



Coordination and Support Action SET4H2

Key Aspects Report

Report on the key aspects for the
deployment of the renewable and
low-carbon hydrogen economy

D5.1

WP5 / T5.1

April 2025

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Executive summary

The development of a renewable and low-carbon hydrogen economy marks a significant transformation in the global energy landscape. In an agreement between representatives of the European Commission (EC), the EU Member States (MS) and SET Plan countries, the establishment of a new Implementation Working Group (IWG) on Hydrogen was agreed (note: until being official, the IWG is called Temporary Working Group, TWG). In order to support the TWG, a coordination and support actions (CSA) project (HORIZON-CL5-2023-D3-03-08) was announced in the Horizon Europe work programme 2023-2024. This report represents deliverable 5.1 from work package (WP) 5 of this CSA-project (SET4H2).

According to the European Commission's Strategic Energy Technology (SET) Plan (2007) and its revision in 2023, aligning and coordinating national efforts is essential for achieving sustainable and timely objectives. In this context, the TWG on Hydrogen has selected activities for its Implementation Plan (IP) to support this transition. Task 5.1 of the SET4H2 project supports the creation and further development of the TWG IP (respectively the activities therein) by the definition, identification, and prioritization of actions on so called key aspects. For the contribution of this activity to the TWG and the SET Plan objectives, see chapter 1.4 and 1.3.

For the concrete work, the AEA, as the task leader, reviewed over 60 relevant and up-to-date publications. This led to the identification of 181 references, which were condensed into 33 actions on key aspects (long list) to ensure clarity and manageability and which then were submitted to the project partners for reviewing. After completing the formulation of the key aspects, the final long list of actions on key aspects was submitted again to the CSA partners for evaluation and voting, which resulted in a short list of prioritized activities on key aspects which will be aligned with the activities of the TWG before starting the next phase of Task 5.1 (mapping of networks and activities at national levels with reference to the key aspects).

The results of this work will serve as a base for the next steps in WP 5, where the focus will shift to analysing hydrogen activities across EU-Member States and SET Plan countries, assessing networks and platforms to identify regions with varying levels of engagement, particularly in relation with the selected key aspects. This mapping will help to shape strategies to develop synergies and address bottlenecks in the SET Plan countries renewable and low-carbon hydrogen economy and will serve as a basis for exchange between the countries and regions, ultimately supporting the TWG's and SET Plan goals.

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List of abbreviations and acronyms

List of abbreviations

Abbreviation	Long form
D	Deliverable
DoA	Description of Action
DOI	Declaration of Intent
EC	European Commission
ETIP	European Technology and Innovation Platform
EU	European Union
HEU	Horizon Europe
IWG	Implementation Working Group
PU	Public
RES	Renewable Energy Sources
R-LC hydrogen	Renewable and low-carbon hydrogen
R&I	Research and Innovation
SRIA	Strategic Research and Innovation Agenda
TWG	Temporary Working Group
WT	Work Task
WP	Work Package

Acronyms of CSA SET4H2 consortium partners

AEA: Österreichische Energieagentur - Austrian Energy Agency

BGH2A: Balgarska Asotsiatsia za Vodorod, Gorivni Kletki I Sahranenie na Energia (Bulgarian Hydrogen, Fuel Cell and Energy Storage Association)

EUREC: Association of European Renewable Energy Research Centers

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DGEG: Direção-Geral de Energia e Geologia (Directorate General for Energy and Geology)

DLR: Deutsches Zentrum für Luft- und Raumfahrt e.V.

HER: Hydrogen Europe Research

MUR: Ministero dell'Università e della ricerca

UNIBO: Alma Mater Studiorum – Università di Bologna

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1. Objective

The development of a renewable and low-carbon hydrogen economy represents a revolution in the international energy system. As emphasized in the revision of the SET Plan 2023 [1], it is of crucial importance to align and coordinate national efforts to ensure that the objectives are achieved in a sustainable way and on-time. The success especially relies on cross-cutting issues addressing agreements, coordination, and exchange of experience on so-called key aspects (see our definition in chapter 2). The alignment and the coordination will take place within the SET Plan IWG, and the CSA consortium will support the IWG (resp. is supporting the TWG) through its work.

1.1 Considerations for Deliverable 5.1

The SET Plan activities are clustered into 10 actions [2] for research and innovation. They address the whole innovation chain, from research to market uptake and are structured according to a classic pattern, with a focus on technologies, economics, materials and energy efficiency.

