



INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

IPHE Country Update March 2024: European Commission

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1. New Initiatives, Programs, and Policies on Hydrogen and Fuel Cells

The Hydrogen and gas markets decarbonisation package

Towards the end of 2023, the co-legislators reached a political agreement on the Hydrogen and Gas Markets Decarbonisation Package. Adoption in the European Parliament is expected in plenary on 10 or 11 April 2024. Once adopted in the Council, it is formally adopted and will enter into force soon thereafter.

The Package will provide the legal certainty and long-term visibility required for attracting much-needed investments into the hydrogen value chain. Its regulatory framework for the hydrogen system is based on proven regulatory principles applied to electricity and gas networks: non-discriminatory third-party access to transport infrastructure, regulated network tariffs, a structural separation of energy production from energy transport (unbundling).

To be in step with the gradual development of the hydrogen market, the Package adopts a two-phase approach consisting of a transitional phase, during which more flexibilities exist, and a final phase starting from 2033 onwards. To recognize hydrogen as an independent energy carrier, the Package also establishes a dedicated European association for hydrogen network operators (“ENNOH”). This entity will focus exclusively on the development of hydrogen networks thereby responding to the real needs of the hydrogen market.

FuelEU Maritime

Adoption on 25 July 2023 of the FuelEU maritime initiative – the new law to decarbonise the maritime sector.

The new regulation contains the following main provisions:

- Measures to ensure that the **greenhouse gas intensity** of fuels used by the shipping sector will gradually decrease over time, by **2% in 2025**, 6% from 2030, 14.5% from 2035, 31 % from 2040, 62% from 2045 and to 80% from 2050.
- A special incentive regime to support the uptake of the so-called **renewable fuels of non biological origin** (RFNBO) with a high decarbonisation potential.
- An exclusion of **fossil fuels** from the regulation’s certification process.
- An obligation for passenger ships and containers to use **on-shore power supply** for all electricity needs while moored at the quayside in major EU ports as of 2030, with a view to mitigating air pollution in ports, which are often close to densely populated areas.



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- A voluntary **pooling mechanism**, under which ships will be allowed to pool their compliance balance with one or more other ships, with the pool – as a whole - having to meet the greenhouse gas intensity limits on average.
- Time limited **exceptions** for the specific treatment of the outermost regions, small islands, and areas economically highly dependent on their **connectivity**.
- Revenues generated from the regulation's implementation ('**FuelEU penalties**') should be used for projects in support of the maritime sector's decarbonisation with an enhanced transparency mechanism.
- **Monitoring** of the regulation's implementation through the Commission's reporting and review process.

The new rules will apply from 1 January 2025, apart from articles 8 and 9 which will apply from 31 August 2024.

ReFuelEU Aviation

On 11 November 2023, the Regulation (EU) 2023/2405 of the European Parliament and of the Council on ensuring a level playing field for sustainable air transport (ReFuelEU Aviation) entered into force.

The regulation aims to increase both demand for and supply of **sustainable aviation fuels (SAF)**, while ensuring a level playing field across the EU air transport market. It is a major regulation that will put air transport on the trajectory of the EU's climate targets for 2030 and 2050, as SAF are one of the key short- and medium-term tools for decarbonising aviation. It should provide a way out of the situation which is hindering their development: low supply and prices that are still much higher than fossil fuels.

Key elements of the regulation include:

- The obligation for aviation fuel suppliers to ensure that all fuel made available to aircraft operators at EU airports contains **a minimum share of SAF from 2025** and, from 2030, **a minimum sub-share of synthetic aviation fuels**, with both shares increasing progressively until 2050.
- The establishment of a **transitional period** allowing fuel suppliers to reach the SAF blending mandate as a weighted average of the quantities they have supplied across the Union, in order to facilitate the organisation of the sector during its creation phase, without affecting the overall level of emissions.
- The obligation for aircraft operators to ensure that the yearly quantity of aviation fuel uplifted at a given EU airport is at least 90% of the yearly aviation fuel required, to avoid emissions related to extra weight caused by **tankering** practices.
- **Reporting** obligations for fuel suppliers, aircraft operators and Union airport managing bodies.

The first reporting year is 2025 (based on 2024 data) for all impacted stakeholders while the main obligations, (i) the supply mandate for SAF and (ii) the obligation to refuel at Union airports and (iii) the facilitation of access to SAF at Union airports, will start in 2025.

The Clean Hydrogen Alliance

The Clean Hydrogen Alliance has now more than 1800 members. One of the main milestones is the pipeline of investment projects to deploy hydrogen technologies which has just been updated end of February 2024.



