



# INTERNATIONAL PARTNERSHIP FOR HYDROGEN AND FUEL CELLS IN THE ECONOMY

## IPHE Country Update December 2021: European Commission

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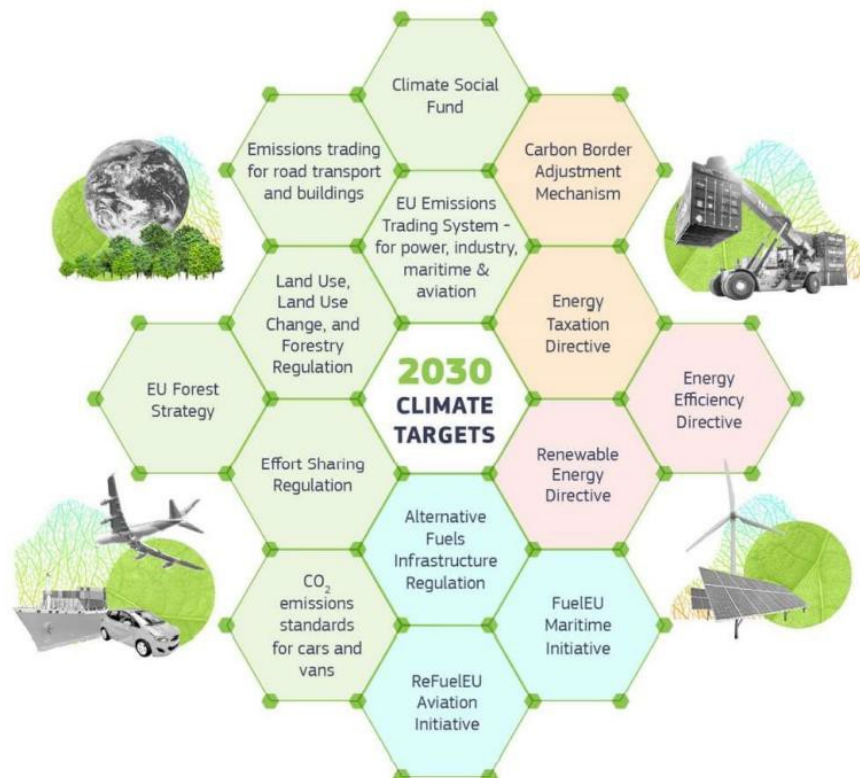
### 1. New Initiatives, Programs, and Policies on Hydrogen and Fuel Cells

The Clean Hydrogen Joint Undertaking should be adopted on 19 November 2021. The EU will support the Partnership with €1 billion euro for the period 2021-2027, complemented by at least an equivalent amount of private investment (from the private members of the partnership), raising the total funding to above €2 billion euro.

#### The 'fit for 55' Climate and Energy Package

The Commission adopted on 14<sup>th</sup> July a new package to align the energy and climate regulatory framework with the higher level of ambition to reduce greenhouse gas (GHG) emissions by 2030 relative to 1990 levels (by at least 55% rather than 40%). This is in line with the Paris Agreement, the European Green Deal and the European Climate Law's objective of making the EU the first climate-neutral continent by 2050.

This new climate and energy package is a set of inter-connected proposals, which all aim to ensure a fair, competitive and green transition of the EU economy to 2030 and beyond. Overall, the package strengthens eight existing pieces of legislation and presents five new initiatives, across a range of policy areas and economic sectors: climate, energy and fuels, transport, buildings, land use and forestry. In addition, there are three energy proposals planned still to be adopted mid-December 2021, which will cover energy performance of buildings, methane and decarbonisation of gas and hydrogen markets.





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Hydrogen features prominently in the following proposed legislations:

### **Revision of the Renewable Energy Directive (RED II)**

The main objective is to increase the EU's renewables target from the current 32% to 38-40%, in line with the 2030 Climate Target Plan. The proposal could lay down measures to increase the share of renewables in all sectors of the economy (heating and cooling, transports, but also industry) and strengthen the sustainability criteria for biomass use.