In 2021, in a broad-based dialogue process, stakeholders from industry, research, civil society and politics were given the chance to express their perspectives on R&I on green hydrogen within the ERA pilot on green hydrogen. The process put a lot of emphasis on transparency, openness and low barriers to participation, the outcome was published as Strategic Research and Innovation Agenda (SRIA) [3], with the thematic structure production, transport and infrastructure, market stimulation and cross-cutting issues. The contents of the chapter on cross cutting issues have been incorporated into the present work.

In addition to the information in the above-named sources, so called key aspects were identified, free from conventional classifications and across different technologies and applications, as a start in WP 5 to serve as a basis for the further work. Actions in WP 5 include identifying the 3 most important aspects and challenges to be solved for a rapid and successful market ramp-up of hydrogen technologies. It should be emphasized at this point, that the present work, together with D 5.2 and D 5.3, which are still to be prepared, is the basis for coordination, exchange and cooperation within regions and states, which is the basic idea behind the SEP Plan.

1.2 General procedure

As task leader, the AEA conducted the elaboration of a long list of key aspects and submitted it to the vote of the CSA Partners, which resulted into a short list of prioritized activities on key aspects which will be aligned with the activities of the TWG before starting the next phase of Task 5.1 (mapping of networks and activities at national levels with reference to the key aspects). With this information and contact points, we will support the exchange and coordination between the regions and countries.

This work also complements the other early deliverables of the project like Del. 3.4 (DEdG), which maps value chains infrastructural and industrial scale-up enablers and challenges identified in the frame of the SET Plan, as well as Del. 4.1 (MUR), which maps initiatives, networks and platforms to engage with on a European level. Together, these initial works pave

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the way for the further development steps of the TWG, which will further be assisted by the activities of the CSA partners. Especially, the results of this work will serve as a base to reference and map national activities and participation in European networks and platforms related to the selected key aspects (Task 5.2).

1.3 Contribution to the SET Plan objectives

The revised SET Plan [1] priorities, actions and IWGs should be accompanied by new priorities on cross-cutting issues to accelerate the development and deployment of clean and efficient energy technologies. Chapter 3 of the revised SET Plan stresses the importance of key factors (in this report formulated as key aspects) such as upskilling and reskilling, social needs, recyclability and reusability ... These are exactly the kinds of aspects that WP 5 will contribute to in cooperation with the IWG.

1.4 Contribution to the IWG objectives

The SET Plan TWG on Hydrogen has finished the selection of 6 activities and the IP is expected to be completed by May 2025. On the basis of the D5.1v1.0 report submitted in November 2024 and the 6 activities selected by the TWG for its IP, a matrix (key aspects vs. IP activities) with possible WP5 contributions was created and submitted to the TWG on the basis of a joint discussion. As there are numerous integration options, the TWG was asked to select 3 options for the supporting WP5 work together with the WP5 task leaders.

1.5 Reference to the Declaration of Intent of the Hydrogen TWG

In its Declaration of Intent (DOI) [4] of April 2024 the TWG recognises the different starting conditions in the countries and regions of Europe. The scope of the future IWG also extends to non-technical cross-cutting issues such as regulation, standardisation, certification, security, education and training organisational change as well as public awareness and acceptance. Different activity levels and non-technical, non-monetary factors (including the exchange) are in focus of the deliverables in WP5.

In addition, the DOI lists in its chapter 6 next steps, to which the TWG members have committed. Among others, “identify all issues of a technological, socio-economic, regulatory or other nature that may be of relevance in achieving the targets” is one of the next steps. This report makes a significant contribution to providing a holistic view on these issues.

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2. Definition of key aspects

The first step in work package 5 (WP5) was to identify key aspects for the establishment of a hydrogen economy. In this context, having the same understanding of what a “key aspect” means, should give guidance for the realisation of the task. This working paper thus describes the development of a definition of a key aspect in the establishment of a hydrogen economy in the sense of the Horizon Europe project SET4H2 (support to the SET Plan Hydrogen Temporary Working Group; SET H2 TWG).

2.1 Approach

In addition to the information given in the funding SET4H2 proposal, the documents listed below were considered to support the definition of a “key aspect”.

The following is indicated: Source considered, reason for the selection (a) and relevant information extracted (b). Relevant keywords and phrases are underlined>.