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The Renewable and Low-Carbon Fuels Industrial Alliance

The Renewable and Low-Carbon Fuels Industrial Alliance is a key flanking measure to the FuelEU Maritime and RefuelEU Aviation initiatives. Since the launch the Alliance has developed and adopted the Work Plan, established 4 Roundtables (following an internal call for experts) which presented their deliverables at the second General Assembly in October 2023. The Alliance counts now **241 members**.

The Alliance project pipeline will be the flagship deliverable. Open call for projects is expected by end of February 2024 to make sure that the investment decisions can take place as soon as possible, since the EU has now implemented demand measures through the RefuelEU Aviation and FuelEU Maritime regulations. The RLCF Alliance is an open platform welcoming businesses from around the world who want to engage with EU fuels value chain. Up till now, 10 members of the Alliance have indicated USA as their country of headquarters, including GA Aviation, Royal Caribbean Group, Goldman Sachs, U.S. Grains Council to name a few.

AZEA – The Alliance for Zero-Emission Aviation

Launched in June 2022 the Alliance for Zero-Emission Aviation is a voluntary initiative of private and public partners who share the objective to prepare the aviation ecosystem to the entry into commercial service of hydrogen-powered and electric aircraft. These novel propulsion technologies will contribute to decarbonise intra-EU flights and enable new climate-friendly mobility offers.

Six Working Groups have been established early 2023 (Rollout scenarios for electric and hydrogen-powered aircraft and related “figures of reference”; Decarbonised electricity/hydrogen supply; Aerodromes; Aviation regulation, certification and standardisation; Integration of electric and hydrogen-powered aircraft into European network; Incentives). Three reports have already been issued: “Current Standardization Landscape”, “Aviation Regulatory landscape for hydrogen and electric aircraft” and “Concept of Operations”. The results of their work will make it possible to establish a roadmap for electric and hydrogen aviation at the end of 2024.

After this initial phase the Alliance will develop further actions that could include for instance:

- Raising awareness amongst airports about the impact of those new technologies on their future activities and the potential of role of Hydrogen Valleys may have (many airports, as part of their decarbonisation effort, are developing as clean energy hubs).
- Promotion of investment projects and facilitating access to finance.
- etc.

The Alliance brings together players from across the aeronautical industry and from the aviation community in the wider sense, such as energy producers (incl. for instance Air Liquide, Linde, Hydrogen Europe, etc), standardisation organisations, regulators, regions, and many other relevant players including NGOs and Trade-Unions. In the coming months, the Alliance intends to start an effort to progressively involve Member States more closely.

Hydrogen in the European Research Area (ERA)

The European Research Area policy agenda includes, for the period 2022-2024, action 11 – an ERA for green transformation, which calls for accelerating R&I and improving the



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collaboration between private and public R&I activities in the Member States towards early market deployment of clean technology solutions. Action 11 contains three sub-actions, of which action 11.1 (Pilot on green hydrogen) and action 11.2 (SET Plan revamp) are relevant for hydrogen.

Last October, the Commission adopted its Communication on the revision of the Strategic Energy Technologies (SET) Plan, which contributes to the EU's energy and climate goals through the coordination of national R&I activities to accelerate the deployment of clean technologies. Currently, we are implementing the updated governance model. In this framework, the Commission is supporting the creation of a Hydrogen Implementation Working Group to coordinate national Hydrogen policies, which should be established by the end of 2024. Last, the yearly SET Plan conference, hosted by the Hungarian presidency, will take place in Budapest on the 14th and 15th of November 2024.

2. Hydrogen and Fuel Cell R&D Update

[Launch of the 2023 Call for Proposals of Clean Hydrogen JU \(January 2023\)](#)

The Clean Hydrogen JU launched its 2023 [Call for Proposals](#) in March 2022.

The Call for Proposals has an indicative total budget of EUR 113.5 million, plus EUR 60 million from Horizon Europe, to be directed towards Hydrogen Valleys topics according to the REPowerEU Plan.

The Call addresses key challenges as identified by the stakeholders in the Clean Hydrogen JU. These challenges encompass different areas of research and innovation with direct and quantified impact towards the achievement of the objectives of the Clean Hydrogen JU in general and to each of the Pillars in particular.

A total of 20 topics are part of the Call for Proposals, including 5 for Renewable Hydrogen Production, 5 for Hydrogen Storage and distribution, 4 for transport and 2 for heat and power. In addition, 2 topics will support Cross-cutting issues. This call also includes 2 Hydrogen Valleys topics.

They are grouped into 11 Research and Innovation Actions (RIA), 8 Innovation Actions (IA), and 1 Coordination and Support Action (CSA). Two of the Innovation Actions, on Hydrogen Valleys, are considered of strategic importance and are selected as flagship projects.

Synergies with other European partnerships and programmes as well as with Member States and regional programmes are at the core of a number of topics.