- Specific sub-targets for the consumption of renewable H<sub>2</sub> for hard-to-decarbonise applications in:
  - Industry Sector: 50% by 2030
  - Transport Sector: 2.6% by 2030
- Changes the framework for accounting renewable hydrogen towards the national contribution by Member State
- Extends the certification framework to all renewable fuels, including renewable hydrogen

### **Revised Alternative Fuels Infrastructure Regulation (AFIR)**

The aim of this revision is to ensure that sufficient interoperable recharging and refuelling infrastructure will be in place throughout the EU and ensure that infrastructure investments indeed go hand in hand with the required vehicle uptake to reach our ambitious emission targets, first by 2030 and then towards 2050. The specific objectives are: (i) ensuring minimum infrastructure to support the required uptake of alternative fuel vehicles across all transport modes and in all Member States to meet the EU's climate objectives; (ii) ensuring the infrastructure's full interoperability; and (iii) ensuring full user information and adequate payment options.

The proposal will include more binding targets for infrastructure rollout, including for hydrogen refuelling infrastructure along the TEN-T core network and urban nodes in support of the ambition set by the Green Deal and Sustainable and Smart Mobility Strategy,

- to have at least 1,000 hydrogen stations by 2030 and half of them by 2025.
- It will also mandate technical specifications for hydrogen refuelling infrastructure.

### **EU Emission Trading Scheme**

Strengthening of existing ETS with an increase of 18% of emission reduction (from - 43% to - 61% by 2030)

- Inclusion of all hydrogen production facilities (>2t/day).
- Remove free allowances for aviation.
- Will now include maritime transport.
- New EU ETS extension for road transport and buildings, operational as of 2025.

### **Set of Policy measures on transport**

#### ➤ **TEN-T Regulation**

The overarching goal of the revision of the TEN-T regulation is to contribute to the European **Green Deal** objectives and the realisation of the **Sustainable and Smart Mobility Strategy** (SSMS).

In the context of **alternative fuels**, the revised TEN-T regulation will make a close link with the revised Directives on the deployment of alternative fuels infrastructure, on intelligent transport systems by including specific standards into the TEN-T.

- The Commission's public consultation on the revised guidelines closed on 5 May 2021. On 26 May 2021, the Commission published the results of its evaluation of the Regulation. It has also confirmed that it plans to put forward the revised regulation in



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December 2021, together with the revised Directive on Intelligent Transport Systems.

### ➤ **FuelEU Maritime**

A legislative proposal to increase the deployment and use of renewable low-carbon fuels in the maritime sector. Targets are expressed in terms of greenhouse gas intensity of the energy used on board (GHG per MJ). A maximum **limit on the greenhouse gas content of energy used by ships** calling at European ports will be set (cruise ships, containerships and ro-pax).

### ➤ **ReFuelEU Aviation**

A legislative proposal to boost significantly the uptake of sustainable aviation fuels (SAF) and maintain a level playing field among market players in the EU aviation internal market. SAF means advanced biofuels and synthetic fuels. Synthetic fuels would be subject to a specific sub-mandate, a priori starting in 2030. Hydrogen is a key “ingredient” to produce synthetic fuels, and therefore the aviation sector will rely on hydrogen already in the short term.

### ***Set of Policy measures on taxation and trade***

#### ➤ **Revision of the Energy Taxation Directive:**

Shifting tax incentives away from fossil fuels and towards clean technologies.

#### ➤ **New Carbon Border Adjustment Mechanism:**

Carbon price on imports of a targeted selection of products to prevent ‘carbon leakage’.