- 1) Green Hydrogen Agenda Process SRIA [3]
 - a) Result of the process from which the SET4H2 project and the SET Plan H2 TWG emerged.
 - b) A green hydrogen economy will not only influence the entire energy system but also society (p.18). How can regulation, standardisation and certification enable the acceptance and diffusion of green hydrogen in Europe? (p.18), interdisciplinary and holistic research approach (p.18), enabling framework (p.18), Cross-cutting issues that deal with the socio-economic and environmental implications of hydrogen technologies as well as the legal framework (p.18).
- 2) EC Communication on the Revision of the Strategic Energy Technology (SET) Plan [1]
 - a) Basic background document for the SET Plan and therefore for the Hydrogen TWG
 - b) The EU's Strategic Energy Technology (SET) supports the development of clean, efficient and cost-competitive energy technologies through coordination and collaboration in clean energy research and innovation (R&I), bringing together European industry, academia and governments of the SET Plan countries (p.1), The revised SET Plan priorities, actions and IWGs should be accompanied by new priorities on cross-cutting issues to accelerate the development and deployment of clean and efficient energy technologies ... (p.7)
- 3) A hydrogen strategy for a climate-neutral Europe [5]
 - a) Basic EU document on hydrogen
 - b) However, deploying hydrogen in Europe faces important challenges that neither the private sector nor Member States can address alone (p.2), All actors, public and private,

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at European national and regional level must work together, across the entire value chain, to build a dynamic hydrogen ecosystem in Europe (p.3), An incentivising, supportive policy framework needs to enable renewable and, in a transitional period, low-carbon hydrogen to contribute to decarbonisation at the lowest possible cost, whilst considering other important aspects, such as industrial competitiveness and its value chain implications for the energy system (p.13), To facilitate the deployment of hydrogen and develop a market where also new producers have access to customers, hydrogen infrastructure should be accessible to all on a non-discriminatory basis (p.16)., Finally, further research is needed to support policy making on a number of cross-cutting areas, in particular to enable improved and harmonised (safety) standards and monitoring and assess social and labour market impacts (p.17).

- 4) European Clean Hydrogen Alliance: Report of the Alliance Roundtables on Barriers and Mitigation Measures [6]
 - a) The document deals with the main barriers that impact the roll out of hydrogen.
 - b) Due to its nature the alliance is also set to provide a unique opportunity to identify the multiple obstacles and bottlenecks related to the investment projects and raise awareness of EU and national decision makers of what needs to be addressed in this starting phase to facilitate the roll out and scale up of hydrogen (p.3). Integration, synchronisation, and visibility appear to be the cornerstones of hydrogen deployment and scale up across the whole value chain (p.7).

- 5) Batteries Europe Position Papers (PP) on Cross-cutting topics 2024 (Education & Skills, Sustainability, Safety, Social Sciences & Humanities, SSH, Hybridisation) [7] [8] [9] [10] [11]
 - a) Chosen in order to look beyond the thematic horizon. The position papers do not deal with hydrogen, but the battery industry is also facing challenges in the development of a European value chain.
 - b) A skilled workforce along the entire battery value chain will therefore be decisive for European companies and industries to be competitive and sustainable (p.14, Education & Skills PP), The availability of abundant, affordable, renewable energy, generated with little or no environmental impact, particularly in terms of carbon emissions, is one of the cornerstones of any advanced and sustainable economy. (p.9, Sustainability PP), While drafting such standards and regulations, standardisation bodies and regulatory authorities should collaborate with the aim to avoid overlapping or mismatching actions (p.11, Safety PP), For this purpose, Batteries Europe has established the cross-cutting TF SSH with the aim to explore the role and potential of SSH research related to the European battery value chain. For instance, the expected high growth rates and corresponding rapid battery technology deployment raise concerns related with broader and more transcendent aspects of sustainability, including ... (p.9, Social Sciences & Humanities PP), Hybridisation takes advantages of different storage systems and combine these together to create an application-relevant solution which may have

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greater reliability, durability, flexibility and better sustainability, leading potentially to lower costs (p.9, Safety PP).