[Results of Call for Proposals 2023 of Clean Hydrogen JU](#)

As a result of the Call for Proposals 2023 (deadline 18 April 2023), the Clean Hydrogen JU received 132 proposals and signed eventually 32 grant agreements¹. Overall, 28 countries are taking part in the projects. The Clean Hydrogen JU contribution will be € 198 mil.

These projects will significantly advance research on hydrogen technologies across the whole hydrogen value chain: from continuous support to very innovative European electrolysis technologies, large-scale demonstration of 1,000 tonnes underground hydrogen storage in depleted natural gas reservoirs, liquid hydrogen refuelling stations, multi-MW fuel cells for maritime applications or fuel cell-based systems for Non-Road Mobile Machinery, next generation of hydrogen turbines or retrofitting existing machinery in hard-to-abate industries, to the building of the European workforce with a Hydrogen Academy and preparing the next generation of products by addressing the strategic research challenges.

¹ For one of them the signing process is still on-going.



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As of January 2024, the Clean Hydrogen JU was managing 154 grants, 69 from Horizon 2020 (former Fuel Cells and Hydrogen 2 JU) and 85 from Horizon Europe under the new JU (with one more grant being under preparation).

An overview of the grants signed so far as part of Calls 2022-2023, as well as the topic budget for call 2024 per research pillar can be seen in the pie chart below. Already EUR 600 million have been committed, excluding the RePowerEU top-up.



3. Demonstration, Deployments, and Workforce Developments Update

FCH2RAIL: Fuel Cell Hybrid PowerPack for Rail Applications

Project FCH2RAIL², supported by the Clean Hydrogen Partnership, aims to develop, build, test, demonstrate and homologate a scalable, modular and multi-purpose Fuel Cell Hybrid PowerPack (FCHPP) applicable for different rail applications (multiple unit, mainline and shunting locomotives) also suitable to for retrofit existing electric and diesel trains, to reach TRL7.

At the heart of the project, there is a bi-mode hybrid powertrain system that combines the electrical power supply from the overhead line with an emission-free hybrid power pack. This power pack consists of fuel cells and batteries and operates independent of the overhead line. The basic idea is then that where energy is available from overhead lines, the train runs on it. Where there are no overhead lines, the energy comes from the fuel cells and battery system, the "Fuel Cell Hybrid PowerPack".

The testing phase in the Spanish tracks has started with the first test run on the Zaragoza-Canfranc line, in the Aragonese Pyrenees and it will continue on lines in Madrid and Galicia.

H2Ports: Public demo of H2PORTS project in Valencia

Project H2Ports³, supported by the Clean Hydrogen Partnership, aims to boost the transition of the European port industry towards an effective low-carbon/zero-emission and safe operative model, piloting, evaluating and demonstrating new Fuel Cell technologies oriented to increase energy efficiency, decarbonisation and safety of port terminals. The pilots to be tested in the project will be the first experiences of the use of hydrogen technologies in port handling equipment in Europe.

On the 28th of November 2023, the project organised a public demonstration of the three pilots developed within the framework of this project, the ReachStacker (container stacker), the 4x4

² https://www.clean-hydrogen.europa.eu/projects-dashboard/projects-repository/fch2rail_en

³ https://www.clean-hydrogen.europa.eu/projects-dashboard/projects-repository/h2ports_en



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tractor unit propelled by hydrogen and the mobile supply station for hydrogen.

The hydrogen ReachStacker and the hydrogen 4×4 terminal tractor are the world's first hydrogen-powered ReachStacker and 4×4 tractor unit to be tested in real operation at a port terminal and have been developed by Hyster and Atena respectively. The pilot tests are scheduled to run until December 2024, subjecting the machines to real operating conditions in a port terminal.

4. Events and Solicitations

Publications

Publication of the Programme Review Report for 2023⁴ (November 2023)

The Programme Review Report 2023 is looking at the activities and results of the Clean Hydrogen JU and how they align with the strategy and objectives set out in its founding Regulation and further elaborated in the Strategic Research and Innovation Agenda.

It covers 81 projects active between January 2022 - March 2023, assigned to seven thematic pillars: Hydrogen Production, Hydrogen Storage and Distribution, Hydrogen End Uses – Transport, Hydrogen End Uses – Clean Heat & Power, Cross-Cutting Issues, Hydrogen Valleys and Hydrogen Supply Chains.

The report highlights numerous achievements of these projects in all areas of the hydrogen value chain, addressing the importance to efficiently combine the output coming from intermittent renewable energy sources with the fluctuating demand.