And finally, an important piece of legislation in preparation,

### **The Hydrogen and gas markets decarbonisation package**

The main aims of the Hydrogen and Gas Market Decarbonisation Package are:

- Facilitating the integration of renewable and low-carbon gases in the existing gas grid. This concerns biomethane injected at distribution level, gas quality in the existing networks, access of renewable gases to LNG terminals.
- Enabling the development of dedicated hydrogen infrastructure and market, allowing hydrogen to become a key component of the energy sector.
- Fostering more integrated network planning between electricity, gas and hydrogen networks.
- Promoting consumer engagement in the RES and low-carbon gas markets.
- Will include terminology and certification of low-carbon hydrogen.

The adoption and publication of this package planned for mid-December this year.

### **The Clean Hydrogen Alliance**

Set up in July 2020, the European Clean Hydrogen Alliance is part of EU efforts to ensure industrial leadership and accelerate the decarbonisation of industry in line with its climate change objectives. The European Clean Hydrogen Alliance supports the large-scale deployment of clean hydrogen technologies by 2030 by bringing together renewable and low-carbon hydrogen production, demand in industry, mobility and other sectors, and hydrogen transmission and distribution. It aims to promote investments and stimulate the rollout of clean hydrogen production and use.

The Clean Hydrogen Alliance has now more than 1500 members. The Commission collected back in May 2021 more than 1000 projects from alliance members. The alliance is currently preparing a pipeline of investment projects to deploy hydrogen technologies, which will be presented at the European Hydrogen Forum on 30 November 2021.



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## 2. Hydrogen and Fuel Cell R&D Update

### [Inauguration of Europe's largest PEM electrolysis plant in REFHYNE project](#)

As part of the REFHYNE European consortium and with EU funding through the Fuel Cells and Hydrogen Joint Undertaking (FCH JU), the fully operational plant is the first to use this technology at such a large scale in a refinery. The Rhineland 20 MW electrolyser will use renewable electricity to produce up to 1,300 tonnes of green hydrogen a year. This will initially be used to produce fuels with lower carbon intensity. In the future, green hydrogen could also be used for industry, to heat homes and to power trucks. ([Read More](#))

### [Navigating the complex requirements in the use of hydrogen for maritime applications](#)

MARANDA, [FLAGSHIPS](#), [ShipFC](#), [HyShip](#) and [HEAVENN](#) are five demonstration projects supported by FCH JU that develop, integrate and trial the use of fuel cells [Proton-exchange Membrane Fuel Cell (PEM) or Solid Oxide Fuel Cell (SOFC)] using ammonia or hydrogen on-board various maritime and fluvial vessels.

These five projects share common topics, such as **hydrogen safety, vessel permit implementation, infrastructure** and **standards for zero emission fuels bunkering**. In addition, project [e-SHYIPS](#) is a Pre-Normative Research project, investigating experimental data on ship design, safety systems, material and components and bunkering procedures for hydrogen.

The projects have collaborated as well with [HySafe](#) and CEN/CENELEC Working Group on Hydrogen for maritime to support the development of an appropriate Pre-Normative Research (PNR).

### [Project Development Assistance for cities and regions: summary report](#)

The report contains summaries of the project plans and work undertaken in each of the selected regions, the activities delivered as part of the observer network, and the next steps after the end of the PDA support period.

The pilot PDA for Hydrogen in regions sets the path for further such initiatives, possibly targeting regions which are not yet involved in the development of hydrogen projects and which could make use of the encompassing advantages of hydrogen as a green energy carrier to ensure local, sustainable and integrated energy solutions. ([Read More](#))

### [PRETZEL – Game-changing high pressure PEM electrolyser](#)

PRETZEL was launched in 2018 to develop an innovative polymer electrolyte membrane electrolyser (PEMEL) that provides significant improvements in efficiency and operability hydrogen pressure, to further reach the emerging market requirements.

