

CLEAN HYDROGEN PARTNERSHIP

ELVHYS project
International Stakeholders' Seminar
30 September 2024 – 01 October 2024

Alberto J. Garcia Hombrados

Project Officer - Clean Hydrogen Joint Undertaking



European context: policies, strategies, funding, initiatives



European context: policies, strategies, funding Policy Frameworks and Financial Mechanisms

The EU is supporting hydrogen through many policies and funding

Policy

The EU's policy framework for renewable hydrogen value chain development consists of a multi-layered regulatory framework that addresses the **specific role renewable hydrogen can play in the EU's wider energy system**.

Overarching Strategic Vision

Policy Framework

Legislation

Funding and Initiatives

To green existing hydrogen value chains and develop new ones, **announced projects must move towards FID** (incl. production, transport, distribution and end-use projects). Public funding instruments and initiatives can contribute to achieving business cases and work as a lever to attract private capital investments.

Financial Instruments

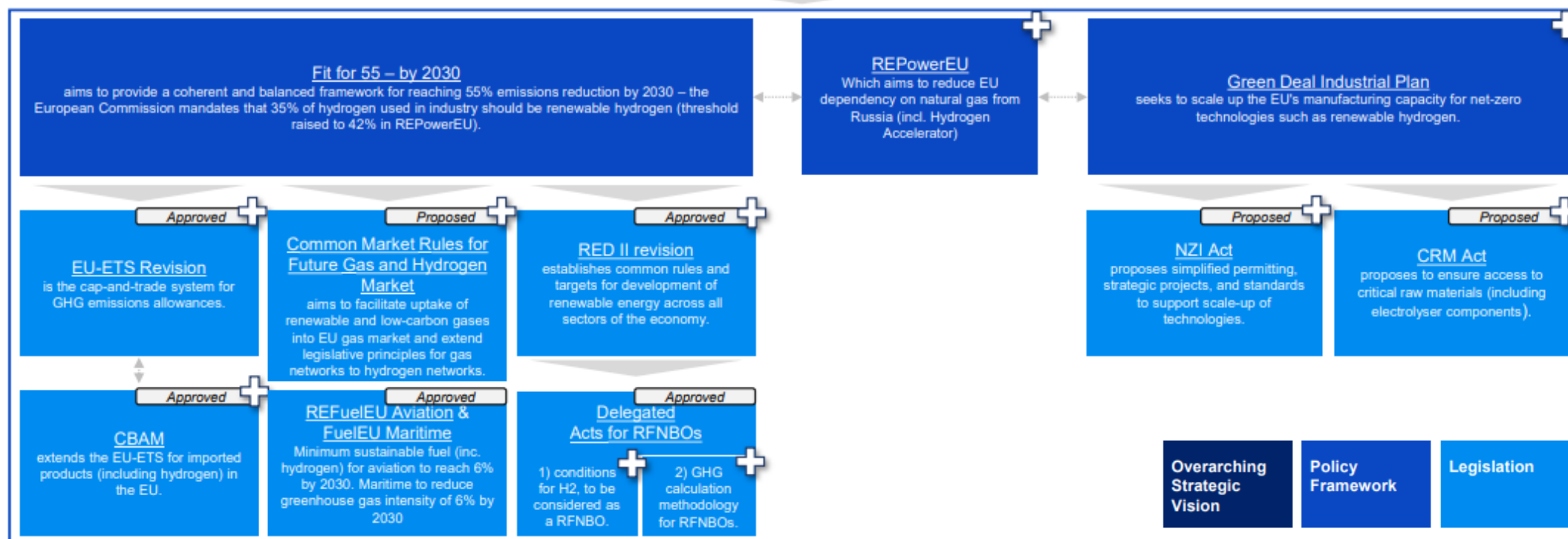
Public-Private Partnerships

European context: policies, strategies, funding

Policies supporting the EU Renewable Hydrogen Market (Non-Exhaustive)

The European Green Deal – by 2050
Aims to set the EU on the path to a green transition, with goal of reaching climate neutrality by 2050

The European hydrogen Strategy – by 2050
roadmap for the establishment and scale up of value chains based on the production of “green” hydrogen







European context: policies, strategies, funding


Funding and Initiatives supporting the EU Renewable Hydrogen Market (Non-Exhaustive)



European context: policies, strategies, funding EU funding programmes (2021 – 2027)

EU funding programmes for the hydrogen sector (2021-2027)

-  Equity
-  Loan
-  Advisory
-  Grants

PROOF OF CONCEPT	PILOT	DEMO	SCALE UP	ROLL OUT
Horizon Europe <ul style="list-style-type: none"> - European Research Council & European Innovation Council - Green Deal Call - Pillar II: Digital and Industry; Climate Energy and Mobility - EIT: InnoEnergy, Climate KIC, KIC Raw Materials - Breakthrough Energy Ventures Europe 				
		ETS Innovation Fund <ul style="list-style-type: none"> - Domestic leg of Hydrogen Bank - General decarbonization (CCS/CCU, renewables, EII) - Industry electrification & hydrogen - Clean tech manufacturing - Mid-sized pilots 		
	Connect Europe Facility <ul style="list-style-type: none"> - Energy and transport Infrastructure 			
		Invest EU + LIFE programme		
ERDF & Cohesion Funds: a greener, carbon free Europe				
Just Transition Fund				
	IPCEI			

