transparent codebook, coding rules, and (ideally) a reliability check; otherwise, this layer should be down-weighted or removed from the evidentiary basis for conclusions.

Overall, the manuscript has clear value as a readable, policy-relevant descriptive synthesis. With greater clarity on the research question and scope, improved reproducibility of the search protocol, stronger claim-to-evidence traceability, and more explicit positioning of the empirical component as descriptive (or, alternatively, added inferential reporting with appropriate reproducibility), the contribution would become substantially more robust and easier for readers to interpret correctly.

Answers to the review questions (expanded)
1) Is the topic of the review discussed comprehensively in the context of the current literature?
Partly.
Why: The review provides a useful overview of survey evidence and country-by-country summaries, but it cannot be considered fully "comprehensive" given the reliance on a **top-10 Google Scholar results** rule, which is not stable nor guaranteed to capture the relevant universe of studies. Evidence coverage is uneven across countries and time.
How to address:

- Provide a **complete, reproducible search protocol** (exact search strings/templates; dates; language handling; deduplication; screening steps).
- Justify the **top-10 cutoff** and discuss likely omissions (grey literature, local-language reports, agency/industry surveys).
- Deposit a **screened-records list** (at least all full-text screened items).

2) Are all factual statements correct and adequately supported by citations?
Partly.
Why: Many statements are plausible and appear grounded in either study summaries or the secondary-analysis tables. The main issue is **auditability**: some EU-wide statements and comparative claims are not always traceable to specific sources/tables, and the distinction between claims drawn from the literature vs from secondary analysis is not consistently explicit. Additionally, the "valence/sentiment" layer is described as subjective; without a transparent coding protocol, claims derived from it are not fully supportable as factual.
How to address:

- Add an **evidence map** linking each major claim to specific study/studies (author-year) or to a specific table.
- Clearly tag provenance: "from reviewed literature" vs "from secondary analysis tables."

- If valence remains, provide a **codebook + coding rules + coder information + reliability check** (even on a subset); otherwise remove/soften valence-based claims.

3) Is the review written in accessible language?
Yes.
Why: The narrative is generally clear, and the structure helps non-specialist readers. Remaining issues are mostly about methodological clarity (not readability).
Minor improvements:

- Use consistent terminology for the review approach.
- More explicit signposting separating “review findings” vs “secondary analysis findings.”

4) Are the conclusions drawn appropriate in the context of the current research literature?
Partly.
Why: Conclusions are largely appropriate if framed as **descriptive synthesis/evidence mapping**. They become less defensible when phrased as strong EU-wide generalisations or as if supported by inferential modelling. This is compounded by uneven evidence coverage and by the fact that the shared empirical outputs are descriptive and do not include formal uncertainty quantification.
How to address:

- Qualify EU-wide claims and add a short **strength-of-evidence** section (robust vs tentative conclusions).
- Improve traceability (evidence map).
- Ensure the language does not imply causal or econometric inference unless such analysis is actually provided.

Is the topic of the review discussed comprehensively in the context of the current literature?
Partly

Are all factual statements correct and adequately supported by citations?
Partly

Is the review written in accessible language?
Yes

Are the conclusions drawn appropriate in the context of the current research literature?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Experimental and behavioural economics; decision-making under risk and ambiguity; social norms and observational learning; applied econometrics and causal inference; survey methodology and quantitative analysis (ordinal outcomes, cross-country comparisons, weighting/design-based inference); systematic reviews/evidence mapping with an emphasis on transparency, replicability, and robustness of conclusions. I am best placed to evaluate the

methodological rigour, reproducibility, and whether conclusions are supported by the available evidence.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 21 January 2026

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Cristiana Tudor
Bucharest University of Economic Studies, Bucharest, Romania