Reaching its final stages, the project has reported encouraging achievements:

- Developed a 25kW PEM electrolyser system based on a hydraulic cell concept capable of reaching an unprecedented cell efficiency of 77%. The patented innovative cell concept reached 100 bar pressure, allowing operations up to 6A cm<sup>-2</sup> at 90°C
- Increased the durability of the cell components. The hydraulic medium compressing everywhere with constant force is additionally cooling the cell from outside, thus preventing the overheating of cell elements
- Reduced the capital cost of stack components by using low-cost coatings

Apart the impressive results, PRETZEL project will have managed to consolidate R&D cooperation relations among consortium partners from different EU states: Germany, France, Spain, Greece and Romania.



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### SWITCH – Developing a novel system prototype based on solid oxide cell technology

SWITCH project succeeded in demonstrating the production of green hydrogen using a reversible solid-oxide electrolyser that is also capable of trigeneration (heat, electricity and hydrogen) when utilising natural gas.

The first part of the project focused on improving the Large Stack Module (LSM) – the core of the system where the electrochemical reaction occurs. Building on the LSM concept previously developed by another FCH JU-funded project - CH2P, SWITCH project consortium managed to engineer and validate the LSM for full reversible operation – to produce hydrogen when fed with electricity and steam. The module has successfully demonstrated the production of 53kg of green hydrogen/day and has been tested already for more than 2100 hours.

With such encouraging results, the project is planning to install and demonstrate a system with an operating time estimated to more than 5000 h and capable of producing 100 kg of hydrogen per day – double than the production capacity initially foreseen. The system will be installed in a hydrogen refuelling station (HRS) in the Shell Technology Centre in Amsterdam.

The overall cost objectives aim at €2.83/kg H<sub>2</sub> (@€40/MWhel) and €4.32/kg (@€80/MWhel) with an assumed methane cost of 3.5 cts/kWh.

### 3. Demonstration, Deployments, and Workforce Developments Update

- To date, **1390<sup>1</sup>** FCEVs have been contracted through FCH JU, out of which **895** are currently deployed and **495** planned or in development phase (mainly via [H2ME](#), [H2ME2](#) projects and [ZEFER](#) project).
- **119** FC buses have been deployed to date through FCH JU and **247** are planned or in development phase. A total of 315 buses have been deployed or planned to be deployed through the [JIVE](#) and [JIVE 2](#) projects (including all buses currently under development).
- **159** HRS are deployed in Europe, out of which **72** deployed via FCH JU (mainly via [H2ME](#) and [H2ME2](#) projects). A chart displaying key data on the number and type of hydrogen refuelling stations deployed in Europe, including location and capacity can be found [here](#) or [here](#).
- **4357** μCHPs contracted via FCH JU, out of which **2880** already deployed (mainly via [PACE](#) and [EneField](#) projects – around 95% of total FCH JU μCHPs).

### 4. Events and Solicitations

#### COP26 (01/11/2021)

The COP26 UN **climate conference** took place between 1 and 12 November 2021 at the Scottish Event Campus (SEC) in Glasgow. **It was an opportunity** for Hydrogen Europe to launch a **special report on hydrogen** developed together with REVOLVE. The report is a comprehensive document, which aims to highlight how **hydrogen is a key piece of the climate neutrality jigsaw** as it's a viable solution to many of the world's climate neutrality objectives: it unleashes the potential of renewables, ensures energy system efficiency, and enables a carbon-neutral industry and transport system. Many of these aspects are explained and showcased in the report, such as:

- myth busters
- facts & figures
- case studies from industry
- market developments
- policy developments
- as well as a section "beyond Europe"

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<sup>1</sup> Latest status 25/10/2021, including non-commercial vehicles



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### **Zero Emission Bus Conference 2021 (17/11/2021)**

The Paris Zero Emission Bus Conference follows the successful 2nd edition held in Cologne, Germany, in November 2018. Over 360 global stakeholders representing 220 organisations will attend the event. Expert speakers will debate routes to commercialisation and will discuss technological readiness of the two zero emission options: battery and fuel cell buses. ZEB 2021 will call on European manufacturers, policy makers and operators to scale up their zero emission ambitions to become global leaders in. ([Read more](#))

### **Africa Green Hydrogen Virtual Forum (22/11/2021)**

Africa's pursuit of clean energy solutions in the transition to a low-carbon future, as well as continent-wide targets to address energy poverty, accelerate economic growth, and ensure a consistent energy supply for years to come, have created fundamental opportunities for green hydrogen developments. There are over 600 million people in Africa without access to electricity, and only 17% of the population in sub-Saharan Africa has access to clean cooking.