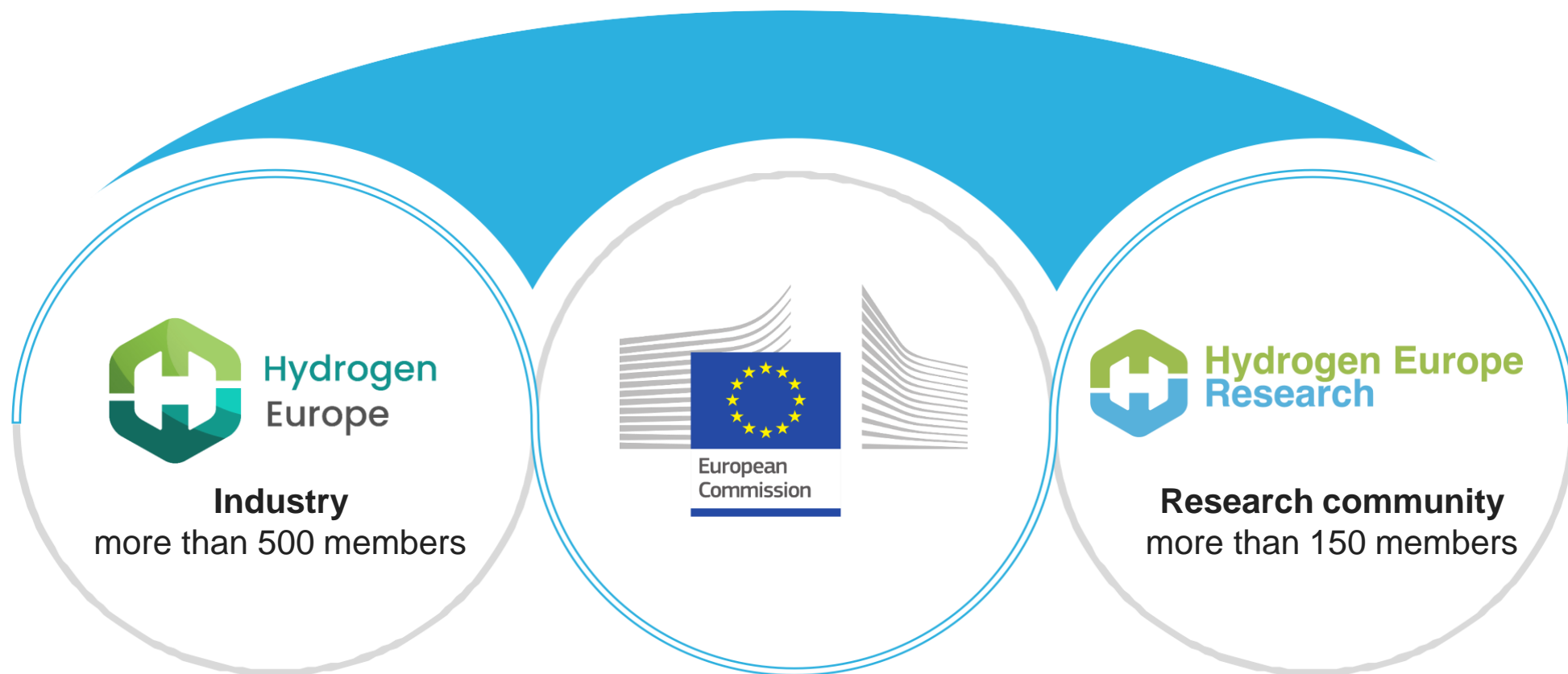
Source: Hydrogen Europe.

Clean Hydrogen Partnership: Overview



Clean Hydrogen Partnership Introduction

EU Institutional Public-Private Partnership (IPPP)



1 billion EURO from Horizon Europe* to implement R&I activities and facilitate the transition to a greener EU society through the development of hydrogen technologies

*** additional 200 million EURO for Hydrogen valleys (under REPowerEU)**

Clean Hydrogen Partnership Objectives

General



Support the implementation of the Commission's **Hydrogen Strategy**



Stimulate **research and innovation on clean hydrogen** production, distribution, storage and end use applications



Strengthen the **competitiveness of the EU clean hydrogen value chain**



Contribute to the EU ambitious **2030 and 2050 climate ambition incl Green Deal**

Specific



Improve the **cost-effectiveness, efficiency, reliability**, quantity and quality of clean hydrogen solutions across **entire value chain**



Strengthen the **knowledge/capacity of scientific and industrial actors** along the Union's hydrogen value chain while supporting the **uptake of skills**



Demonstrations of clean hydrogen solutions with a view to **local, regional and Union-wide deployment**, aiming to involve stakeholders in all Member States and across **entire value chain**

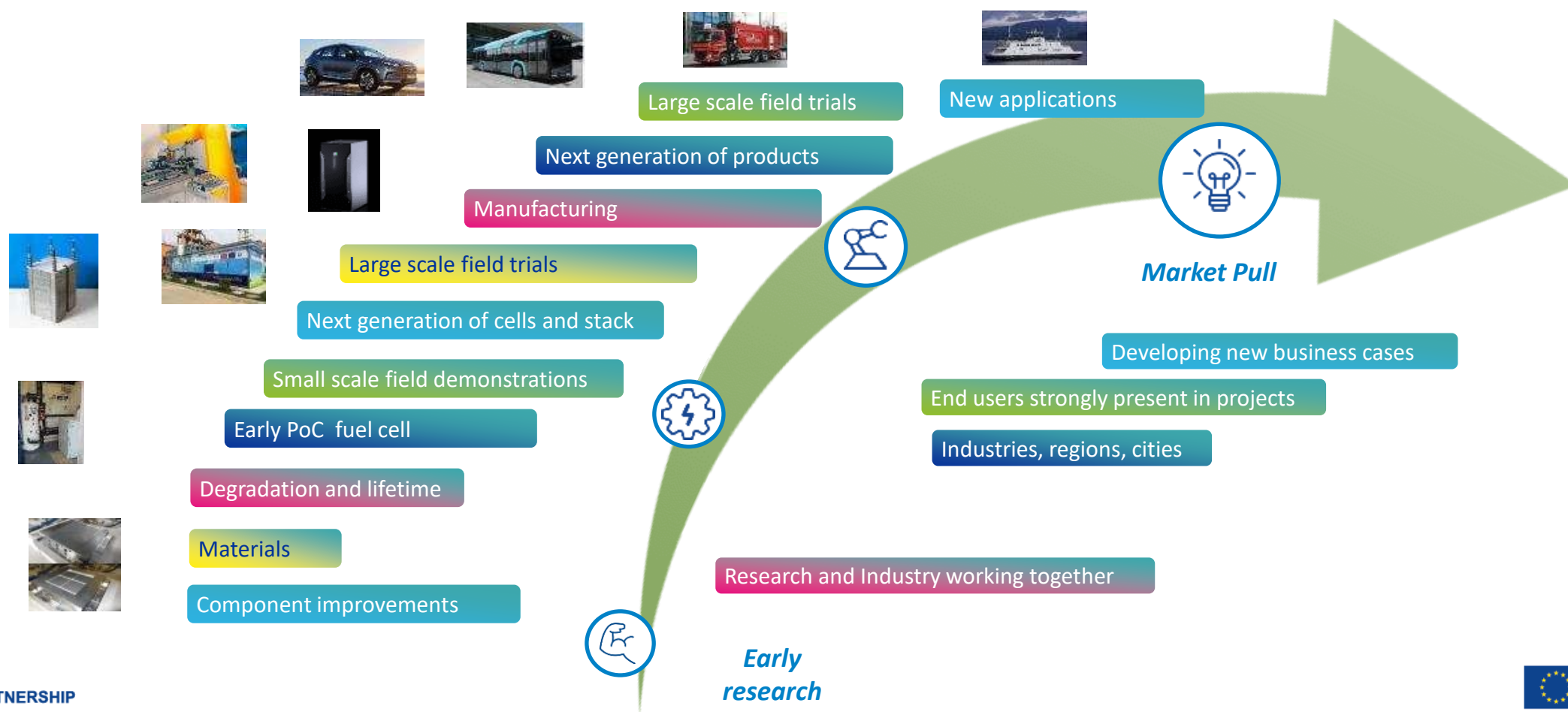


Increase **public and private awareness, acceptance** and uptake of clean hydrogen solutions