The manuscript sets out to take stock of what is known about public awareness and acceptance of hydrogen and fuel cell technologies across the EU27, with an eye to the practical problem that social acceptance can slow or redirect implementation even when the policy direction is settled. It does this by assembling and screening country-specific evidence and then drawing together the recurring themes that appear in that evidence base. The paper's central message is familiar to readers of the wider energy-acceptance literature, but still valuable in this policy moment: awareness remains limited, perceived safety and cost concerns matter, trust in institutions and firms shapes how people interpret information, and local context influences whether acceptance translates into support for siting and deployment.
The paper has several clear strengths. The motivation is well chosen and easy to follow, and the manuscript is written in generally accessible language for a broad readership. The effort to cover all member states, even when the evidence base is uneven, is also worthwhile, because it makes the gaps visible rather than quietly defaulting to a handful of well-studied countries. Finally, the commitment to open materials is consistent with the journal's ethos and increases the potential usefulness of the piece for others working on related syntheses or policy briefs.
My reservations concern the parts of the study that determine whether readers can trust the synthesis as a review rather than as an informed narrative. At present, the methods are described in a way that conveys the broad intention, but not in a way that allows another team to reproduce the corpus, repeat the screening, and understand exactly how the thematic conclusions were built from the underlying sources. This matters in a review article because the strongest claims in the discussion are only as strong as the audit trail that leads to them. The manuscript would benefit from a more concrete specification of the search and screening protocol: the exact search strings used, the dates on which searches were run, how language differences were handled, what fields were searched, how duplicates were treated, and the criteria used at each screening stage. The current approach of limiting retrieval to a small set of results per country may be a practical choice in a rapid review, but it also introduces a non-trivial risk of selection bias, especially in countries where results are dominated by grey literature or where terminology varies. If the authors keep this design, they should justify it more directly and, ideally, show a simple sensitivity check

demonstrating that the headline conclusions do not change when the retrieval window is widened for a subset of countries.

A related issue is the connection between factual statements and the evidence cited. Many claims are referenced, but some of the broader statements read as summaries that could plausibly be true while still being difficult for the reader to trace back to specific included studies. This is not a matter of adding more citations in bulk. It is more about tightening the link between claims and sources, particularly for conclusions that are framed at the EU-wide level. One straightforward way to do this would be to make the extraction framework explicit and to present a compact summary of the included studies that records, for each source, the country, population, technology context, outcome measure, and the main acceptance drivers reported. That kind of evidence map would allow the reader to see when a conclusion rests on multiple comparable studies versus when it is driven by a small number of heterogeneous sources. It would also help the authors state the limits of generalisation more precisely when the literature is thin or skewed toward particular national contexts.

The manuscript also uses a polarity-style categorisation of findings, described in language that comes close to “sentiment” labelling. If this element is intended as a substantive contribution, it needs a clearer protocol. The revision should spell out what was coded, whether coding was based on full texts or abstracts, how “positive”, “mixed”, and “negative” were defined, and how borderline cases were resolved. Readers will also want to know whether the coding was done by one person or more than one, and what steps were taken to limit subjectivity. If the authors cannot support this with a sufficiently transparent coding rulebook and at least a modest reliability check, I would encourage them to drop the polarity classification and rely instead on a structured thematic synthesis that does not require assigning valence labels. In its current form, this part of the paper risks looking more assertive than the underlying procedure warrants.

Finally, the paper should be clearer about the role played by different evidence streams. The abstract and parts of the framing refer to a Gallup awareness survey, but the body of the paper reads primarily as a literature review and narrative synthesis. If the survey is a central empirical input, it needs to be presented as such, with enough information about what was analysed and how it was used. If it is mainly background motivation, that is perfectly acceptable, but then the manuscript should say so plainly and keep the review claims anchored in the included studies. As it stands, there is a risk that readers will misattribute particular conclusions to the survey rather than to the reviewed sources, which weakens the clarity of the argument.

The points that must be addressed for the article to be scientifically sound are the ones that secure transparency and traceability. The paper needs a fully specified search and screening protocol that a reader could replicate, and it needs a more explicit link between the principal conclusions and the underlying evidence base, with careful signalling where coverage is uneven. In addition, the polarity-style classification should either be supported by a clear coding protocol with steps taken to reduce subjectivity, or it should be removed. Once these elements are in place, the paper’s conclusions would sit more comfortably within the current literature and the article would be much closer to meeting the standard expected for an openly reviewed synthesis on Open Research Europe.

Is the topic of the review discussed comprehensively in the context of the current literature?

Partly

Are all factual statements correct and adequately supported by citations?