Yet, the continent holds sizeable renewable energy resources that could address these issues. By leveraging these resources in the production of green hydrogen, Africa could significantly enhance energy access, security, and supply. Africa has seen vast amounts of progress in green hydrogen developments across the region with countries such as South Africa, Niger, Mali and Namibia redirecting its focus on the utilisation of renewable energies through green hydrogen. ([Read more](#))

### **European Hydrogen Week (29/11/2021)**

To match the unprecedented interest in hydrogen technologies, FCH JU will dedicate an entire week of events - from 29 November to 3 December 2021 - to the essential role of hydrogen in meeting the 2050 climate neutrality goal of the European Green Deal and boosting the economic recovery.

The series of events taking place during the week include the European Hydrogen Forum, the meeting of the Clean Hydrogen Alliance, the FCH JU Programme Review Days and the FCH JU Awards (now at the fourth edition). The European Hydrogen Forum, which takes place on 29 November, will mark the launch of the Clean Hydrogen Partnership – as the successor of the Fuel Cells and Hydrogen Undertaking.

The event will bring together key policy-makers, industry representatives, civil society organisations and the research community to discuss the breakthroughs and opportunities of green hydrogen technologies in achieving climate neutrality while creating jobs and growth. We expect more than 5000 participants online - from Europe and beyond. ([Read more](#))

### **Hydrogen Economy Europe (02/12/2021)**

Hydrogen is transforming the global energy landscape and no more so than in Europe. Last year, the European Commission placed hydrogen at the forefront of Europe's green recovery, with an ambitious plan of achieving 6 GW of renewable hydrogen by 2024, and 40 GW by 2030.

However, the roadmap is unclear. The cost of hydrogen remains high, the business case has not been defined, and the infrastructure requirements are colossal. To build the hydrogen economy in Europe, investments of up to €470 billion will be needed in the next 30 years. Will Europe's hydrogen bet pay off?

The inaugural Reuters Events: Hydrogen Economy Europe will address these challenges head-on, gathering industry leaders across the public and private sector. Covering policy & regulation, scaling up production, infrastructure, and end-use sectors, attendees will leave with both the critical information and partnerships they need for expansion in Europe. ([Read more](#))



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

The 2020 (first) yearly Innovation Fund's (funded with allowances from the EU's Emission Trading System) calls for large- and small-scale projects, worth EUR 1 billion and EUR 100 million respectively, were closed in Q2 and Q1-2021.

In the large-scale Call, 292 proposals were deemed admissible and 70 (worth about EUR 6.7 bn of request for support and potential to avoid 402 MtCO<sub>2e</sub> over 10 years) were actually invited for the second stage of the selection process. Hydrogen related projects account for over ¼ of these 70 proposals. Different paths for green H<sub>2</sub> production account for about 40% of these H<sub>2</sub> projects; blue H<sub>2</sub> share is about 25% of the green H<sub>2</sub> projects share; CCU (combining it with H<sub>2</sub> for Methanol & Ethanol) projects are about the double of the blue H<sub>2</sub>; and projects exclusively dedicated to H<sub>2</sub> usage account for close to 1/3 of the H<sub>2</sub> projects. On the other hand, it was also announced that 4 large hydrogen projects (out of 15) will receive Project Development Assistance to advance their maturity – in Spain (2), Denmark & Norway and Portugal. The Project Development Assistance will be provided via the European Investment Bank.