Success Stories 2023⁵ (October 2023)

The Clean Hydrogen Partnership Success Stories publications for 2023 cover a wide variety of innovations and important breakthroughs, from larger MW-scale electrolyzers and advances in proton ceramic electrolyzers, faster hydrogen refuelling and standardisation of fuel cell components of heavy-duty transport or the usage of hydrogen fuelled vehicles in ports. They also focus on the skills for a European hydrogen industry and how hydrogen valleys are contributing to Europe's green hydrogen economy and energy security. These success stories highlight how the Clean Hydrogen Partnership's projects and initiatives are making hydrogen a reality in Europe!

Historical Analysis of Clean Hydrogen JU Fuel Cell Electric Vehicles, Buses and Refuelling Infrastructure Projects⁶ (March 2024)

The Historical Analysis of Clean Hydrogen JU Fuel Cell Electric Vehicles, Buses and Refuelling Infrastructure Projects covers demonstration activities conducted during the past two decades, aimed at promoting hydrogen mobility in Europe.

The demonstration projects focused on testing the capabilities of Fuel Cell Electric Vehicles (FCEVs), Fuel Cell Electric Buses (FCEBs), and associated Hydrogen Refuelling Stations

⁴ https://www.clean-hydrogen.europa.eu/media/news/programme-review-report-2023-available-now-2023-11-20_en

⁵ https://www.clean-hydrogen.europa.eu/media/publications/success-stories-2023_en

⁶ https://www.clean-hydrogen.europa.eu/media/news/hydrogen-mobility-projects-key-achievements-and-recommendations-2024-03-07_en



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(HRS) to replace conventional vehicles, with over 1300 FCEVs and more than 400 FCEBs deployed from 2005 to 2023.

The projects aimed to accelerate the adoption of fuel cell technology in the EU car and bus manufacturing industry, while also providing climate benefits. They not only demonstrated the operational benefits and technological readiness of hydrogen-powered transportation but also laid the groundwork for a pan-European hydrogen refuelling network.

The report delves into the strategic initiatives, and recent developments that have shaped the EU's approach to hydrogen as a pivotal component of its energy transition, particularly within the transport sector.

The conclusions highlight the pivotal role that the Clean Hydrogen JU and its predecessors played in advancing hydrogen mobility, while also addressing challenges and offering key recommendations to foster the growth of hydrogen mobility in Europe.

Challenges identified include: competition from battery electric alternatives, high hydrogen fuel costs and a fragile supply chain for components.

Key recommendations include: continued investments in research and innovation, to reduce costs and enhance the efficiency of fuel cell systems, as well as hydrogen production and refuelling infrastructure; enhanced financial support, such as subsidies or tax incentives specific to hydrogen mobility and continuous supply chain development.

Events & Initiatives

Technical Assistance to Generate Synergies with Members States and Regions

As part of its effort to generate synergies with Member States and Regions, the Clean Hydrogen Partnership launched a call for regional and national Managing Authorities from the EU-27 and Horizon Europe associated countries aiming to develop cooperation in relevant key areas for hydrogen development. As a result of the support, Managing Authorities can expect to strengthen cooperation with the JU in key areas regarding R&I and the exploitation of results, including: Technical Assistance, Knowledge Management and Funding and Financing, leading to the signature of Cooperation Agreements.

This initiative has been the latest in a series of valuable collaborations between the Clean Hydrogen Partnership and authorities at different territorial levels (regional/national) and presents an outstanding opportunity to work together to advance hydrogen on a regional/national level. In pursuing this initiative, the Clean Hydrogen Partnership has contracted a team composed of CIRCE, White Research and Q-Plan International.

The Call garnered great interest from a broad range of Managing Authorities spanning diverse geographies and Authority types, overall receiving 21 eligible applications from 15 different countries. From these 21, 10 Authorities were selected⁷ to receive the Technical Assistance from the Partnership, based on the objective merits of their Expression of Interest, the need to ensure wide geographic coverage of the initiative (at least half of the selected Managing Authorities must be from 5 different EU-13 countries) and selecting only 1 Managing Authority per country.

⁷ https://www.clean-hydrogen.europa.eu/media/news/evaluation-results-call-expression-interest-receiving-technical-assistance-generate-synergies-clean-2023-10-04_en



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Moreover, as part of the tender for Technical Assistance to Generate Synergies with Members States and Regions, an assessment was made of the various policy and funding initiatives in the hydrogen field across 32 European countries⁸.

The resulting report covers national and regional/local hydrogen (H₂) strategies of the EU-27, as well as of the HE associated countries with representatives in the Clean Hydrogen Joint Undertaking State Representatives Group (SRG), namely Norway, Iceland, Turkey, Israel and Georgia.

