SET4H2

Coordination and Support Action SET4H2

SET Plan Progress Report for SETIS II

Support to the TWG contributions to the SET Plan

D2.3

WP2 / T2.1
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Executive summary

The Temporary Working Group on Hydrogen (TWG H2) is a new group initiated 2023 under the revised Strategic Energy Technology Plan (SET Plan). In recognition of the systemic role and importance of hydrogen in the future energy system, the TWG aims to better link the thematic areas of the SET Plan that relate to hydrogen. In 2025 the Implementation Working Group (IWG) Hydrogen has not been established yet but has an aspirational status as Temporary Working Group. In support of the TWG, the Coordination and Support Action (CSA) SET4H2 has reported on the current status, recent developments and activities, challenges and future plans of the TWG to inform stakeholders within the European Research and Innovation arena and to indicate the synergies of future collaboration.

Deliverable D2.3 “SET Plan Progress Report for SETIS II, Support to the TWG contributions to the SET Plan” is part of the work package WP2 “Secretarial support to the IWG and transfer of SRIA Results into IWG and SET Plan”, and a direct output from task T2.1 “Secretarial support and organisational logistics to the IWG members and supporters”. The report was delivered on 28 May 2025 to the SET Plan secretariat to be included in the SET Plan Progress Report 2025. The CSA took participated in the online information session on the SET Plan 2025 reporting exercise on 24 March 2025 to gain insights in reporting expectations for this year.

The document has been formatted according to the requirements set out by the European Commission to contribute to the yearly Progress Report on the activities of the Implementation Working Groups of the SET Plan.

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List of Abbreviations and CSA SET4H2 Partners

List of Abbreviations

Abbreviation	Long form
CETPartnership	Clean Energy Transition Partnership
CHJU	Clean Hydrogen Partnership
CSA	Coordination and Support Action
DoI	Declaration of Intent
EERA	European Energy Research Alliance
IWG	Implementation Working Group
SET Plan	European Strategic Energy Technology Plan
SRIA	Strategic Research and Innovation Agenda
TRI	Transition Initiatives
TWG	Temporary Implementation Working Group

CSA SET4H2 consortium partners

Nr.	Partner	Acronym	Country
1	Deutsches Zentrum für Luft- und Raumfahrt e.V.	DLR	Germany
2	Ministero dell'Università e della Ricerca	MUR	Italy
2.1	Alma Mater Studiorum – Università di Bologna	UniBO	Italy
3	Direção-Geral de Energia e Geologia (Directorate General for Energy and Geology)	DGEG	Portugal
4	Balgarska Asotsiatsia za Vodorod, Gorivni Kletki I Sahranenie na Energia (Bulgarian Hydrogen, Fuel Cell and Energy Storage Association)	BGH2A	Bulgaria
5	Österreichische Energieagentur - Austrian Energy Agency	AEA	Austria
6	Association of European Renewable Energy Research Centers	EUREC	Belgium
7	Hydrogen Europe Research	HER	Belgium

1. Details of the working group on hydrogen

The Temporary Working Group on Hydrogen (TWG) is a new group initiated 2023 under the revamped SET Plan. In recognition of the systemic role and importance of hydrogen in the future energy system, the TWG aims to better link the thematic areas of the SET Plan that relate to hydrogen. It receives organisational, logistic and secretarial support through the CSA project SET4H2. This includes support in applying an integrated, systematic and interdisciplinary approach to address research needs, while taking into account the different starting conditions of European countries in the energy transition. Furthermore, the CSA will contribute to enhancing cooperation and synergies among Member States and SET Plan countries, ensuring their active involvement in decision-making and implementation of Research & Development & Innovation (R&D&I) activities as well as facilitating mutual coordination of national and regional hydrogen funding programmes. The CSA will help develop positive impacts on the next integrated SET Plan, Horizon Europe work programme, national/regional hydrogen strategies as well as National Energy and Climate Plans (NECP) to accelerate the hydrogen economy and strengthen ERA as a whole.