In the small-scale call (CAPEX below EUR 7.5 mn), 232 proposals were received of which yet again over ¼ are hydrogen related. Overall, 32 projects for a total budget of grants worth EUR 108 million were approved, out of which 4 hydrogen projects in Spain (2), Italy and Poland. Another project in France, in the glass/ceramics industry, although not focused on it is also compatible with hydrogen.

The next call for large projects under the Innovation Fund is already open (launched on 26/10/2021) and its budget will increase from EUR 1 billion to EUR 1.5 billion. For small-scale projects the following call is expected for March 2022, with an indicative budget of EUR 100 million, i.e., similar to the first call.

### 6. Regulations, Codes & Standards, and Safety Update

Overall, the FCH 2 JU activities on Regulation, codes and Standards (RCS) are the following:

- Research grants, mostly on Pre-Normative Research activities. Over the last period, 10 PNR projects have been ongoing (see below the project list and details).
- The activities performed by the '[Regulations, Codes and Standards Strategy Coordination \(RCS SC\) Group](#)', a working group composed of industry and research centres around these topics. The RCS SC Group has contributed to better coordination concerning RCS issues in the FCH 2 JU Programme, including the identification of RCS priorities for the FCH2 JU Annual Work Plans and proposals for standardization for the Annual Union Work Plan (AUWP) on Standardization of the Commission. Nevertheless, this group hasn't had much activity over the last period.
- [Cooperation with JRC](#), which includes activities of diverse nature around this topic, e.g. harmonization of testing protocols. Over 2021, several technical reports have been published: (i) [Historical Analysis of FCH 2 JU Stationary Fuel Cell Projects](#), (ii) [Historical Analysis of FCH 2 JU Electrolyser Projects](#), and (iii) [EU harmonised terminology for hydrogen generated by electrolysis](#).
- Cooperation with CEN-CENELEC SFEM WG H2 to outline roadmaps about the needs on standardization, challenges, etc. The outcomes of the SFEM WG H2 were published in 2016 in a [report](#) that provides inputs about the needs regarding (i) pre-normative research and (ii) standardization for further development at European level. An [updated report](#) was released in 2018. The FCH 2 JU continues to cooperate with SFEM WG H2, in particular with the Task Force set up on Industrial Needs Hydrogen Quality.
- [FCH Observatory module on Policy and RCS](#), provides users with a comprehensive overview of the most relevant policies, rules and standards that directly or indirectly affect the development and deployment of the hydrogen technologies covered by the



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FCHO. This section of the portal is updated on an annual basis and in July 2021 a new set of [reports](#) has been released.

Regarding the projects, the JU addresses RCS mainly through Pre-Normative Research (PNR) grants, as PNR is an essential step for advancing standards and in the last instance the regulations and codes that refer to those standards. Over the last period, 10 PNR projects are ongoing:

- [HYDRAITE](#): PNR focused on hydrogen quality and quality assurance, the project aims to provide inputs to ISO 14687.
- [PRESLHY](#): PNR for safe use of liquid hydrogen. As a result of the first results of this project, an ISO/PWI 24077: “Safe Use of LH2 in Non-Industrial Settings” has been established.
- [HYTUNNELS-CS](#) : PNR for safety of hydrogen driven vehicles and transport through tunnels and similar confined spaces. The project targets UN GTR #13 “Global technical regulation on hydrogen and fuel cell vehicles” and standards of ISO/TC 197 “Hydrogen Technologies” and CEN/CLC/JTC6 “Hydrogen in Energy Systems”.
- [THYGA](#): PNR on the impact of blends of natural gas and hydrogen on end use applications in the domestic and commercial sectors. The project targets many different standards and committees.
- [HIGGS](#): PNR covering the gaps of knowledge of the impact that high levels of hydrogen could have on the high pressure gas infrastructure, its components and its management.
- [PRHYDE](#): PNR centred in developing refuelling protocols for heavy-duty hydrogen vehicles, on-road and off-road (rail, maritime).
- [ID-Fast](#): PNR on degradation mechanisms and definition of Accelerated Stress Testing (AST) protocols for PEM fuel cells.
- [AD-ASTRA](#): PNR on degradation mechanisms and definition of Accelerated Stress Testing (AST) protocols for SO cells.
- [e-SHYIPS](#): PNR on hydrogen-based fuels solutions for passenger ships.
- [MultHyFuel](#): PNR on H2 refuelling stations in multifunctional contexts (multiple fuels).