Supporting clean hydrogen R&D across the whole value chain

- Universal successor of the Fuel Cells and Hydrogen 2 Joint Undertaking (FCH 2 JU) and has taken over its legacy portfolio
- From research to delivering hydrogen solutions in the market, from individual applications to H2 Valleys



Clean Hydrogen Partnership Strategic Research and Innovation Agenda (SRIA) 2021-2027

- Strategic document identifying key **priorities** and the essential **technologies and innovations** required to achieve the objectives of the JU

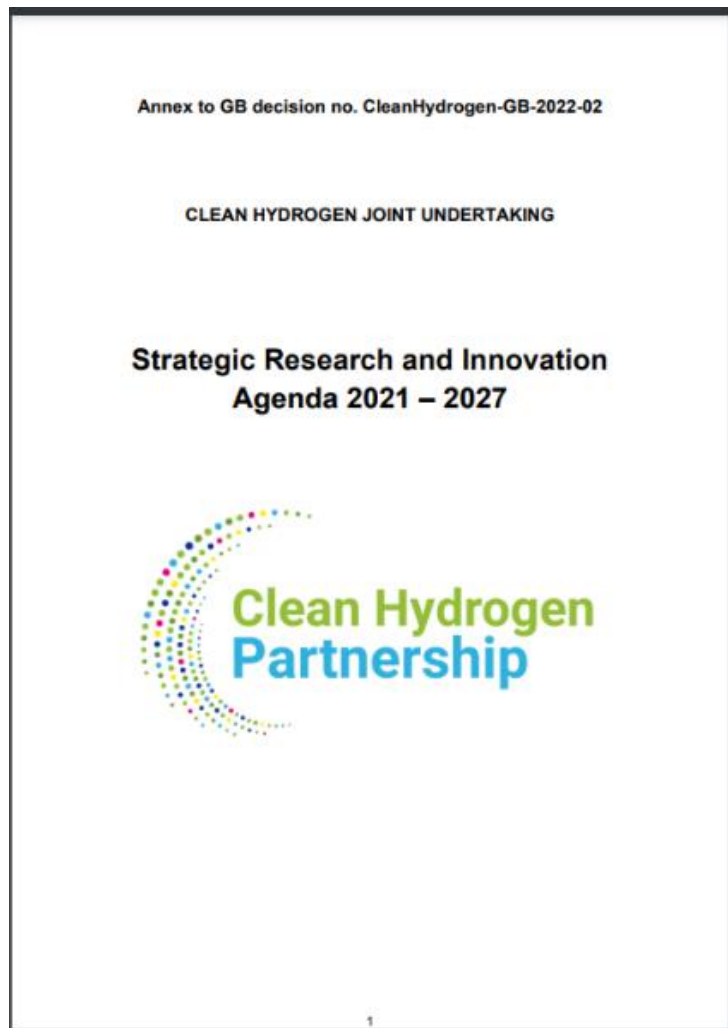
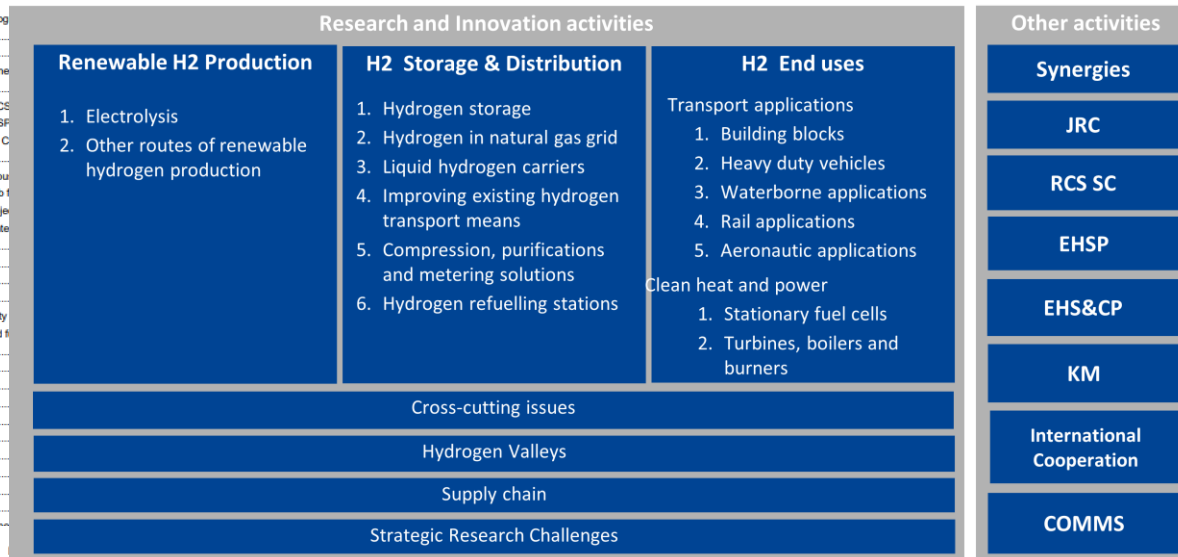
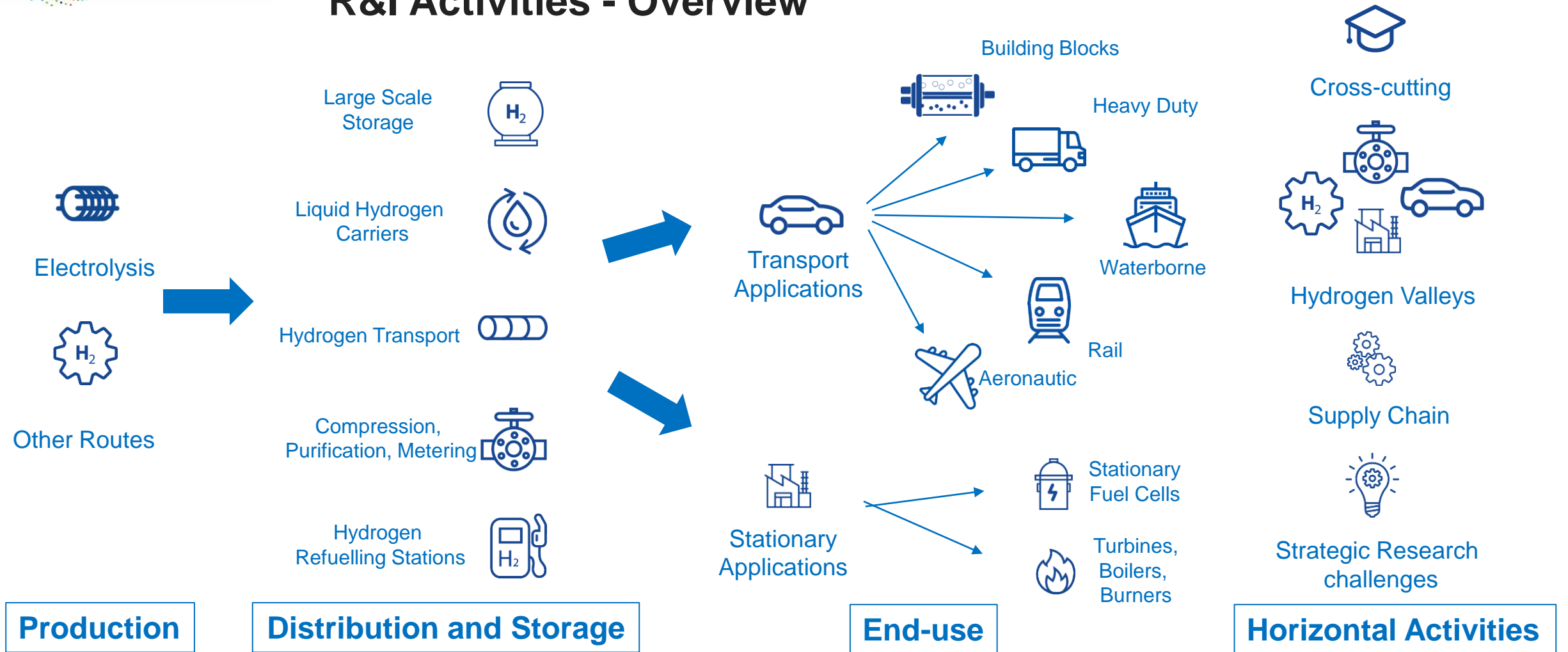