Launching event of the European Hydrogen Academy⁹ (17 January 2024)

The European Hydrogen Academy, funded under the Clean Hydrogen JU call for proposals 2023, kicked off in January 2024. Funded with an EU contribution of almost EUR 3 million (+2 million from the partners), it brings together 17 members from different EU countries, as well as Switzerland and the UK. It will focus on formal education, in line with the Net Zero Industry academies framework and complementing the vocational, Erasmus+-funded project GreenSkills4H₂. Lasting for 54 months, it will have the goal to create networks of 100 universities and 500 schools offering recognised qualifications and adapting their curricula to hydrogen technologies. It will develop university-type courses, retraining and reskilling, and focus on 200 occupational projects.

5. Investments: Government and Collaborative Hydrogen and Fuel Cell Funding

Innovation Fund

On 23 November 2023, the European Commission launched the Innovation Fund 2023 Call with a total budget of €4 billion available for innovative low-carbon technologies in various sectors. Project promoters may apply for grants under five topics with distinct budget and capital expenditure (CAPEX) requirements:

- **General decarbonisation (large-scale)** - €1.7 billion available for projects with CAPEX above €100 million
- **General decarbonisation (medium-scale)** - €500 million available for projects with CAPEX between €20 million and €100 million
- **General decarbonisation (small-scale)** - €200 million available for projects with CAPEX between €2.5 million and €20 million
- **Cleantech manufacturing** - €1.4 billion available for projects with CAPEX above €2.5 million focusing on the manufacturing of components for renewable energy, energy storage, heat pumps and hydrogen production
- **Pilot** - €200 million available for projects with CAPEX above €2.5 million focusing on deep decarbonisation.

Projects will be assessed based on their potential to reduce greenhouse gas emissions, their degree of innovation, maturity, replicability and cost efficiency. The deadline is 9 April 2024.

⁸ https://www.clean-hydrogen.europa.eu/media/news/generate-synergies-member-states-and-regions-assessment-hydrogen-policies-and-funding-strategies-2023-11-30_en

⁹ <https://cordis.europa.eu/project/id/101137988>



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The European Hydrogen Bank

The European Hydrogen Bank provides support to move the hydrogen economy from niche to scale and contribute to ambitions to produce 10 million tonnes (Mt) renewable hydrogen in the EU and import another 10 Mt to the EU by 2030.

The objective of this facility is to cover the cost gap between renewable and fossil hydrogen in the absence of a sufficient green market premium, whilst leveraging a maximum amount of private financing into subsidized projects.

Alongside reducing the cost gap, the bank will contribute to early market formation by providing price/cost discovery through competitive auctions.

The domestic side of the bank will be implemented through auctions under the Innovation Fund.

The 1st pilot auction for renewable hydrogen production in Europe, has attracted 132 bids from projects located in 17 European countries.

The total support requested far exceeds the currently available budget of €800 million.

All bids taken together provide for a total planned electrolyser capacity of 8.5 gigawatts (GWe). Over the span of ten years, this would lead to a total production volume of 8.8 million tonnes of renewable hydrogen. On a yearly basis, this would cover close to 10% of the EU's REPowerEU ambition for domestic renewable hydrogen production in 2030.

Producers of renewable hydrogen have made their bids to receive support in the form of a fixed premium per kilogram of renewable hydrogen produced. This premium bridges the gap between the cost of production and the price buyers are currently willing to pay for renewable hydrogen rather than fossil hydrogen. The Commission is also offering a new "Auctions-as-a-service" mechanism to enable Member States to benefit from the EU-level platform and award national funding to additional projects, in full respect of State aid rules. Germany is the first EU country to make use of the "Auctions-as-a-service" feature, putting up €350 million from its national budget for renewable hydrogen production projects located in Germany in case eligible bids for German projects cannot receive Innovation Fund support due to budget limitations.

The second auction with a much larger financing of €2.2bn is announced for the end of 2024.

Important Projects of Common European Interest (IPCEI) on Hydrogen

The first 2 Hydrogen IPCEIs: Hy2Tech and Hy2Use are up and running. The General Assemblies and the first IPCEI Conference took place on 5-6 December 2023 in Berlin. It was the moment to take stock of projects implementation and to assess developments.

The Commission has approved, under EU State aid rules, a third Important Project of Common European Interest ('IPCEI') to support hydrogen infrastructure. This IPCEI is expected to boost the supply of renewable hydrogen, thereby reducing dependency on natural gas and helping to achieve the objectives of the [European Green Deal](#) and the [REPowerEU Plan](#).

The project, called "**IPCEI Hy2Infra**", was jointly prepared and notified by seven Member States: France, Germany, Italy, the Netherlands, Poland, Portugal, and Slovakia.

The Member States will provide up to **€6.9 billion in public funding**, which is expected to unlock €5.4 billion in private investments. As part of this IPCEI, 32 companies with activities in one or more Member States, including small and medium-sized enterprises ('SMEs'), will participate in 33 projects.