Partly

Is the review written in accessible language?
Yes

Are the conclusions drawn appropriate in the context of the current research literature?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Sustainable finance and energy economics; Financial econometrics; asset pricing and portfolio theory.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 19 January 2026

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Dimitrios Tzioutzios
Department of Mechanical and Industrial Engineering, Norwegian University of Science and Technology, Trondheim, Norway

Thank you very much for your contribution to an important research subject for Hydrogen and Fuel Cell Technology development and uptake, such as a review of evidence from existing public perception and technology acceptance studies focusing on the EU region. I appreciate the effort invested in the manuscript and commend the authors for the clear and structured presentation of concise summaries of the reviewed studies. As far as I am concerned, the research is novel and contributes significantly to the academic discourse through a focused literature review. The manuscript is well-written, with accessible language and minimal errors. A summary of the article is provided below:

This paper examines public perceptions of hydrogen as a future energy carrier across the European Union. Through a systematic literature review, the authors synthesised findings from 30 survey-based studies that include respondents from EU countries, identifying common patterns and key factors influencing public attitudes. The analysis is complemented by a sentiment evaluation to provide additional insight into prevailing perceptions. The results indicated that, while general awareness of hydrogen is relatively high, self-reported understanding remains limited and varies according to sociodemographic factors such as age, gender, and geographic location. Support for hydrogen energy is positively associated with environmental concern and trust in science, particularly when hydrogen is

framed as a safe and low-carbon option, whereas concerns related to safety, cost, and production pathways continue to shape public scepticism, according to the authors' analysis. The study concludes with an outline of policy-relevant implications providing guidance for policymakers and stakeholders seeking to enhance the social acceptability of hydrogen technologies in alignment with the European Union's hydrogen and climate objectives, emphasising the need for targeted and transparent communication strategies.

Next, I offer some comments that—in my opinion—would improve the clarity of the authors' messages and will give a more comprehensive understanding to readers. Following a few general notes, my comments are organised according to the manuscript's outline.

General Comments

1. I begin with the point that represents my principal methodological concern. A core requirement of a systematic literature review is the precise documentation of all procedural steps in order to ensure that the results are reproducible when the same search parameters are applied. In this context, the criterion of selecting "the top ten results per country" raises concerns. Search engines are known to personalise and localise results based on factors such as browser cookies, user history, and internet service provider characteristics. Consequently, the ranking of the "top ten" results identified by the authors may not correspond to the top ten results obtained by another researcher, *ceteris paribus*.

To be clear, this concern does not relate to the choice of Google Scholar over alternative databases (e.g. Web of Science), but rather to the reliance on first-page or top-ranked results as a cut-off criterion. Such rankings may be influenced by multiple external factors, potentially introducing bias into the search process and undermining reproducibility.

To address this issue, I would kindly ask the authors to provide additional clarification on this exclusion criterion and to explain how this potential source of bias was mitigated in their methodological approach. If this issue was not explicitly accounted for during the data collection and analysis phases, it should be transparently acknowledged as a limitation in the relevant section of the manuscript. In my view, this concern is not insurmountable, but it does require clearer justification and reporting.

2. In the same vein, I would like to draw the authors' attention to a study that appears to meet the stated inclusion criteria but does not seem to have been captured in the review: Huan et al. (2024) - https://doi.org/10.1016/j.scs.2024.105653 . This study examines public acceptance factors using survey data from three countries, one of which is Spain. I find its omission somewhat surprising, as the term "Spain" is explicitly mentioned in the abstract, suggesting that the study should have been retrieved given the described search strategy (title and abstract screening) and inclusion criteria (i.e. English-language publication, survey-based research, and a European focus).

This example illustrates why a more detailed and transparent description of the search strategy and screening procedures is essential. Clearly defining the boundaries of what was included and excluded would help readers understand how studies were identified, screened by title and abstract, and ultimately selected for analysis. I would therefore recommend revising and possibly reorganising the methodology section to clarify these steps, particularly in light of the apparent omission of relevant studies.

Full disclosure: I note that I am a co-author of the aforementioned paper and was therefore aware that it satisfies the stated inclusion criteria as described in the manuscript. The authors may, of course, decide whether to incorporate this study into their analysis or to provide a clear justification for its exclusion. I would like to raise the point that there is a possibility that other relevant studies may have been omitted as well, and this issue should be addressed during the analysis (or supplemented *ex-ante*) or explicitly acknowledged in the manuscript.