1.1 Composition of the Working Group

Working Group Chair Name: Nadine May, DLR (Germany)

SET Plan countries' institutional representatives (member):

- Austria (member)
- Belgium (member)
- Bulgaria (member)
- Czechia (member)
- Finland (member)
- France (member)
- Germany (member)
- Hungary (member)
- Italy (member)
- Poland (member)
- Portugal (member)
- Slovenia (member)
- Spain (member)
- Norway (member)
- Turkey (member)

SET Plan countries' institutional representatives (observer):

- Romania (observer)

Other participating entities:

- Clean Hydrogen Joint Undertaking
- Hydrogen Europe Research
- EUREC
- DG RTD
- DG ENER

The Working Group does not have an EuropeanTechnology Innovation Platform (ETIP) associated with it.

The **Coordination and Support Action Project** (CSA) SET4H2 was set up on May 2024 and will continue till 30 April 2026 in order to support the TWG/IWG Hydrogen. Contact person is Anne Dreysel, DLR (Germany). The Website can be accessed under the link https://set4h2.eu/.

1.2 Cooperations

EERA

A cooperation with EERA has been established, with a representative joining the TWG meetings on occasion. The Chair of the TWG and the representative keep in touch on an occasional basis. The Chair receives updates on the status of the working group, and carries this information on to other committees.

CETPartnership

The CETPartnership is regularly involved in the TWG. The Chair keeps in touch with the representative from TRI3. The representative attends the TWG meetings and has held a presentation. There is an occasional exchange of information, but also a deeper involvement as the TWG is asked to provide feedback on a hydrogen call of TRI3, as well as TRI3 giving feedback on the activity fiches developed for the IP. TWG was invited to speak at a TRI3 event in Berlin and give a presentation.

2. Snapshot

The Temporary Working Group Hydrogen focuses on cooperation, support and uptake of R&I on hydrogen technology across Europe. The goal is to implement the results from the SRIA of the ERA pilot initiative Agenda Process on Green Hydrogen, published in 2022, in an integrated, systematic and interdisciplinary approach to address research needs in the hydrogen sector and enhance cooperation among SET Plan Countries.

The activities will include maximising and broadening the uptake of learnings from EU, national and regional R&I programmes and hydrogen activities. These are coordinated in order to identify the most effective instruments and frameworks for cross-border R&I collaboration. The cooperation and synergies will enable Member States and SET-Plan countries to strengthen Europe's position in the global market and maintain industrial competitiveness.

The CSA SET4H2 was established in May 2024 to support the IWG Hydrogen with essential analyses and reports. The TWG has built a community of active members and supporters and made significant progress towards the Implementation Plan and corresponding activities.

3. Recent developments

Following the submission of the Declaration of Intent in April 2024 the TWG Hydrogen held several virtual working meetings to continuously advance the Draft Implementation Plan. The emphasis was placed on developing activities to prioritise European collaboration and fostering support for Research and Innovation in the field of hydrogen. Technical subgroups, with topics covering the entire hydrogen value chain, including cross-cutting issues such as collaboration, sustainability, and legal aspects enabled targeted discussions among members.

The CSA played an instrumental role in facilitating the discussions within the TWG and supported the development of the IP with analysis reports distilling key aspects in R&I on hydrogen and providing comprehensive mappings of European initiatives, networks and platforms as well as scale-up enablers and challenges.

Promoting the topic of hydrogen within the SET Plan, members of the TWG participated in panel discussions at the ERA Forum in Brussels and the SET Plan conference in Budapest. As hydrogen is a cross-cutting topic, collaboration with other European hydrogen initiatives and working groups of the SET Plan was established. This collaboration includes contributions to workshops of the CETP and the ETIP Forum. In turn, CHJU and CETP presented their current developments at TWG meetings and initiated fruitful discussions to collaborate and join forces to advance the topic of hydrogen at European level. Within SET Plan the TWG contributed to the Cluster Workshop and nominated two delegates for the Cross-cutting Task Forces on Societal Needs and materials and Circularity.

4. Status of the implementation plan

The Implementation plan as a whole is still being coordinated among the members of the TWG and must be approved by the Steering Group. As the Implementation plan is not yet officially accepted, it is not publicly available yet.

A target for sustainability has been added since the Declaration of Intent was created. This is also supported by the TWG joining the Cross-cutting Task Force on Materials and Circularity.