IPCEI Hy2Infra will cover a wide part of the hydrogen value chain by supporting:



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- i. the deployment of 3.2 GW of **large-scale electrolysers** to produce renewable hydrogen;
- ii. the deployment of new and repurposed **hydrogen transmission and distribution pipelines** of approximately 2,700 km;
- iii. the development of large-scale **hydrogen storage facilities** with capacity of at least 370 GWh; and
- iv. the construction of **handling terminals** and related port infrastructure for **liquid organic hydrogen carriers** ('LOHC') to handle 6,000 tonnes of hydrogen a year.

Participants will also collaborate on **interoperability and common standards** to prevent barriers and facilitate future market integration. The IPCEI will support the gradual emergence of an EU-wide hydrogen infrastructure starting from different regional clusters.

Several projects are expected to be implemented in the near future, with various large-scale electrolysers expected to be operational between 2026 and 2028, and pipelines between 2027 and 2029 depending on the geographic area. The overall completion of projects is planned for 2029, with timelines varying depending on projects and companies.



Additional IPCEIs in the pipeline

- **4th Hydrogen IPCEI – Hy2Move**
 - Focus: hydrogen use in the mobility and transport sectors
 - State of play: under assessment (Q2 2024)

Other State Aid instruments – Projects under Climate, Environmental protection and Energy Aid Guidelines (CEEAG).

For stand-alone or dedicated infrastructure projects, environmental protection projects, there are other more suitable and streamlined State aid compatibility rules, such as the CEEAG.

Few projects are now supported under this scheme, the majority addressing the decarbonisation of the steel sector.



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6. Regulations, Codes & Standards, and Safety Update

The Joint Research Centre of the European Commission and the Clean Hydrogen Partnership published a report on: **EU harmonised testing protocols for high-temperature steam electrolysis**¹⁰. It proposes testing protocols for assessing the performance and durability of high-temperature steam electrolysis stacks and systems using electricity from variable renewable energy sources. The focus is on solid oxide steam electrolysis (SOEL) and proton-conducting ceramic steam electrolysis (PCCEL). The harmonised test methods and protocols are based on the outcomes of European pre-normative research and on standards of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). The protocols are intended to be used by the research community and industry alike, for example, to evaluate research and development progress, set research and innovation priorities including cost targets and technological benchmarks as well as making informed decisions regarding technology selection in power-to-hydrogen and hydrogen-to-industry (H2I) applications.

A second report is under public consultation and will be finalised early in 2024: **EU harmonised accelerated stress testing protocols for low-temperature water electrolyser**¹¹. This document proposes accelerated stress testing protocols for assessing the performance degradation of low-temperature water electrolyser stacks, for alkaline, anion exchange membrane and proton exchange membrane water electrolysis.

The Clean Hydrogen JU set up in 2022 a Regulations, Codes and Standards Strategy Coordination (RSC SC) Task Force, composed of representatives of the European Commission, Hydrogen Europe and Hydrogen Europe Research secretariats, and the JU Programme Office.

The main goal of the RCS SC Task Force is the definition, coordination and monitoring of the strategy related to RCS within the Programme with the ultimate goal of increasing the EU impact in RCS development in Europe and beyond, with the focus but not limited to Standards.

Over the last period, the RCS SC Task Force held regular meetings in view of reaching a common agreement on the practical work of the Task Force bearing in mind its role, priorities, and tasks entrusted to the Task Force (JU SRIA, Section 4.3). As a result, the focus of RCS Task Force activities is twofold:

- (i) Coordination for the identification of PNR needs of strategic importance in Europe that can be addressed as topics in the subsequent JU calls for proposals
- (ii) Design and deploy a batch of measures to increase the impact of the RCS/PNR-related activities at the programme and the project level in standardisation.

Concerning the identification of PNR needs, Task Force members started to review relevant reports where different organisations flagged the gap/need for PNR activities relevant to hydrogen and fuel cell technologies in the EU. These include the reports¹²¹³ published by the CEN-CENELEC Sector Fora on Energy Management Working Group on Hydrogen (SFEM WG H2)¹⁴, or the “Roadmap on Hydrogen Standardisation”¹⁵ published by the European Clean

¹⁰ <https://publications.jrc.ec.europa.eu/repository/handle/JRC129387>

¹¹ https://www.clean-hydrogen.europa.eu/media/news/public-consultation-jrcs-technical-report-eu-harmonised-accelerated-stress-testing-protocols-low-2024-02-05_en

¹² <https://op.europa.eu/en/publication-detail/-/publication/99f62cea-a877-11e5-b528-01aa75ed71a1>

¹³ <https://publications.jrc.ec.europa.eu/repository/handle/JRC129387>

¹⁴ <https://www.cenelec.eu/areas-of-work/cenelec-sectors/energy-and-utilities-cenelec/hydrogen/>

¹⁵ <https://ec.europa.eu/docsroom/documents/53721>



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Hydrogen Alliance (ECH2A)¹⁶, to name but a few. The RCS SC Task Force will conclude the review in 2024 aiming at identifying out of all the PNR needs, what priorities can be addressed within the JU Programme in the next years.