6) US Hydrogen Strategy and Roadmap [12]

- a) Selected in order to include relevant documents from outside Europe.
- b) Acceleration is key to meeting our climate goals. However, this must be done in a strategic and holistic way, taking into consideration the potential role of hydrogen within a portfolio of solutions to tackle the climate crisis (p.7), crosscutting efforts to promote diversity, equity, inclusion, and accessibility; engage communities, ranging from environmental justice groups to Tribes, tribal organizations and labour unions; develop the workforce; advance policy; support the technology and energy transition; and enable market adoption at scale (p.58).

For the purposes of this project, what is not (in order to narrow down the topic area or to give aspects that have perhaps received less attention up to now a chance) a key aspect:

Obvious requirements for better hardware and monetary support. This means: no hardware improvements (price reduction, longer lasting hardware, more efficient hardware, ...), no hardware roll-out, no deployment of a hydrogen transport infrastructure and no mere "more money demand".

Both aspects (hardware and budget) are of course much important, but they are obvious, quantifiable and a fundamental part of established technical development.

Nevertheless, aspects that can encourage or accelerate hardware or financial support are taken into account.

2.1 Definition

The proposed definition for a key aspect is:

Key aspects are all relevant measures and circumstances which contribute significantly to an enabling environment for a rapid development of a competitive European hydrogen economy. Though, the key aspects do not refer to obvious hardware requirements and pure monetary support nor to the mix of drivers and enablers that are anyhow required at a Member State and European level to address the energy transition towards net-zero emissions. Specifically, the key aspects refer to those factors, that facilitate cooperation, coordination and mutual acceptance, enable the knowledge exchange and the uptake of synergies.

An enabling and supporting environment for a rapid development of a competitive European hydrogen economy, for example, is characterized by:

- ensuring, that the original arguments (carbon saving and energy security) in favour of the deployment of hydrogen technology are at the core. In particular, the factors that

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strengthen the link between hydrogen and renewable energy production should be underlined.

- supporting an interdisciplinary and holistic R&I approach, taking the entire value chain into account.
- considering socio-economic and environmental implications in the different national contexts.
- disseminating accurate information for the public and enabling a rapid diffusion of knowledge among the different stakeholder groups.
- fostering societal engagement, inclusion and acceptance (information, market and infrastructure access).
- implementing supportive policy framework including incentives that ensures a level playing field with fossil energy carriers and feedstocks and enable hydrogen application niches.
- enabling a functioning labour market on the whole value chain assisted by structural initiatives on skills enhancement.
- developing a widely accepted, fair and transparent certification processes (such as an agreed methodology for the calculation of CO₂ Emissions or a mutual product certification).
- avoiding overlapping or mismatching actions, synchronising of actions on EU, national and regional levels.
- encouraging multilateral cooperation of European countries pursuing a common goal.

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3. Methodology

3.1 Research and consolidation

Based on the common agreed definition on key aspects – in short words all relevant measures and circumstances which contribute significantly to an enabling environment for a rapid development of a competitive European renewable and low-carbon hydrogen economy, with the exception of obvious hardware requirements and pure monetary support – we have searched over 60 qualitative and relevant publications (a list of the publications can be found in the annex of the present document) for such key aspects and extracted 181 relevant references.

Of course, many aspects were mentioned several times in total or were described only slightly differently in the diverse documents. We have therefore condensed these 181 findings into 33 key aspects, with the intention of not losing the original meaning while creating a manageable number of key aspects respectively possible actions.

Based on the experience gained during the work, the aspects have been assigned to 6 categories.

The draft of the long list has been sent to the CSA Partners for reviewing, the valuable feedback we received underlined how crucial the formulation of each measure is and based on this reviewing, we could reformulate, extend or precise the list of actions on key aspects.

3.2 Selection of a short list of key aspects

After finalization of the long list of actions on key aspects, we decided, in consultation with the consortium leader (DLR), to ask the project partners to evaluate the list of actions.

An online form was thus created, with the following request to the CSA members:

- Evaluate, inside each category, the priority of the actions on key aspect in a range from 1 (= high priority) to 5 (low priority).
- Select the top 1 to maximum 3 actions on key aspects across all categories and explain why.

The results of this evaluation lead to a ranking of the actions inside each category (see the results in 4.2) and over all the categories. The final short list will be then aligned with the activities of the TWG before starting the next phase of Task 5.1 (mapping of networks and activities at national levels with reference to the key aspects).

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4. Results: Key Aspects

The key aspects are formulated as actions in this report. A few of the actions are based on our own considerations, but if it would be helpful for the description of an TWG activity, we should be able to provide one or more literature sources for each action if necessary.