Table of contents

Executive summary.....	11
1. Introduction.....	17
1.1. The European Green Deal and the climate neutrality ambition of Europe.....	17
1.1.1. The role of hydrogen technologies.....	18
1.1.2. The EU hydrogen strategy for a climate-neutral Europe.....	20
1.2. The R&I support of hydrogen activities of the European Union.....	23
2. Clean Hydrogen.....	
2.1. Mission and vision.....	4.1. Interface with EU policies and other programmes.....
2.2. Objectives of the Clean Hydrogen Joint Undertaking.....	4.1.1. Need to reinforce synergies.....
3. Research and Innovation.....	4.1.2. Toolbox to generate funding synergies.....
3.1. Structure of the Clean Hydrogen Joint Undertaking.....	4.1.3. Cooperation mechanisms to deliver synergies.....
3.2. Renewable Hydrogen.....	4.2. Cooperation with JRC.....
3.2.1. Electrolysis.....	4.3. Regulations, Codes and Standards (RCS).....
3.2.2. Other routes.....	4.4. European Hydrogen Safety Panel (EHSF).....
3.3. Hydrogen Storage.....	4.5. European Hydrogen Sustainability and Security.....
3.3.1. Hydrogen Storage.....	4.6. Knowledge management.....
3.3.2. Hydrogen in transport.....	4.6.1. (Current) Knowledge activities in previous programmes.....
3.3.3. Liquid Hydrogen.....	4.6.2. Clean Hydrogen as the Knowledge Hub.....
3.3.4. Improving Efficiency.....	4.6.3. Dissemination & Exploitation of the project.....
3.3.5. Compression.....	4.7. The role of small and medium-sized enterprises.....
3.3.6. Hydrogen Refuelling.....	4.8. International cooperation strategy.....
3.4. Hydrogen End Use.....	4.9. Communication.....
3.4.1. Building Blocks.....	5. Programme implementation.....
3.4.2. Heavy-duty vehicles.....	5.1. Budget.....
3.4.3. Waterborne applications.....	5.2. Conditions for participation and eligibility.....
3.4.4. Rail applications.....	5.3. Types of action: specific provisions and funding.....
3.4.5. Aeronautics.....	5.4. Rules for participation.....
3.5. Hydrogen End Use.....	6. Governance.....
3.5.1. Stationary Fuel Cells.....	6.1. Main actors: roles and representation.....
3.5.2. Turbines, boilers.....	6.2. Governing Board.....
3.6. Cross-cutting.....	6.3. Executive Director.....
3.6.1. Sustainability.....	6.3.1. Programme Office.....
3.6.2. Education and Training.....	6.4. States Representatives Group.....
3.6.3. Safety, Pre-NET.....	6.5. Stakeholders' Group.....
3.7. Hydrogen Valley.....	7. Programme monitoring and reporting.....
3.8. Supply chain.....	8. Modern Administration.....
3.9. Strategic Research.....	8.1. Objective of human resources.....
4. Additional activities.....	8.2. Main principles of the human resources.....
	8.3. Staff establishment plan and sound financial management.....
	8.4. Assurance and audit.....
	8.4.1. Financial management.....
	8.4.2. Internal control and risk management.....
	8.5. Fraud risk management.....
	8.6. Document Management, digital.....
	8.6.1. Information Management.....
	8.6.2. Digital Transformation.....
	8.7. Sound environmental management.....
	Annex 1 – Programme Level Key Performance Indicators for the Clean Hydrogen for Europe Joint Undertaking.....
	Annex 2 – State-of-the-art and future targets – Renewable Hydrogen production.....
	Annex 3 – State-of-the-art and future targets – Hydrogen storage and distribution.....
	Annex 4 – State-of-the-art and future targets – Hydrogen end use: transport applications.....
	Annex 5 – State-of-the-art and future targets – Hydrogen end use: stationary applications.....
	Annex 6 – State-of-the-art and future targets – Cross-cutting issues.....
	Annex 7 – Common R&I Roadmaps.....



Clean Hydrogen Partnership Strategic Research and Innovation Agenda (SRIA) 2021-2027 R&I Activities - Overview