On the other hand, the Task Force assessed a set of potential measures to increase the impact of the JU projects in the relevant RCS. As a result of this work, the Task Force endorsed a few measures that have been included in the AWP 2025. For example, projects performing PNR activities have an additional information obligation to report up to 4 years after the end of the project if the results of the project have effectively contributed to European or international standards, and projects resulting from Innovation Actions should consider a public report with both the Legal and Administrative Processes (LAP) and the Regulations, Codes, and Standards relevant to the technologies and/or applications at the project scope, and the barriers and/or gaps identified during the project implementation alongside any other relevant information to share the lessons learned and provide recommendations to support the update and/or development of suitable and enabling legal and regulatory frameworks.

On safety, the European Hydrogen Safety Panel (EHSP) initiative¹⁷ was launched by the JU in 2017. The mission of the EHSP is to assist the JU both at programme and at the project level in assuring that hydrogen safety is adequately managed, and to promote and disseminate hydrogen safety culture within and outside of the JU Programme.

The EHSP is composed of a multidisciplinary pool of experts grouped in ad-hoc working groups (task forces) according to the tasks to be performed and to expertise. Collectively, the members of the EHSP have the necessary scientific competencies and expertise covering the technical domain needed to make science-based recommendations to the Clean Hydrogen JU.

Over 2023, in view of the increased support expected from the EHSP in the Clean Hydrogen JU Programme, as anticipated in the AWP 2023, the Clean Hydrogen JU worked to conclude a service framework contract for the provision of support for coordinating and managing the EHSP, strengthening its coordination, activities, and impact. To this end, the JU published a call for tenders¹⁸ in August 2023 and after receipt of tenders, proceeded with the opening and evaluation. The award and signature of the framework contract are expected in 2024.

¹⁶ https://single-market-economy.ec.europa.eu/industry/strategy/industrial-alliances/european-clean-hydrogen-alliance_en

¹⁷ <https://www.clean-hydrogen.europa.eu/get-involved/european-hydrogen-safety-panel-0>

¹⁸ <https://etendering.ted.europa.eu/cft/cft-display.html?cftId=14149>



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Summary Country Update March 2024: European Commission¹⁹

| Transportation | Target Number | Current Status | Partnerships, Strategic Approach | Policy Support ²⁰ |
|-------------------------------|---------------|---|---|------------------------------|
| Fuel Cell light duty Vehicles | No target | Total size of fleet in EU27 for passenger cars (M1) and vans (N1) is 4309. | To a large degree addressed through Clean Hydrogen JU Demo projects | |
| FC Bus | No target | Total size of fleet in EU27 for buses and coaches (M2 & M3) is 206. | Mostly addressed through Clean Hydrogen JU Demo projects | |
| Fuel Cell Trucks | No target | Total size of fleet in EU27 for Trucks (N2 & N3) is 55. | Mostly addressed through Clean Hydrogen JU Demo projects | |
| Forklifts | No target | To the JU knowledge, 335 units have been deployed in Europe (of which 273 via Clean Hydrogen JU). | Mostly addressed through Clean Hydrogen JU Demo projects | |

¹⁹ Source for all data: Data are mainly coming from the European Hydrogen Observatory, unless they do not exist there, in which case the ones of the Clean Hydrogen JU funded projects are mentioned (clarified in the fourth column). Most of the data collected in the first half of 2023 concern the status by the end of 2022, although some updated data for 2023 are included (when possible). Please note that unless noted otherwise, the data from the European Hydrogen Observatory are reported only for EU27 – and they are not limited to the ones of the Clean Hydrogen JU projects-, while the ones of the Clean Hydrogen JU cover also UK, EFTA, etc.

²⁰ In terms of all related projects funded by the Clean Hydrogen JU, the support was given in the form of a grant. Other types of support could also have been provided, but at EU level these concerned mostly EU funding from different instruments.