On safety, the FCH 2 JU launched the [European Hydrogen Safety Panel \(EHSP\)](#) in 2017. The mission of the EHSP is to assist the FCH 2 JU Programme and projects in assuring that hydrogen safety is adequately managed and to promote and disseminate a high-level hydrogen safety culture within the FCH 2 JU Programme and beyond. Over the last period, the EHSP has published two new reports.

- A new guidance document for the [Safety Planning and Management in EU hydrogen and fuel cell projects](#). Building on the first safety planning guidance document published in 2019, the new document provides further information on safety planning, monitoring, and reporting for hydrogen and fuel cell projects in Europe. It helps EU projects to incorporate state-of-the-art hydrogen safety by integrating safety learnings, expertise and planning.

An analysis of safety data and events contained in the European Hydrogen Incidents and Accidents Database (HIAD 2.0). The number of events within HIAD 2.0 has been increasing from about 250 events in 2018 to almost 500 events in 2020. The EHSP, in close collaboration with the Joint Research Centre (JRC) of the European Commission, has published the lessons learned from their in-depth assessment in a [report](#), which includes recommendations stemmed from those lessons for different sectors and applications involving hydrogen.





## Summary Country Update December 2021: European Commission

Transportation	Target Number	Current Status <sup>2</sup>	Partnerships, Strategic Approach	Policy Support
Fuel Cell light duty Vehicles <sup>3</sup>	No target	To date, 1390 FCEVs have been contracted through FCH JU, out of which 895 are currently deployed and 495 planned or in development phase.	Addressed through FCH 2 JU Demo projects	Subsidy per vehicle in demo projects
FC Bus	No target	- 132 buses deployed in Europe through FCH JU (of which 13 discontinued) - 247 more buses planned or developed through FCH JU	Addressed through FCH 2 JU Demo projects	Subsidy per vehicle in demo projects
Fuel Cell Trucks <sup>4</sup>	No target	-15 garbage trucks contracted through FCH JU ( <a href="#">REVIVE</a> ) -16 trucks contracted through FCH JU ( <a href="#">H2Haul</a> )	Addressed through FCH 2 JU Demo projects. As of today marginal activity, however upcoming projects will demonstrate a fleet within the next years	Subsidy per vehicle in demo projects
Forklifts	No target	- 335 deployed in Europe (of which 273 via FCH JU)	Addressed through FCH 2 JU Demo projects	Subsidy per vehicle in demo projects

<sup>2</sup> Data covering both FCH JU and FCH 2 JU (for simplicity referred to just as FCH JU)