3. I would welcome further clarification regarding the extent to which the literature summaries—apparently produced by the authors—provide a more reliable basis for identifying salient sentiments than direct analysis of the original studies themselves (for example, through systematic examination of their respective results sections). Introducing an additional layer of language editing or summarisation may inadvertently add interpretative bias. If this issue was explicitly considered and addressed during the analytical process, it would be helpful to state this clearly in the methodology section. Otherwise, I believe this aspect should be acknowledged as a limitation of the study.

4. In general, I would expect a clearer and more explicit linkage between the arguments presented in the discussion and the specific studies from which they are derived. While the arguments themselves are logical and well structured, their grounding in the reviewed literature is not always sufficiently transparent. The discussion section should actively engage the study's findings with existing research, and more pronounced connections to the analysed studies would strengthen this engagement.

Although there are instances where previously numbered studies are referenced in the discussion of the findings, several arguments are not clearly anchored in the reviewed literature through explicit citation. In my view, this issue could be addressed relatively easily by incorporating additional in-text references to the relevant works. I have indicated a few illustrative cases where such clarification would be particularly beneficial in the discussion section (see below).

5. In general, the number of references listed in the bibliography is relatively low for a review paper. While 30 papers were included in the analysis, only a handful of additional sources (exactly five) are cited in the introduction and discussion/conclusion to enrich the discourse. From my perspective, this reflects a somewhat limited engagement with the broader body of relevant academic literature. I have also noted the absence of explicit positioning in the introduction section (see below). An additional improvement could be the early integration of key terms—such as *energy sustainability*, *public engagement*, *environmental attitudes*, and *renewable energy transition*—which emerge from the synthesis but are not thoroughly discussed in the initial framing of hydrogen technology acceptance.

Title, Abstract and Keywords

6. I found the title of the manuscript somewhat unclear. Specifically, the main title, "evidence synthesis", appears overly generic and abstract, and does not sufficiently convey the substantive focus of the study. In contrast, the subtitle is considerably more informative and provides a clearer indication of the manuscript's scope and content. I would therefore recommend that the authors reconsider the formulation of the main title to make it more specific and informative.

Furthermore, it would be beneficial to indicate explicitly in the title that the manuscript is a systematic literature review. Doing so would help set clear expectations for readers regarding the

nature and methodological approach of the study.

Taking these points into account, one possible restructuring of the title could be along the following lines: “Public perceptions of hydrogen and fuel cell technologies: A systematic literature review of evidence from the European Union.”

7. I appreciate that the abstract clearly outlines the methodology, concisely presents the main findings, and refers to the expected contribution of the study. However, I found the opening of the abstract somewhat abrupt. I would therefore recommend adding a brief introductory sentence at the beginning that highlights the contemporary relevance and significance of the study, in order to better contextualise the work for readers.

8. There appears to be a notable discrepancy between the abstract and the content of the manuscript. The 2023 Gallup International Awareness of Hydrogen Technologies Survey is mentioned only in the abstract and does not appear elsewhere in the paper. I suspect that this reference may have been included in error, as the remainder of the manuscript presents a literature review of survey-based studies conducted between 2005 and 2024 on public perceptions of hydrogen technologies.

By contrast, the plain language summary appears to be more closely aligned with the actual content of the study. I would therefore recommend that the authors review and revise the abstract to ensure consistency with the scope and focus of the manuscript.

Introduction

9. I found the introduction somewhat underdeveloped, particularly with regard to articulating the rationale for undertaking an additional literature review on public perceptions of hydrogen technologies. The justification for the study is less pronounced than one might expect, and the discussion does not engage with previous, related review works to a sufficient extent. There are several relevant studies in this area that are not outdated (e.g. Scovell, 2022 [as cited]; Emodi et al., 2021 - https://doi.org/10.1016/j.ijhydene.2021.06.212), and positioning the present work more explicitly in relation to these existing contributions would help to better orient readers and clarify the unique purpose and added value of this review. In this context, the authors may also wish to more clearly underscore the main research question(s) that this literature review seeks to address or illuminate.

To be clear, I consider the review to be both significant and novel. However, this is not sufficiently highlighted in the introductory section. In my view, a key justification for this study lies in the rapidly expanding body of academic literature on hydrogen technology perception over the past decade, as well as the specific focus on studies conducted within EU Member States. Making this argument more explicit in the introduction would substantially strengthen the framing of the manuscript.