4.1 Long list of key aspects

Category 1: Collaboration and communication

- Intensify the exchange between industry, research, and regulatory and policy makers, in order to support the joint establishment of clear, long-term, realistic, and holistic decarbonization pathways and to identify unnecessary regulatory and trade barriers.
- Encourage governments, private companies and research institution to establish Public-Private Partnerships or joint ventures to share risks and benefits for projects that foster innovation and scale up infrastructure.
- Strengthen international exchange, monitor the progress of first movers, assessing and sharing success factors, best practices, barriers, lessons learnt and identify necessary new international partnerships.
- Intensify cooperation between the digital and energy sectors and find new fields on how digitalisation can address challenges related to the deployment of the R-LC hydrogen economy.
- Identify relevant target groups for public relations and set up dedicated communication strategies, addressing their specific concerns about R-LC hydrogen (e.g.: economical, societal, safety or environmental concerns).

Category 2: Acceleration of the renewable and low-carbon hydrogen economy

- Estimate the demand for R-LC hydrogen and identify business models in existing and new application areas.
- Analyse R-LC hydrogen supply-side potentials and diversification possibilities including imports of renewable and low-carbon hydrogen and its derivatives as well as local resources.
- Evaluate existing infrastructures and their readiness for the use of R-LC hydrogen (admixtures or 100% R-LC hydrogen) or their need for conversion.
- Advocate and propose framework conditions for rapid and concentrated infrastructure and project authorisations at EU-level.
- Support the creation of regional R-LC hydrogen ecosystems that can serve as testbeds for new technologies, digital integration and business models.
- Analyse and monitor funding schemes for the entire R-LC hydrogen-value chain to assess whether EU priority sectors are well covered and disseminate targeted suggestions for improvement or new funding programmes, identify synergies and new potential collaborations and avoid duplicates.

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- Advocate for a professional and accessible infrastructure for technology testing and validation for innovators and technology developers to test their product's manufacturability and propose an accelerated certification process for innovative products.

Category 3: Environment protection and risk prevention

- Compile and share accurate factual and unbiased information about the environmental and social impacts of a deployed R-LC hydrogen economy.
- Monitor research and development on recovery/substitution processes for platinum group metals/critical raw materials and per- and polyfluoroalkyl substances, as well as on advanced materials, that prevent the risk of leaks and failures on pipelines and storage tanks.
- Monitor research activities on the traceability of R-LC hydrogen (e.g.: using block-chain technology, IoT etc.), support the establishment of a harmonised certification and guarantee of origin scheme, and prevent greenwashing.
- Monitor research and risk assessment activities on a safer use, transport and storage of R-LC hydrogen and support the adoption of risk mitigation practices and international safety standards.

Category 4: Good governance, policies, and regulations

- Monitor the alignment of the R-LC hydrogen targets in national plans (NECP) and dedicated hydrogen strategies with objectives at European level, highlight best practices and identify gaps.
- Monitor the alignment of R-LC hydrogen objectives with legislation at Member State and EU level and provide dedicated proposals for better regulations.
- Support the introduction of well-defined market regulatory measures at EU and international level to ensure a level-playing field.
- Support governments in the efficient organisation of state aids for R-LC hydrogen infrastructure.
- Monitor the progress of the R-LC hydrogen economy world wide and compare with targets (e.g.: production, demand, new permits, social and environmental impacts) and provide targeted proposals to fill gaps.
- Monitor that the development of R-LC hydrogen economy is well-aligned with the deployment of renewable energy production facilities.
- Monitor and propose regulation and subsidies schemes that trigger the demand of R-LC hydrogen and support its implementation.
- Support the establishment of a common (at least EU, better international) emissions accounting methodology for R-LC hydrogen production including LCA calculations.

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- Improve and further develop international standards for electrolyzers and fuel cells as well as for resilient construction of new hydrogen infrastructure (incl. gas infrastructure to transport mixtures of R-LC hydrogen and methane).

Category 5: Human resources

- Identify needs for skilling, upskilling and reskilling of the workforce to meet the demand on the entire R-LC hydrogen value chain.
- Support high quality exchange of knowledge and lessons learnt by the adoption of common -agreed quality assurance schemes.
- Propose targeted educational and training programs involving universities and industries that foster the exchange of knowledge/skills along the entire renewable and R-LC hydrogen value chain.