Clean Hydrogen Partnership

SRIA: Other Activities - Overview

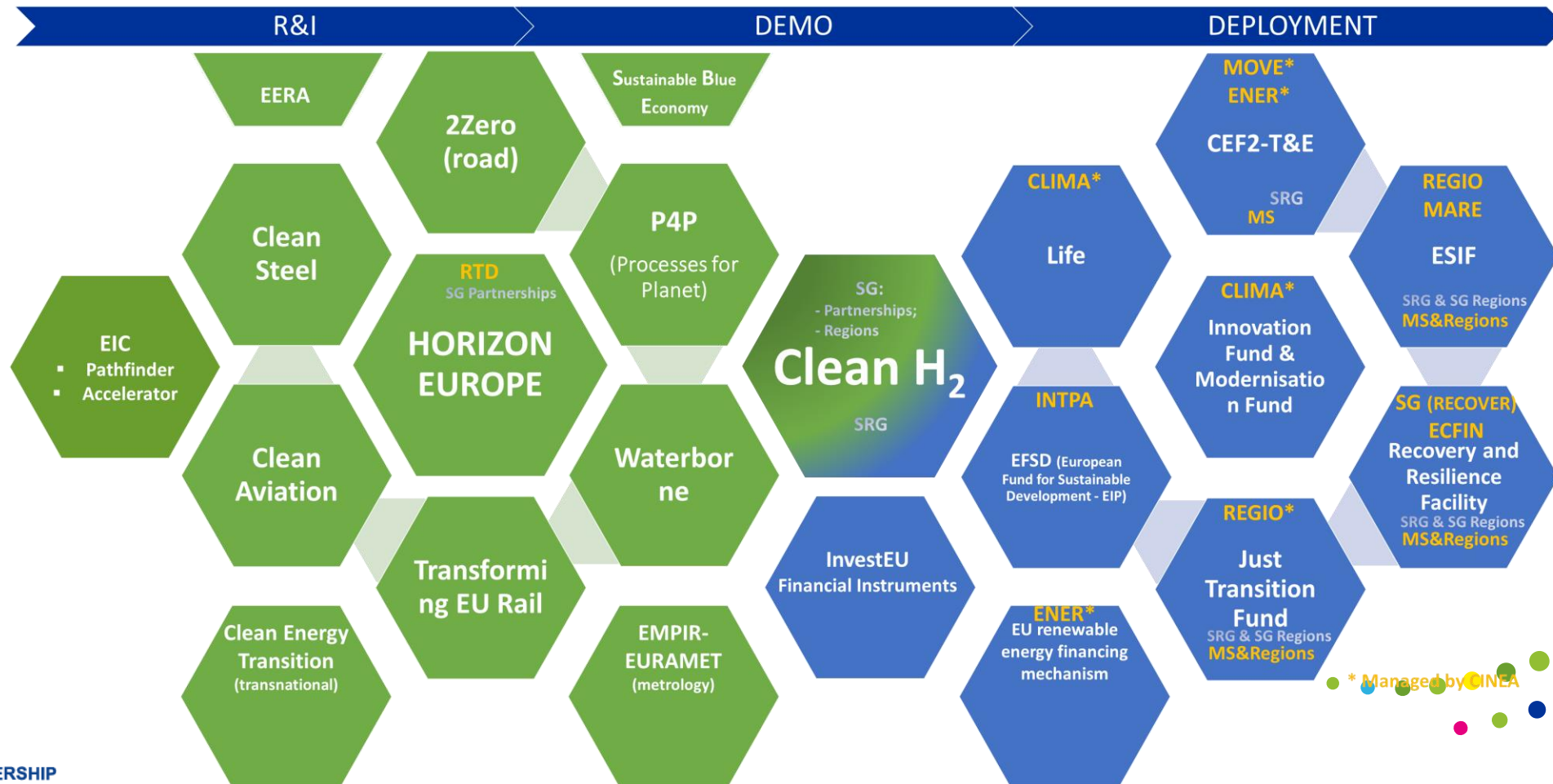
- Additional activities necessary to fulfil the Clean Hydrogen JU objectives
 - Developing synergies with other partnerships and programmes
 - Regulations, Codes and Standards
 - European Hydrogen Safety
 - European Hydrogen Sustainability and Circularity
 - Knowledge management
 - Competitiveness, SMEs
 - International Cooperation
 - Communication activities



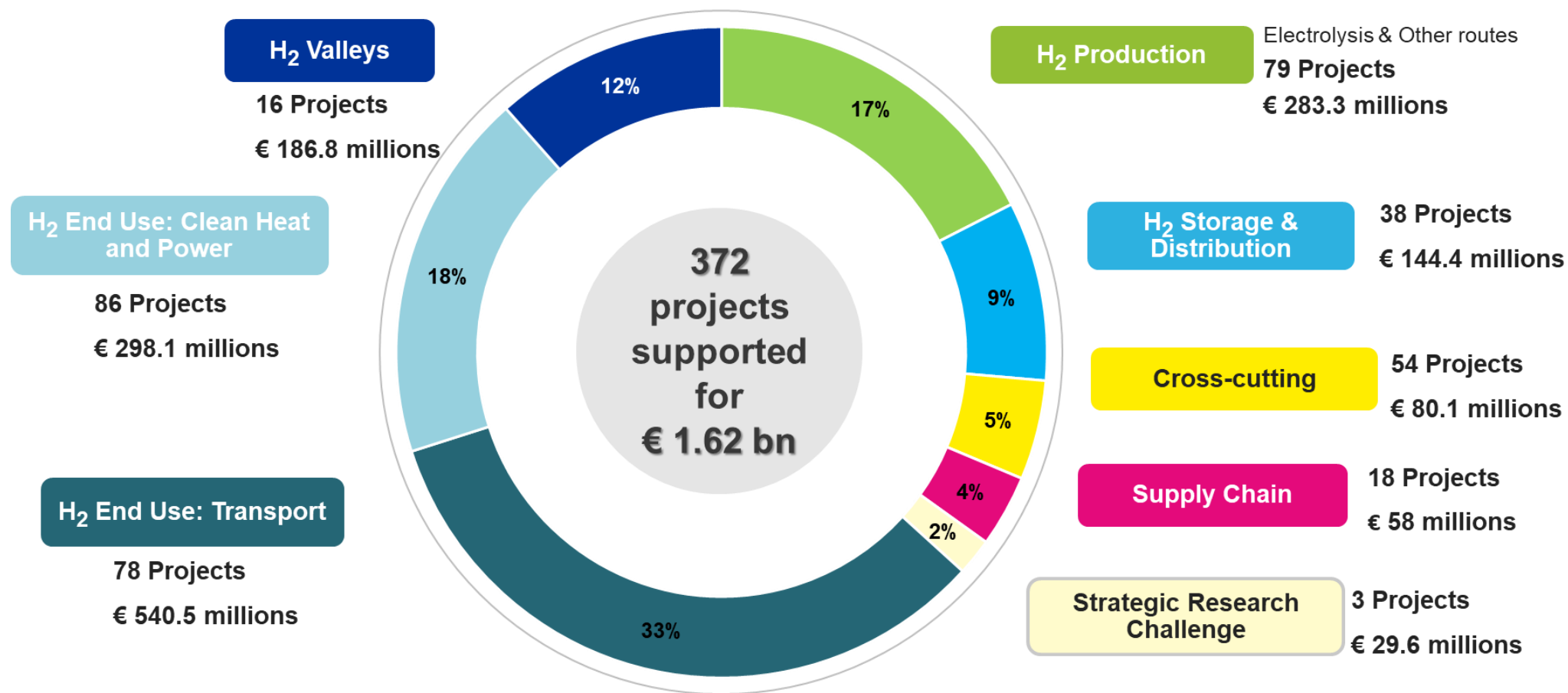
Clean Hydrogen Partnership Synergies - Overview

14

Strong cooperation is key to deal with bigger yet fragmented EU and National/Regional Funds to meet EU Green Deal Ambition!