10. It would be beneficial to expand the final paragraph of the Introduction—or to insert a brief concluding paragraph—to provide a clearer outline of the contents of the subsequent sections of the manuscript. This would give readers an overview of the structure and main topics covered in the following sections, thereby facilitating comprehension and allowing them to follow the argumentation more easily.

Literature review on public perceptions of hydrogen technology (Methodology?)
11. Consistency in the use of methodological terminology is essential. The manuscript makes reference to a 'systematic literature review', a 'rapid literature review', and a 'rapid evidence assessment', presumably referring to the same approach. This variation may cause confusion for readers.

I would recommend clearly defining the methodology employed using standardised and precise terminology—an excellent reference is Sutton et al. (2019 - DOI: 10.1111/hir.12276)—and maintaining consistency throughout the manuscript. This will enhance clarity and help readers follow the study's methodological approach more easily.

12. In accordance with PRISMA guidelines, it would be helpful to provide a list of the keywords used for the query construction. Similarly, the inclusion and exclusion criteria for the studies should be clearly presented—for instance, specifying the time of data collection, period of review, languages, and geographical scope. I noticed that most of it is present in the description, albeit scattered across various paragraphs. I would recommend including all of this information in a concise table to supplement the text in the methodology section, which would enhance transparency and reproducibility.

13. I am unclear about what is meant by 'pan-European entries' (p. 3). Does this refer to studies that included survey respondents from more than one EU country, or to studies targeting countries outside the EU but still within the European region? Were studies covering multiple target countries treated differently from single-country surveys? Likewise, were studies including countries outside the scope of the review handled separately, or were only the EU-relevant findings discussed?

Providing such clarifications in the methodology section would offer readers a more comprehensive understanding of how the analysis was conducted. I would recommend revising this phrasing to remove any ambiguity from the sentence.

14. Figure 1 reports three additional entries from other sources, yet the text mentions only two (in addition to the 28 identified through the search). Please check for consistency between the figure and the text.

Additionally, the phrase 'hand searches' may be unclear. I would recommend rephrasing it as 'manual searches' or providing a more descriptive term. Any revisions should also be reflected in Figure 1 to ensure alignment.

15. Could the authors please specify which software tool was used to conduct the sentiment analysis? It would be helpful to state the name and version of the tool to allow readers to understand any technical limitations and to ensure transparency in the methodology.
Sources

16. The authors could consider enriching the analysis summary with visualisations, for example a timeline of the reviewed studies or graphs illustrating the distribution of sample sizes. Such additions would enhance the clarity and accessibility of the findings for readers.

17. "Notably, the most recent study, [...]" (p. 3): It would be advisable to include the appropriate in-

text reference at this point to clearly attribute the source and support the statement made.

Summaries of relevant research studies (Results?)
18. This section provides very succinct and informative summaries of the reviewed studies and is well written overall. I would only recommend adding one in-text citation for each study within the respective summarising paragraph. I note that Table 1 includes all references—an excellent compilation—but including the author–year citation in the text would further facilitate readers wishing to follow up on individual studies.

19. Table 1 (p. 5): Minor suggestion: Ideally, this table could be made more informative by including the target survey countries and the sample sizes, as these aspects are discussed in the text. I believe there is sufficient space to accommodate this information if the table contents are slightly rearranged.

20. Table 2 (p. 6): I commend the authors for this clear and informative table.

21. Source 11 (p. 8): I believe this is a typographical error and the authors likely intended to write 'machine learning' in the first sentence. Please check again.

22. Source 28 (p. 10): Reintroducing the acronym 'HFS' is unnecessary, as it was already defined in the summary of Source 23. The authors may either continue using the acronym as is, or simply remove it in this sentence, since the non-abbreviated description is already provided.

23. 'Hydrogen public opinion results by valence' (p. 10): While 'valence' is technically accurate, it may be unfamiliar to a large portion of readers. I would therefore advise against using it in the sub-heading without providing an explanation in the text. Perhaps the term 'sentiment', used earlier, could serve as a more accessible alternative. My concern here relates solely to language accessibility; the term itself is valid and precise.

Conclusions (in my view still Results or Discussion—see comment below)
24. In general, the Conclusion section should not introduce new knowledge or, in this case, new findings from the synthesis of data. From my perspective, the synthesis of the literature review constitutes a core part of the Discussion section that precedes it. The Conclusions should primarily provide a concise summary of the key findings and, where appropriate, highlight future research directions. Limitations may also be included here if they have not been addressed earlier in the Discussion.