5. Status of the activities on hydrogen

5.1 Planned activities under the draft implementation plan:

The TWG Hydrogen developed a series of activities addressing the entire value chain for hydrogen deployment and its role in the energy mix. The measures are intended to overcome the main challenges by identifying issues of European importance and implementing REPowerEU Hydrogen Accelerator goals. The selected assessment, collaboration, and knowledge transfer activities will focus on several directions. At present, five activities are to be included in the Implementation Plan. The primary areas of focus pertain to system integration, production, infrastructure, and cross-cutting domains:

1. Hydrogen valleys play an important role as pilot projects in developing a European hydrogen economy and decarbonising energy-intensive industries. While varying in size and scope, they bring together all the elements of renewable hydrogen production, storage and end-use into an integrated ecosystem aligned to local or regional requirements. H2-based local energy communities (H2LECs) are new players in the market and can provide efficient balancing of local energy production (incl. Prosumers) and consumption (e.g. residential buildings, SMEs, industries, public institutions) without large-distance transport of hydrogen. The activity will address the question of how smaller and fully integrated hydrogen-based systems could become a viable bottom-up pillar in the European energy and hydrogen supply system. Another question is how to successfully connect hydrogen valleys across Europe, thus increasing the regions where elements of a hydrogen economy are emerging.
2. The fast and efficient deployment of renewable and low-carbon hydrogen requires a comprehensive analysis and mapping of existing and potential hydrogen production capacities and demand sites in Europe. An EU-wide approach allows not only for the identification of hydrogen production capacities and locations in EU countries, but also for the development of support mechanisms for transporting hydrogen either produced in the EU or imported from other regions. Matching the order of merit for hydrogen supply and demand provides information to support the EU industrial policy on renewable hydrogen recommendations such as the calibration of market incentives, the prioritisation of scarce EU funding and the realistic update of the renewable hydrogen production and import targets set by the REPowerEU plan. In doing so, it should consider regional and sector-specific characteristics.
3. Next generation electrolysis solutions for the production of hydrogen based on AEM, PEM or SOEC concepts are pivotal for the sustainable transition towards a hydrogen economy. In providing space and resources for early-stage research, scientific and technological challenges in hydrogen production can be overcome through technological diversification. This will also contribute to strengthening the resilience of the European energy supply and economy. In addition, high temperature electrolysis using PCC and MCE, CFE, direct seawater electrolysis, carbon dioxide electrolysis as well as co-electrolysis are emerging technologies that can increase the production and deployment of hydrogen in the framework of a decarbonised economy.

However, further advances are necessary to improve their performance in terms of efficiency, durability and flexibility, while also reducing the use of Critical Raw Materials (CRMs) such as platinum group metals and the overall costs.

4. Per- and polyfluoroalkyl substances (PFAS) are a large and diverse group of substances, of which fluoropolymers and perfluoropolyethers in particular are of very wide relevance in the hydrogen sector for their use as highly specialised materials for membranes, sealing, coating and other balance-of-plant equipment. PFAS have raised health and environmental concerns, which are currently addressed by restriction and phase out proposals in the EU and beyond. Within this framework, it is crucial to investigate and develop novel, fluorine-free materials (e.g. hydrocarbon-based ionomers) with comparable properties and efficiencies, to be used as viable alternatives in the hydrogen industry.
5. Research into the recycling of hydrogen technologies at their End of Life is crucial for improving circularity, sustainability and resource efficiency in the hydrogen industry. Research activities should focus, among others, on the development of efficient and cost-effective methodologies for the recovery of raw materials from clean hydrogen technology components and systems; material recovery and disposal processes with minimized environmental impact; efficient and cost-effective technologies and processes for the disassembly, resource recovery from, and recycling of clean hydrogen technologies including the reuse of single components. In addition, the lesson learned within this research field would be very valuable in developing alternative materials, designs, manufacturing processes, and other aspects of clean hydrogen technologies.

5.2 Additional comments concerning the Hydrogen activities

The TWG is continuously developing its agenda on hydrogen and tailoring its activities accordingly. The activities selected for inclusion in the Implementation Plan at present do not encompass all aspects of the value chain. In order to enhance the European hydrogen landscape, a selection of topics was made, with the objective of ensuring that they were supported across a range of active SET Plan countries. Furthermore, it was imperative to avoid the duplication of themes that were already being covered by other European initiatives and other IWGS. Further activities are currently in development and will be fed into the process in due course.