Clean Hydrogen Partnership JU Programme implementation



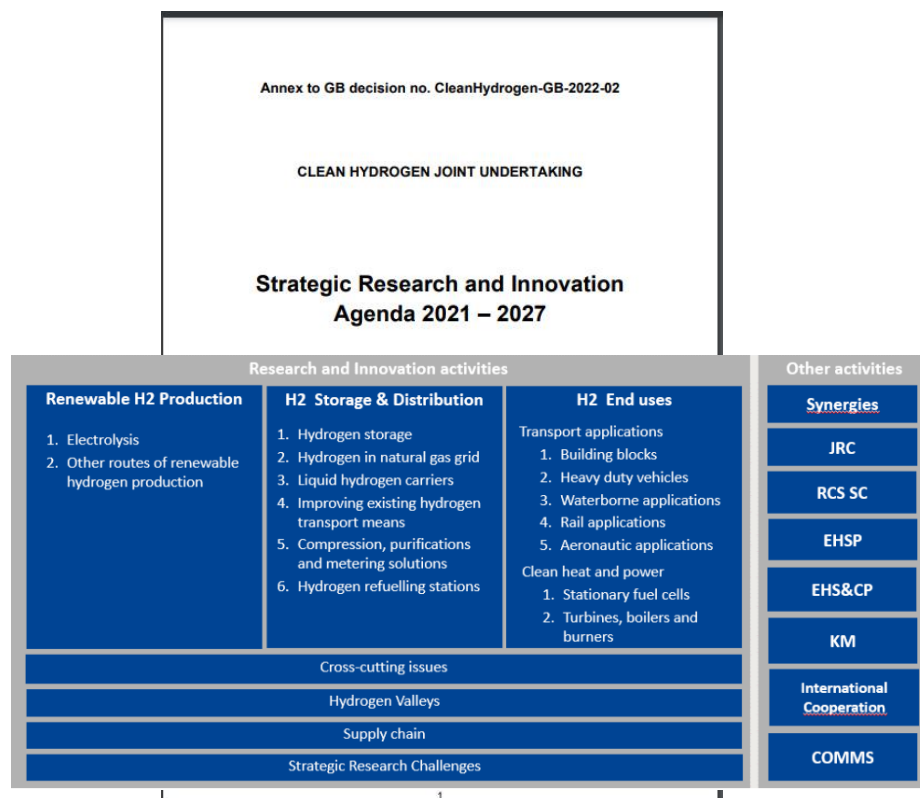
Supporting clean hydrogen R&I across the whole value chain and at all TRLs
(from basic research to field demonstration)

ANNEX to GB decision no. CleanHydrogen-GB-2023-20		Table of Contents	
1	Introduction	12	
1.1	Mission statement of Clean Hydrogen JU	12	
1.2	Background and link with the Strategic Research and Innovation Agenda	13	
1.3	Strategy for the implementation of the programme	16	
1.3.1	Implementation Strategy	16	
1.3.2	Planned research and innovation actions	18	
1.3.3	Other activities	22	
2	Work Programme 2022		
2.1	Executive summary 2022 and		
2.1.1	Message from the Execu		
2.1.2	Executive Summary		
2.2	Operational activities of Clear		
2.2.1	Objectives, Indicators and		
2.2.1.1	Objectives		
2.2.1.2	Key Performance		
2.2.1.3	Risk Assessment		
2.2.2	Scientific priorities, challenges		
2.2.3	Call for Proposals		
2.2.3.1	Call		
RENEWABLE HYDROGEN			
HORIZON-JTI-CLEANH2	temperature steam electrical		
HORIZON-JTI-CLEANH2	temperature steam electrical		
HORIZON-JTI-CLEANH2	for highly pressurised hydrogen		
HORIZON-JTI-CLEANH2	electrolysis		
HORIZON-JTI-CLEANH2			
HORIZON-JTI-CLEANH2	splitting		
HORIZON-JTI-CLEANH2	installations closer to technology		
HORIZON-JTI-CLEANH2	applications		
HORIZON-JTI-CLEANH2			
HORIZON-JTI-CLEANH2	hydrogen		
HYDROGEN STORAGE AND DISTRIBUTION			
HORIZON-JTI-CLEANH2	Compatibility of materials with hydrogen		
HORIZON-JTI-CLEANH2	Hydrogen detection system for continuous monitoring and hydrogen natural gas mixture networks		
HORIZON-JTI-CLEANH2	Validated prototype		
HORIZON-JTI-CLEANH2	Ammonia for ammonia cracking		
HORIZON-JTI-CLEANH2	Efficient organic hydrogen carriers		
HORIZON-JTI-CLEANH2	Developing shipping		
HORIZON-JTI-CLEANH2	Increase components for high flow HRS		
HORIZON-JTI-CLEANH2	Develop high capacity and energy-efficient (FC) compressed		
HORIZON-JTI-CLEANH2	Sampling HRS		
HORIZON-JTI-CLEANH2	Implement components for high flow HRS		
HORIZON-JTI-CLEANH2	Develop stationary compressed hydrogen refuelling solid short-distance maritime operations		
HYDROGEN END USES: TRANSPORT APPLICATIONS			
HORIZON-JTI-CLEANH2	Develop versatile PEMFC stacks for high power range as		
HORIZON-JTI-CLEANH2	Innovative next generation of improved PEMFC stacks for		
HORIZON-JTI-CLEANH2	Large scale Duty Vehicle along the TEN-T corridor		
HORIZON-JTI-CLEANH2	Liquid hydrogen		
HORIZON-JTI-CLEANH2	Large scale propelled inland roadway vessels		
HORIZON-JTI-CLEANH2	Develop Cells for Aviation: Development of dedicated air system		
HORIZON-JTI-CLEANH2	Develop system with a gas-purging, fuel metering, heat management		
HORIZON-JTI-CLEANH2	Develop Cells for Aviation: disruptive next-gen high temperature aviation		
HYDROGEN END USES: CLEAN HEAT AND POWER			
HORIZON-JTI-CLEANH2	Design and industrial deployment of innovative manufacturing processes for solid oxide fuel cells systems and fuel cell components		
HORIZON-JTI-CLEANH2-2022-04-02: Ammonia powered fuel cell system focusing on superior efficiency, durable operation and design optimisation		154	
HORIZON-JTI-CLEANH2-2022-04-03: Renewable SOC system development, operation and energy system (grid) integration		157	
HORIZON-JTI-CLEANH2-2022-04-04: Day Low NO _x combustion of hydrogen-enriched fuels at high-pressure conditions for gas turbine applications		161	
CROSS-CUTTING		164	
HORIZON-JTI-CLEANH2-2022-05-01: Public hydrogen infrastructure and fuel cell technologies		164	
HORIZON-JTI-CLEANH2-2022-05-02: Safety of cryogenic hydrogen transfer technologies in public areas for mobile applications		167	
HORIZON-JTI-CLEANH2-2022-05-03: Safe hydrogen injection management at network wide level towards European gas sector transition		170	
HORIZON-JTI-CLEANH2-2022-05-04: Development of validated test methods and requirements for measuring devices intended for measuring NG200 modules		174	
HORIZON-JTI-CLEANH2-2022-05-05: Research & Innovation co-operation with Africa on hydrogen		178	
HYDROGEN VALLEYS		180	
HORIZON-JTI-CLEANH2-2022-06-01: Hydrogen Valleys (large-scale)		180	
HORIZON-JTI-CLEANH2-2022-06-02: Hydrogen Valleys (small-scale)		186	
STRATEGIC RESEARCH CHALLENGES		191	
HORIZON-JTI-CLEANH2-2022-07-01: Addressing the sustainability and criticality of hydrogen and fuel cell materials		191	
2.2.3.1	Conditions of the call and management rules	195	
2.2.3.2	List of countries entrusting the JU with national funds for the call	202	
2.2.3.3	Country specific eligibility rules	204	
2.2.4	Calls for tenders and other actions	205	
2.2.4.1	Calls For Tenders	205	
2.2.4.2	Support to EU policies	206	
2.2.4.3	Collaboration with JRC – Rolling Plan 2022	207	
2.2.5	Follow-up activities linked to past calls: monitoring, evaluation and impact assessment	213	
2.2.5.1	Knowledge management	213	
2.2.5.2	Feedback to policy	215	
2.2.6	Cooperation, synergies and cross-cutting themes and activities	216	
2.2.6.1	Synergies with other Programmes	216	
2.2.6.2	Synergies implemented via the Call for Proposals	216	
2.2.6.3	Collaborations with other agencies and partnerships to deliver synergies	218	
2.2.6.4	Supporting regions and Member States through technical assistance	219	
2.2.6.5	Regulations, Codes and Standards Strategy Coordination (RCS SC)	219	
2.2.6.6	European Hydrogen Safety Plan (EHSP)	220	