Category 6: Inclusive and just development

- Ensure international and inclusive exchange of knowledge to share best practices and lessons learnt between advanced movers and new adopters.
- Monitor that the development of R-LC hydrogen economy and the implementation of dedicated policies ensure equitable access to hydrogen technologies and benefits across different communities, respect sustainability requirements (social, environmental) which are aligned with SDGs of the United Nations.
- Monitor and analyse the availability and affordability of renewable electricity and R-LC hydrogen and provide targeted proposals to support a fair and inclusive access of these technologies and products.
- Promote the development of hydrogen infrastructure in EU partnering developing countries and regions and stimulate R-LC hydrogen technologies, especially in hard to abate industries.

4.2 Short list: selected Key Aspects

Five institutions of the CSA evaluated the priority of the actions on key aspects in each category. The results of the vote are shown below:

- Category 1: Collaboration and communication: Intensify the exchange between industry, research, and regulatory and policy makers, in order to support the joint establishment of clear, long-term, realistic, and holistic decarbonization pathways and to identify unnecessary regulatory and trade barriers.
- Category 2: Acceleration of the renewable and low-carbon hydrogen economy: Estimate the demand for R-LC hydrogen and identify business models in existing and new application areas.
- Category 3: Environment protection and risk prevention: Monitor research activities on the traceability of R-LC hydrogen (e.g.: using block-chain technology, IoT etc.), support the establishment of a harmonised certification and guarantee of origin scheme, and prevent greenwashing.
- Category 4: Good governance, policies, and regulations: Support the introduction of well-defined market regulatory measures at EU and international level to ensure a

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level-playing field AND Monitor and propose regulation and subsidies schemes that trigger the demand of R-LC hydrogen and support its implementation (same number of points for both actions).

- Category 5: Human resources: Propose targeted educational and training programs involving universities and industries that foster the exchange of knowledge/skills along the entire renewable and R-LC hydrogen value chain.
- Category 6: Inclusive and just development: Promote the development of hydrogen infrastructure in EU partnering developing countries and regions and stimulate R-LC hydrogen technologies, especially in hard to abate industries.

Voters were then able to select, from all the categories, the actions on key aspects that they considered to be the highest priority. Taking into account the voters' first and second assessments, the following actions on key aspects were considered to be the highest priorities across all voting categories:

- 1 Collaboration and communication: Intensify the exchange between industry, research, and regulatory and policy makers, in order to support the joint establishment of clear, long-term, realistic, and holistic decarbonization pathways and to identify unnecessary regulatory and trade barriers.
- 2 Propose targeted educational and training programs involving universities and industries that foster the exchange of knowledge/skills along the entire renewable and R-LC hydrogen value chain.

Then, the three following other actions on key aspects are also considered to have high priority by the voters:

- 3 Estimate the demand for R-LC hydrogen and identify business models in existing and new application areas.
- 4 Monitor research activities on the traceability of R-LC hydrogen (e.g.: using block-chain technology, IoT etc.), support the establishment of a harmonised certification and guarantee of origin scheme, and prevent greenwashing.
- 5 Promote the development of hydrogen infrastructure in EU partnering developing countries and regions and stimulate R-LC hydrogen technologies, especially in hard to abate industries.

From these 3 third place winners, the task leader of WP5 propose number 5 for the further work. This short list will be aligned with the activities of the TWG before starting the next phase of Task 5.1 (mapping of networks and activities at national levels with reference to the key aspects).

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5. Outlook

The definition and identification of key aspects were crucial to develop a shared vision across the CSA consortium on the cross-cutting issues for the development of the R-LC hydrogen economy. The short list on actions on key aspects that have been evaluated to have most priority will be aligned with the activities of the TWG and, together with the other early deliverables of the project, will pave the way for its further development steps.

On the basis of the D5.1v1.0 report submitted in November 2024 and the 6 activities selected by the TWG for its IP, a matrix (key aspects vs. IP activities) with possible WP5 contributions was created and submitted to the TWG on the basis of a joint discussion. As there are numerous integration options, the TWG was asked to select 3 options for the supporting WP5 work together with the WP5 task leaders.

After agreeing on the options to be pursued, we will next focus in WP5 on analysing the current status quo in the Member States in terms of activities. Especially, we will assess, analyse and classify the existing networks, platforms and institutions (at regional, national and European level) according to their activities in relation to the selected options.