6. Challenges

Hydrogen technologies are rapidly transitioning from research and demonstration toward full-scale deployment, yet they continue to face a range of systemic and structural barriers that demand coordinated, cross-sectoral responses. From a sector-wide perspective, the emergence of a clean hydrogen economy requires a comprehensive strategy that integrates technological maturity with regulatory clarity, robust financial instruments, and large-scale infrastructure development.

A key obstacle remains the high cost of hydrogen production - especially renewable hydrogen. Overcoming this challenge calls not only for the large-scale industrialisation of electrolyser manufacturing, but also for the development of cost-efficient transport and storage infrastructure, all underpinned by the achievement of economies of scale. These technological imperatives are further complicated by fragmented regulatory frameworks across EU Member States, which affect certification procedures, traceability, safety standards, and public acceptance.

At the TWG level, specific challenges include the absence of a fully institutionalised Implementation Working Group, limited coordination between existing R&I activities, and the need for legal clarity across the hydrogen value chain. While the TWG is well positioned to act as a coordination hub, bridging the gap between policy ambition and implementation will require sustained effort.

To succeed, the TWG must be more deeply embedded within the broader SET Plan architecture, supported by consistent EU and national-level funding, and empowered to foster harmonised standards. Strengthening dialogue with industry, academia, and civil society will also be essential to ensure that Europe’s hydrogen transition is not only technically sound but socially inclusive and economically resilient.

7. Investments

Achieving the objectives outlined in the draft Hydrogen Implementation Plan will demand significant and long-term investment across the value chain. According to recent estimates, meeting EU hydrogen goals will require over €300 billion in cumulative investment by 2050, with approximately €80–100 billion needed by 2030 to support electrolyser deployment, infrastructure, and end-use applications. Broadly, three tiers of investment are critical:

Short-Term (2025–2030):

Immediate funding is essential for demonstration projects, large-scale electrolyser deployment, and infrastructure pilots (transport corridors, storage hubs, refueling stations). These efforts are pivotal to meeting REPowerEU goals and require EU-level coordination and co-financing through mechanisms such as the Innovation Fund and the Clean Hydrogen Joint Undertaking.

Medium to Long-Term (2030–2050):

After 2030, investment must focus on scaling industrial capacity, establishing a pan-European hydrogen backbone, and embedding hydrogen within integrated, multi-vector energy systems. This phase will depend more heavily on private capital and de-risking instruments (e.g. Carbon Contracts for Difference).

Systemic Enablers:

Investment is also necessary in enabling domains such as workforce development (upskilling and reskilling), digitalisation (e.g. hydrogen data spaces), and circularity (including eco-design of hydrogen technologies). Standardisation efforts and regulatory frameworks must likewise be prioritised.

Key stakeholders include EU institutions, Member States, private investors, industrial alliances, and regional authorities. A coordinated investment strategy—blending public and private financing—is essential to building the robust hydrogen economy envisioned by the SET Plan.

8. Future plans

The prospects for hydrogen in the EU depend on the acceleration of the market uptake. Enhanced collaboration, clear regulatory frameworks and stable support mechanisms are necessary. The EU regulations as well as auctions of the European Hydrogen Bank and IPCEIs are supporting the integration of hydrogen into the energy mix. EU Member States will need to coordinate policy objectives and align their targets with the EU's overall goals, particularly with regard to the pace of production ramp-up by 2030. As production and demand for hydrogen vary across the Member States, coordinating the cross-border cooperation and allocating resources within the EU will be central to the success of decarbonisation.