<sup>3</sup> Includes Fuel Cell Electric Vehicles with Range Extenders

<sup>4</sup> As above



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Aviation & Maritime	No target	- 4 fuel cell vessels planned - 1 pilot aircraft planned	Addressed through FCH 2 JU Demo projects. As of today marginal activity.	Subsidy per vehicle in demo projects
H <sub>2</sub> Refueling Stations	Target Number	Current Status	Partnerships, Strategic Approach	Policy Support
70 MPa On-Site Production	No target	-155 HRSs deployed for road transport (buses, cars, trucks MHVs) and another 75 planned or under construction.	Addressed through FCH 2 JU Demo projects	Fixed amount of subsidy per HRS installation
70 MPa Delivered	No target	From the above, 72 HRS have been deployed via FCH JU out of which: <ul style="list-style-type: none"> <li>• 10 x 350 delivered H2</li> <li>• 7 x 350 onsite production</li> <li>• 2 x 350 unspecified</li> </ul>	Addressed through FCH 2 JU Demo projects	Fixed amount of subsidy per HRS installation
35 MPa On-Site Production	No target	<ul style="list-style-type: none"> <li>• 4 x 700 delivered H2</li> <li>• 2 x 700 onsite production</li> <li>• 28 x 350/700 delivered H2</li> <li>• 11 x 350/700 onsite prod.</li> <li>• 3 (others) trucked-in</li> <li>• 1 (others) onsite production</li> </ul>	Addressed through FCH 2 JU Demo projects	Fixed amount of subsidy per HRS installation
35 MPa Delivered	No target	<ul style="list-style-type: none"> <li>• 4 have been decommissioned</li> </ul> - 36 additional HRSs contracted via FCH JU	Addressed through FCH 2 JU Demo projects	Fixed amount of subsidy per HRS installation



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Stationary	Target Number <sup>5</sup>	Current Status	Partnerships, Strategic Approach	Policy Support
Small <sup>6</sup>	No target	Ca 4267 planned via FCH JU of which 2829 deployed	Medium-scale deployment through FCH 2 JU demo project	Fixed amount of subsidy per unit
Medium <sup>7</sup>	No target	74 planned of which 36 deployed	Small-scale demo projects via FCH 2 JU	Funding dependent on power level
Large <sup>8</sup>	No target	2 deployed of which one deployed (in China) and 1 planned	Small-scale demo projects via FCH 2 JU	Funding dependent on power level
District Grid <sup>9</sup>	No target			
Regional Grid <sup>10</sup>	No target			
Telecom backup	No target	10 deployed via FCH JU, of which 9 medium and 1 small	Small-scale demo projects via FCH 2 JU	Funding dependent on power level
H <sub>2</sub> Production	Target <sup>11</sup>	Current Status	Partnerships, Strategic Approach	Policy Support

<sup>5</sup> Targets can be units installed and/or total installed capacity in the size range indicated

<sup>6</sup> <5 kW (e.g., Residential Use), excl. telecom backup

<sup>7</sup> 5kW – 400 kW (e.g., Distributed Residential Use), excl. telecom backup

<sup>8</sup> 0.3MW – 10 MW (e.g., Industrial Use)

<sup>9</sup> 1MW – 30 MW (e.g., Grid Stability, Ancillary Services)

<sup>10</sup> 30MW plus (e.g., Grid Storage and Systems Management)

<sup>11</sup> Target can be by quantity (Nm<sup>3</sup>, kg, t) and by percentage of total production; also, reference to efficiency capabilities can be a target



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Fossil Fuels <sup>12</sup>	No target	Out of scope of the FCH 2 JU		
Water Electrolysis <sup>13</sup> (PEM, Alkaline, SOEC)	No target	16.8 MW of electrolysers deployed in Europe through FCH JU (of which 13 discontinued) and another 53.8 MW planned		
By-product H <sub>2</sub>	No target			
<b>Energy Storage from Renewables</b>	<b>Target<sup>14</sup></b>	<b>Current Status</b>	<b>Partnership, Strategic Approach</b>	<b>Policy Support</b>
Power to Power <sup>15</sup> Capacity	No target			
Power to Gas <sup>16</sup> Capacity	No target	40 FCH JU (Research & Demonstration) projects contribute directly or indirectly in the PtG concept with 140.5m€ funding.		

<sup>12</sup> Hydrogen produced by reforming processes

<sup>13</sup> Please indicate if targets relate to a specific technology (PEM, Alkaline, SOEC)

<sup>14</sup> Can be expressed in MW of Installed Capacity to use the electricity from renewable energy generation, and Annual MWh of stored energy capacity

<sup>15</sup> Operator has an obligation to return the electricity stored through the use of hydrogen back to electricity

<sup>16</sup> 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)