A mapping of ‘hot spots’ and ‘white spots’ will be created to get an overview on countries or regions with more or with less hydrogen engagement and activities related to the selected options. Country fact sheets on hydrogen activities will be created, gathering existing information (IEA, IPHE, CH JU and national data sets).

The overall objective of WP5, in its mission to support the development of the TWG, is to identify the potential for developing synergies between Member States/regions, as well as any bottlenecks, and to initiate targeted communication with stakeholders.

	Document:	Key Aspects Report		
	Authors:	AEA		Version: 1.1
	Reference:	D5.1		Date 23.04.2025

6. Literature

- [1] European Commission, „Revision of the Strategic Energy Technology (SET) Plan,“ 2023.
- [2] E. Commission, „European Commission, Strategic Energy Technology Plan,“ [Online]. Available: https://energy.ec.europa.eu/topics/research-and-technology/strategic-energy-technology-plan_en#key-action-areas. [Zugriff am 23 April 2025].
- [3] Expert groups of the agenda process, „Strategic Research and Innovation Agenda (SRIA),“ 2022.
- [4] „TWG Hydrogen Declaration of Intent,“ DLR Project Management Agency, 2024.
- [5] European Commission, „A hydrogen strategy for a climate-neutral Europe,“ 2020.
- [6] European Clean Hydrogen Alliance, „REPORTS OF THE ALLIANCE ROUNDTABLES ON BARRIERS AND MITIGATION MEASURES,“ 2021.
- [7] Batteries Europe Secretariat, „Position Paper Education & Skills,“ 2024.
- [8] Batteries Europe Secretariat, „Position Paper Hybridation,“ 2024.
- [9] Batteries Europe Secretariat, „Position Paper Safety,“ 2024.
- [10] Batteries Europe Secretariat, „Position Paper Social Sciences & Humanities,“ 2024.
- [11] Batteries Europe Secretariat, „Position Paper Sustainability,“ 2024.
- [12] United States Department of Energy, „U.S. National Clean Hydrogen Strategy and Roadmap,“ 2023.

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7. Annex

List of literature reference for the elaboration of the long list

Nr.	Name	Autor	Year
1	Building a European Research Area for clean hydrogen	European Commission	2022
2	Strategic Research and Innovation Agenda 2021-2027	Clean Hydrogen Partnership	
3	Project Pipeline - Hydrogen Forum 30 November 2021	European Clean Hydrogen Alliance	2021
4	Empfehlungen des HyPA-Beirats zur Umsetzung und Weiterentwicklung der "Wasserstoffstrategie für Österreich"	Hydrogen Partnership Austria	2024
5	A hydrogen strategy for a climate-neutral Europe	European Commission	2020
6	Opportunities for Hydrogen Energy Technologies Considering the National Energy & Climate Plans	Fuel Cells and Hydrogen Joint Undertaking	2020
7	Implementation Roadmap - cross border projects and costs update	European Hydrogen Backbone	2023
8	Analysing future demand, supply, and transport of hydrogen	European Hydrogen Backbone	2021
9	Hydrogen Roadmap Europe	Fuel Cells and Hydrogen Joint Undertaking	2019
10	Final Declaration of Intend	IWG on Hydrogen	2024
11	Global Hydrogen Review 2023	International Energy Agency	2023
12	Roadmap on Hydrogen Standartisation	European Clean Hydrogen Alliance	2023
13	Forschungsbedarf der österreichischen Stakeholder an Wasserstofftechnologien	Hydrogen Partnership Austria	2024
14	Annual Report Task & Member Updates	Hydrogen TCP	2023
15	First steps on regulation and certification of hydrogen	International Energy Agency	2023
16	The breakthrough Agenda Reprot	IEA, IRENA, UN Climate Change high-level Champions	2023
17	Towards hydrogen definition based on their emissions intensity	International Energy Agency	2023
18	Northwest European Hydrogen Monitor 2024	International Energy Agency	2024
19	Strategic Research and Innovation Agenda	Expert groups of the agenda process	2022
20	U.S. national clean hydrogen strategy and roadmap	United State Department of Energy	2023
21	revision of the Strategic Energy Technology (SET) Plan	European Commission	2023