In the coming year, the Hydrogen TWG will focus on completing, approving and putting into action its first full Implementation Plan, with strong attention to sustainability, cross-border cooperation, and alignment with key EU initiatives such as REPowerEU and the Net-Zero Industry Act. Knowledge gained from the analyses and reports of the supporting CSA SET4H2 will enable the group to initiate the implementation of the planned activities and measures. Key actions will include:

- Improving activity fiches, using input from CETP, ETIP Hydrogen, and national experts to ensure relevance and clarity.
- Strengthening collaboration with other IWGs to support shared infrastructure, logistics, and circularity efforts.
- Increasing visibility and participation, especially by reaching out to Member States not yet involved and connecting with new national hydrogen strategies. A useful tool will be surveys for prognostic analyses. The currently available data provides a good basis but has an inherent time lag.
- Contributing actively to the five new SET Plan task forces by offering insights on certification, training, and digital tools for hydrogen deployment.

The TWG will continue to take part in European and international events (such as ENLIT, EUSEW, and national hydrogen forums).

9. Synergies

Work undertaken in other working groups has relevance and can be significant for the advancement and the success of the implementation plan.

9.1 Cooperation with Implementation Working Groups

A cooperation has been established with the following groups or with which the TWG plans to cooperate in the future:

	Would like to cooperate in the future	Cooperation has been already established
Solar photovoltaics	✓	✓
Solar thermal technologies		
Wind energy	✓	✓
Geothermal energy	✓	
Ocean energy	✓	✓
Direct current technologies		
Positive energy districts		
Energy systems	✓	
Energy efficiency in buildings		
Sustainable and efficient energy use in industry	✓	
Batteries	✓	
Renewable fuels and bioenergy	✓	✓
CCS - CCU	✓	
Nuclear safety		

Table 1: Cooperation with Implementation Working Groups

9.2 Synergies with other working groups and stakeholders

Collaborating with existing SET Plan IWGs, allows the new H2 IWG to leverage existing frameworks, extend the reach and relevance of hydrogen solutions, and contribute more effectively to Europe's clean energy transition. Synergies are possible at different levels:

- Systemic Integration and Cross-Sector Innovation: Hydrogen serves as a cross-cutting vector for decarbonization, energy storage, and sector coupling. Collaborating with existing IWGs allows the H2 IWG to integrate hydrogen into diverse applications in sectors, e.g. industry, transport, power, and buildings — where applicable.
- Complementarity and Coherence: Many IWGs already engage with hydrogen-related technologies—e.g., PV, wind, CST, bioenergy, and CCUS—but often in fragmented ways. Collaboration ensures consistency, avoids duplication, and aligns efforts under a common strategic framework to accelerate hydrogen deployment and innovation.
- Infrastructure and Market Synergies: Coordination enables the co-development of shared infrastructures (e.g., hydrogen hubs, P-to-X systems), which are essential for cost-effective scaling. It also fosters the creation of unified markets and regulatory frameworks necessary for hydrogen uptake.
- Policy Alignment and Strategic Impact: Joint efforts help align national and EU strategies (e.g., Green Deal, Hydrogen Strategy, Net-Zero Industry Act) and demonstrate the systemic value of hydrogen within the EU's climate neutrality roadmap.
- Filling Gaps and Amplifying Impact: By linking with existing IWGs, the new H2 IWG can help address identified gaps—such as infrastructure, regulatory fragmentation, and lack of integrated R&I—by promoting shared innovation priorities, coordinated funding, and tailored implementation pathways.
- Building Resilience and Fairness: Synergies support a just and geographically balanced energy transition, especially for Member States with limited renewable resources, by enabling localized hydrogen solutions through sector integration.

9.3 Involvement in the task forces

The TWG Hydrogen is involved in two cross-cutting task forces of the SET Plan:

1. Materials and Circularity
2. R&I for societal needs

10. Additional aspects

The TWG Hydrogen within the SET Plan was established based on the ERA Pilot Agenda Process Green Hydrogen. The Strategic Research and Innovation Agenda formed the basis for the IP, with the group being supported by Member States that had already contributed actively. Although the bottom-up process was very successful, incorporating its main objectives into the SET Plan framework is proving to be a challenge.

Cross border collaboration involves not only European member states but also sectors, industry and research. A European Technology and Innovation Platform would provide industry insights and perspectives, as well as additional momentum, validation of results and financing in order to support the acceleration of the hydrogen ramp-up. Ideas such as kick-start funding establish an ETIP and support from other existing actors could be discussed.

Within the TWG the support of the technical subgroups could be optimised. One objective would be to ensure that technical support is fairly distributed across the groups.


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