25. Cases where authors should indicate which study they are referring to, so that readers can clearly identify the source of the information (on p. 12). a) 'Findings from the Netherlands, for example, [...]', b) 'This is evidenced by studies indicating that individuals[...]', c) 'The Netherlands research elucidates a pivotal finding[...]', d) 'This necessity is echoed in the research from Ireland, [...]', e) 'The insights from Spain and Italy, [...]', f) '[...]as also seen in research in Denmark highlighting hesitance[...]', g) 'Public opinion research in the EU27 indicates[...]'.

26. '[...]exhibit general positivity but face challenges due to the NIMBY (Not in my backyard) phenomenon' (p. 12): Once again, re-introducing the acronym NIMBY here is not necessary, as it has already been mentioned in the summary of Study #5 earlier.

27. 'There are some examples of overlap in the data. [...] Most studies were opinion surveys; however, one survey (#15) was a willingness-to-pay study.' (p. 12): This paragraph is primarily descriptive, presenting an overview of the survey format of a subgroup of the reviewed studies. I am uncertain about the point the authors are trying to convey, as it appears somewhat disjointed from the rest of the section. This could likely be resolved with a clearer opening sentence or a brief concluding remark. Otherwise, it is unclear what the implications of the data overlap are, or why it is important to describe these studies at this point within the discussion on public perceptions.

In my view, this description of the analysed studies would be better placed in the 'Sources' section, as it aligns more naturally with the discussion of survey coverage of the reviewed studies.

28. 'Countries with established hydrogen initiatives and high-profile energy policies [...] influence of national framing, media coverage, and institutional trust on public opinion.' (p. 13): It would be beneficial to include citations here—either from the analysed studies or from other relevant literature—to situate this argument within the context of existing research.

29. 'Engagement must be designed to foster deeper [...] risk concerns and adapting strategies to the social and informational realities of lower-familiarity groups.' (p. 13): These arguments would be strengthened by the inclusion of an appropriate citation to support them.

30. While I commend the authors for including study limitations, I would recommend also highlighting potential avenues for future research. Beyond the identified research gaps—which are generally well stated—acknowledging limitations arising from the specific scope of the study can naturally point to interesting directions for further investigation. In this regard, I suggest revising the final paragraph to outline one or two potential areas for future research.

Additionally, please ensure that the study limitations also address methodological aspects of this literature review and analysis, as noted in my earlier comments.

Policy Implications

31. I commend the authors for clearly enumerating the policy implications of their research. This section could, however, be further strengthened by establishing direct links to previous studies, thereby providing stronger support for the proposed evidence-based policy strategies. From my perspective, the authors could draw on the reviewed articles to illustrate cases in which each issue has been identified, or refer to the relevant discussion in the respective studies (or from additional sources) to substantiate their reasoning.

That said, I would also suggest reconsidering the placement of this section. Policy implications, being derived from the broader discussion, are typically not part of the conclusion section. In my view, the conclusion should focus on summarising the key findings and highlighting the study's contributions. As noted in an earlier comment, substantial restructuring of the conclusion is recommended, with only the final paragraph in its current form serving as the actual conclusion.

References

1. Huan N, Yamamoto T, Sato H, Sala R, et al.: Cross-national examination of facilitators and hindrances to the public acceptance of hydrogen refuelling facilities. *Sustainable Cities and Society*. 2024; **113**. Publisher Full Text
2. Emodi N, Lovell H, Levitt C, Franklin E: A systematic literature review of societal acceptance and

stakeholders' perception of hydrogen technologies. *International Journal of Hydrogen Energy*. 2021; **46** (60): 30669-30697 Publisher Full Text
3. Sutton A, Clowes M, Preston L, Booth A: Meeting the review family: exploring review types and associated information retrieval requirements. *Health Information & Libraries Journal*. 2019; **36** (3): 202-222 Publisher Full Text

Is the topic of the review discussed comprehensively in the context of the current literature?
Partly

Are all factual statements correct and adequately supported by citations?
Partly

Is the review written in accessible language?
Yes

Are the conclusions drawn appropriate in the context of the current research literature?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: I am confident that I have sufficient expertise and experience in related research areas to evaluate this review article in its entirety. My areas of expertise include disaster risk communication and perception, hydrogen safety, and hydrogen technology acceptance.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.