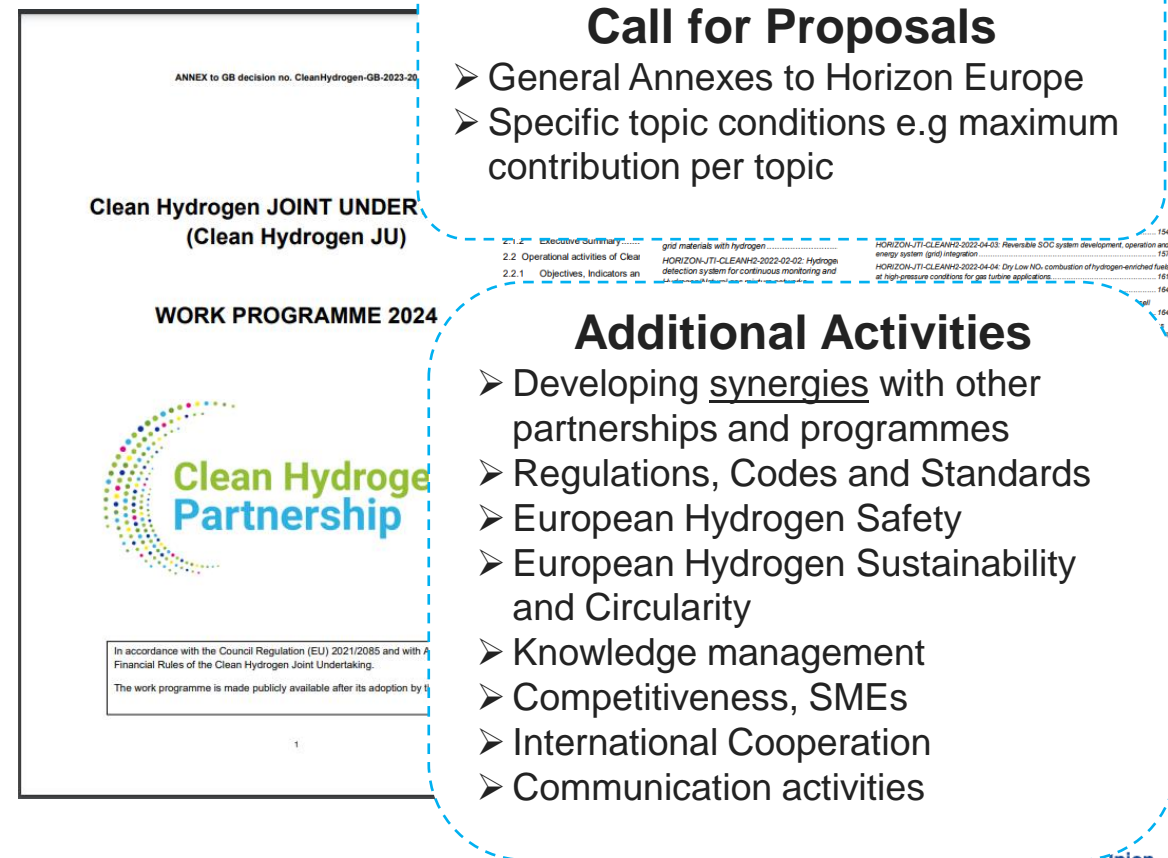
Clean Hydrogen Partnership

Key documents

- **Strategic Research and Innovation Agenda (SRIA):**
- Key **priorities** and the essential **technologies** and **innovations** required to achieve the objectives of the JU



- **Annual Work Programme:**
- Scope and details of the activities for a specific year



Clean Hydrogen Partnership – Call for Proposals

International participation and Eligibility for funding



Horizon Europe is open to the world, except (see [EU Sanctions map](#))

- Legal entities established in Russia, Belarus, or in non-government controlled territories of Ukraine
- Legal entities established in China for innovation actions



Yet, to be eligible for funding, applicants must be established in one of the eligible countries, i.e.:

- The EU members states and their overseas countries and territories
- Countries associated to Horizon Europe
- **Low and middle-income countries**: Afghanistan, Algeria, ... , Zambia, Zimbabwe
- **Exceptionally**, any other country, if
 - The Clean Hydrogen JU considers that their participation as a beneficiary is essential for implementing the project



If not eligible for funding, applicants will have to participate at their own cost. These participants should **explain in the proposal how their funding will be secured**.