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22	Reports of the alliance roundtables on barriers and mitigation measures	European Clean Hydrogen Alliance	2021
23	Position paper - Education & Skills	Batteries Europe Secretariat	2024
24	Position paper - Sustainability	Batteries Europe Secretariat	2024
25	Position paper - Safety	Batteries Europe Secretariat	2024
26	Position paper - Social Sciences & Humanities	Batteries Europe Secretariat	2024
27	Position paper - Hybridisation	Batteries Europe Secretariat	2024
28	Benchmarking International Battery Policies	Frauenhofer Institut ISI	2024
29	IPHE Vision Paper	International Partnership for Hydrogen and Fuel cells in the economy	2024
30	Hydrogen Impact on climate change	International Partnership for Hydrogen and Fuel cells in the economy	2024
31	Hydrogen emissions from a hydrogen economy and their potential global warming impact	Joint Research Center, European Union	2022
32	Clean hydrogen and other decarbonated gases	Joint Research Center, European Union	2023
33	Environmental life cycle assessment (LCA) comparison of hydrogen delivery options within Europe	Joint Research Center, European Union	2024
34	Hydrogen Certification 101	IPHE, IRENA, Hydrogen Concil, International Power-to-X Hub	2023
35	Hydrogen Europe Manifesto for the 2024 European elections	Hydrogen Europe	2024
36	Hydrogen Europe Position paper	Hydrogen Europe	2024
37	Resilience criteria in European public funding Instruments	Hydrogen Europe	2024
38	The EU hydrogen strategy: hydrogen Europe's Top10 key recommendations	Hydrogen Europe	2020
39	H2ero Net Zero Different energy carriers require separate systems of guarantees of origin	Hydrogen Europe	2021
40	A workable approach to additionality, geographic and temporal correlation is key to the achievement of the EU Hydrogen Strategy	Hydrogen Europe	2021
41	Hydrogen Europe Position paper CO ₂ Emission Standards for Heavy-Duty Vehicles	Hydrogen Europe	2023
42	Hydrogen Europe Position Paper Hydrogen technologies can boost the energy performance of buildings	Hydrogen Europe	2022

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43	Hydrogen Europe Position Paper A regulatory framework fit for a European hydrogen market	Hydrogen Europe	2022
44	Hydrogen Europe Position Paper Advanced Materials for the Hydrogen Industry – Policy recommendations	Hydrogen Europe	2024
45	Use of hydrogen in Buildings	Hydrogen Europe	
46	Hydrogen Europe Position Paper Critical Raw Materials Act – Hydrogen Europe’s views	Hydrogen Europe	2023
47	DATASET: Hydrogen-related projects for Monitoring Flash and Factsheet	CORDIS Database	2024
48	ETS and CBAM – implications for the hydrogen sector	Hydrogen Europe	2022
49	Hydrogen Europe Position Paper Industrial Emissions Directive revision	Hydrogen Europe	2023
50	Hydrogen monitoring flash	European Commission	2024
51	Factsheet How do the EU R&I Programmes support hydrogen research in Europe	European Commission	2024
52	Triologue recommendations Revision of the Trans-European Network for Transport Regulation (TEN-T)	Hydrogen Europe	2023
53	Hydrogen Europe Position paper REPowering the EU with Hydrogen Valleys (Roadmap)	Hydrogen Europe	2023
54	How Hydrogen can help decarbonise the maritime sector	Hydrogen Europe	2021
55	Hydrogen Europe Position paper on the sustainable and smart mobility strategy	Hydrogen Europe	2020
56	H2ero Net Zero Reforming carbon market to enable a liquid, sustainable and affordable hydrogen market	Hydrogen Europe	2021
57	Hydrogen as the cornerstone of zero-emission aviation: towards the decarbonization of air transport	Hydrogen Europe	
58	Hydrogen Europe Position paper on the alternative fuel’s infrastructure directive	Hydrogen Europe	2020
59	Hydrogen Europe Position paper Weights and Dimensions Directive	Hydrogen Europe	2023
60	Hydrogen Europe Position Net Zero Industry Act	Hydrogen Europe	2023
61	Position paper - Digitalisation	Batteries Europe Secretariat	2024
62	The EU’s industrial policy on renewable hydrogen - Legal framework has been mostly adopted – time for a reality check	European Court of Auditors	2024

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63	Methodology for the evaluation of cross-cutting themes in development cooperation	Institute for evaluations and social analyses		
64	Bend the trend Pathways to a liveable planet as resource use spikes	UN environment programme	2024	