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| Aviation & Maritime | No target | Based on the JU knowledge of R&I projects deploying vessels, 13 vessels have been implemented. Also 1 pilot aircraft was implemented and tested, funded by the JU. | Partly through Clean Hydrogen JU Demo projects. As of today marginal activity. | |
|-----------------------------------|---------------|---|--|---|
| H ₂ Refueling Stations | Target Number | Current Status | Partnerships, Strategic Approach | Policy Support |
| 70 MPa On-Site Production | No target | <p>By the end of 2022, in EU27 there were a total of 178 HRS²¹ with public access, of which:</p> <ul style="list-style-type: none"> - 109 operating only at 700 bar for cars - 18 operating only at 350 bar, 15 of which only for cars and 3 only for buses - 51 operating at dual 350 and 700 bar (serving either cars or buses) | Addressed through CEF and Clean Hydrogen JU Demo projects | |
| 70 MPa Delivered | No target | | Addressed through CEF and Clean Hydrogen JU Demo projects | |
| 35 MPa On-Site Production | No target | | Addressed through CEF and Clean Hydrogen JU Demo projects | |
| 35 MPa Delivered | No target | | There is no information on private HRS. | Addressed through CEF and Clean Hydrogen JU Demo projects |

²¹ Data in the Observatory are currently validated, there may be slight differences in the reported numbers.



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| Stationary ²² | Target Number ²³ | Current Status | Partnerships, Strategic Approach | Policy Support |
|-----------------------------|-----------------------------|--|--|--|
| Small ²⁴ | No target | 4,161 contracted via Clean Hydrogen JU of which 2,978 deployed | Medium-scale deployment through Clean Hydrogen JU demo project | Grant with maximum contribution from Clean Hydrogen JU |
| Medium ²⁵ | No target | 74 contracted of which 36 deployed | Small-scale demo projects via Clean Hydrogen JU | Grant with maximum contribution from Clean Hydrogen JU |
| Large ²⁶ | No target | 2 deployed of which one deployed (in China) and 1 planned | Small-scale demo projects via Clean Hydrogen JU | Grant with maximum contribution from Clean Hydrogen JU |
| District Grid ²⁷ | No target | | | |
| Regional Grid ²⁸ | No target | | | |
| Telecom backup | No target | 10 deployed via Clean Hydrogen JU, of which 9 medium and 1 small | Small-scale demo projects via Clean Hydrogen JU | Grant with maximum contribution from Clean Hydrogen JU |
| H ₂ Production | Target ²⁹ | Current Status | Partnerships, Strategic Approach | Policy Support |

²² At the moment no such data are available on the Observatory, so only Clean Hydrogen JU projects are reported.

²³ Targets can be units installed and/or total installed capacity in the size range indicated

²⁴ <5 kW (e.g., Residential Use), excl. telecom backup

²⁵ 5kW – 400 kW (e.g., Distributed Residential Use), excl. telecom backup

²⁶ 0.3MW – 10 MW (e.g., Industrial Use)

²⁷ 1MW – 30 MW (e.g., Grid Stability, Ancillary Services)

²⁸ 30MW plus (e.g., Grid Storage and Systems Management)

²⁹ Target can be by quantity (Nm³, kg, t) and by percentage of total production; also, reference to efficiency capabilities can be a target



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| | | | | |
|---|--|--|--|-----------------------|
| Fossil Fuels ³⁰ | No target | Produced 9.3 Mt of hydrogen in 2023 | | |
| Water Electrolysis ³¹ (PEM, Alkaline, SOEC) | Renewable hydrogen: 6 GW by 2024, 40 GW by 2030 (EU Hydrogen Strategy ³²) | Produced 23 kt of hydrogen in 2023. This corresponds to 174.28 MW of water electrolysis capacity. A further 46 projects are under construction and are expected to deliver an additional 1,199.07 MW of water electrolysis capacity once operational by 2025. | | |
| By-product H ₂ | No target | Produced 900 kt of hydrogen in 2023 | | |
| Energy Storage from Renewables | Target³³ | Current Status | Partnership, Strategic Approach | Policy Support |

³⁰ Hydrogen produced by reforming processes

³¹ Please indicate if targets relate to a specific technology (PEM, Alkaline, SOEC)

³² <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0301&from=EN>

³³ Can be expressed in MW of Installed Capacity to use the electricity from renewable energy generation, and Annual MWh of stored energy capacity



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| | | | | |
|--|-----------|---|--------------------------------|--|
| Power to Power ³⁴ Capacity | No target | | | |
| Power to Gas ³⁵ Capacity | No target | 40 Clean Hydrogen JU (Research & Demonstration) projects contribute directly or indirectly in the PtG concept with € 140.5 Million funding. | Projects via Clean Hydrogen JU | Grant with maximum contribution from Clean Hydrogen JU |

³⁴ Operator has an obligation to return the electricity stored through the use of hydrogen back to electricity

³⁵ Operator has the opportunity to provide the stored energy in the form of hydrogen back to the energy system through multiple channels (e.g., merchant product, enriched natural gas, synthetic methane for transportation, heating, electricity)