Exceptions apply if international partner activities are essential to the project (special criteria in Horizon Europe)

Clean Hydrogen Partnership – Call for Proposals

International participation and Eligibility for funding



All topics are opened to international cooperation
... and in particular (but not limited to) participation of countries **from Mission Innovation - Clean Hydrogen Mission is encouraged**

Clean Hydrogen Mission Innovation Challenge Members



Australia



China



Morocco



UK



Brazil



USA



South Korea



Norway



Canada



India



Saudi Arabia



European Union ←



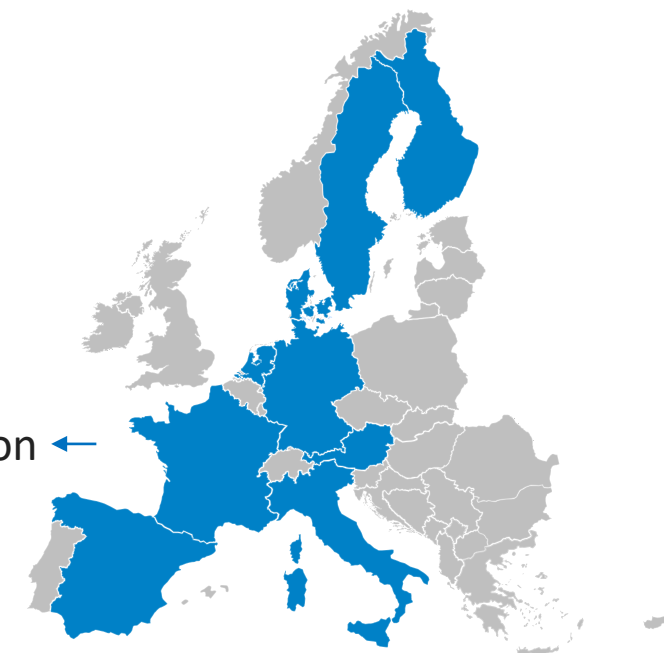
Chile



Japan



UAE



ELVHYS Project Context: Liquid Hydrogen Pre-Normative Research



Clean Hydrogen Partnership JU projects on Liquid Hydrogen (LH2) - Overview

Production



Integrated Design for Efficient Advanced Liquefaction of Hydrogen

International Collaboration

Japan - Kawasaki Heavy Industries



H2 liquefaction via the magnetocaloric effect yields substantial cost and energy savings

Distribution and Storage



Novel Insulation Concepts for large-scale storage and transport of LH2 Tanks

Large Storage

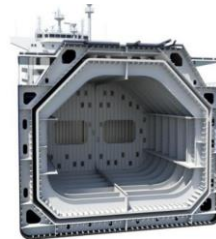


Liquid Hydro Carriers

Hydrogen



Compression, Purification, Metering



Hy Refuell



1st LH2 aircraft:
▪ Small LH2 tank



▪ Lightweight LH2 tank for aviation

End-use

Building Blocks



Heavy Duty

- Demo vessel and LH2 fuel supply chain in NO
- LH2 storage on-board with 2 concepts below/on deck

Large LH2 tanks for maritime vessels:

- Material research (insulation)
- 180m3 ⇔ 10t LH2 demo



Station Fuel C

Turbine Boilers Burners

Horizontal Activities



Identify LH2 safety critical areas where knowledge gaps exist and standards needed

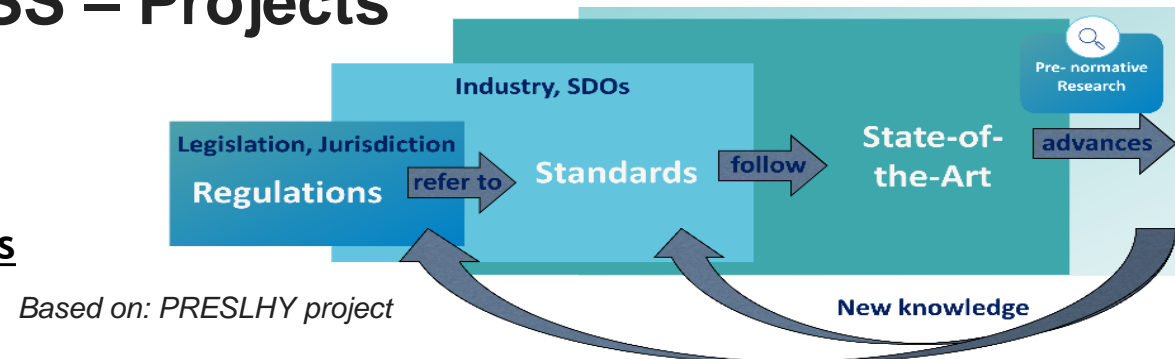
Hydrogen Valleys



Safety and efficiency of LH2 transfer technologies (tank to tank) in public areas for mobile applications (trucks, ships, stationary tanks)

Clean Hydrogen Partnership JU Activities on PNR/ RCSS – Projects

Pre-Normative research (PNR) activities:
An essential step advancing Regulations, Codes, and Standards



“Supporting and facilitating adequate/ enabling frameworks for market uptake”



For further information
<https://www.clean-hydrogen.europa.eu/>



Clean Hydrogen Partnership

[Home](#)
[About Us ▾](#)
[Projects](#)
[Get involved ▾](#)
[Apply for funding ▾](#)
[Knowledge management ▾](#)
[Media ▾](#)

European Partnership for Hydrogen Technologies

Clean Hydrogen Joint Undertaking's main objective is to contribute to EU Green Deal and Hydrogen Strategy through optimised funding of R&I activities

[About Us ^](#)
[Projects](#)
[Get involved ▾](#)
[Apply for funding ▾](#)
[Get involved ^](#)
[Apply for funding ▾](#)
[Knowledge management ▾](#)
[Apply for funding ^](#)
[Knowledge management ▾](#)
[Knowledge management ^](#)
[Media ▾](#)
[Who We Are](#)
[Organisation](#)
[Our Story](#)
[Key documents](#)
[Mission & Objectives](#)
[Contact](#)
[Vacancies](#)
[Privacy Policy](#)
[European Hydrogen
Safety Panel](#)
[Fuel Cells and Hydrogen
Observatory](#)
[FCH Regions' Hub](#)
[European Hydrogen
Refuelling Station
Availability System](#)
[CertifHy](#)
[Mission Innovation
Hydrogen Valleys
Platform](#)
[Calls for proposals](#)
[Call for experts](#)
[Info Day 2022](#)
[Financial Engineering](#)
[Procurements](#)
[Dissemination and
exploitation tools](#)
[Tools for Innovation
Monitoring \(TIM\)](#)
[Technology monitoring -
TRUST](#)
[Programme Review Days](#)
[SRIA Key Performance
Indicators \(KPIs\)](#)
[Collaboration with JRC](#)

Clean Hydrogen Partnership European Hydrogen Observatory

Relaunched September 2023

Highlights:

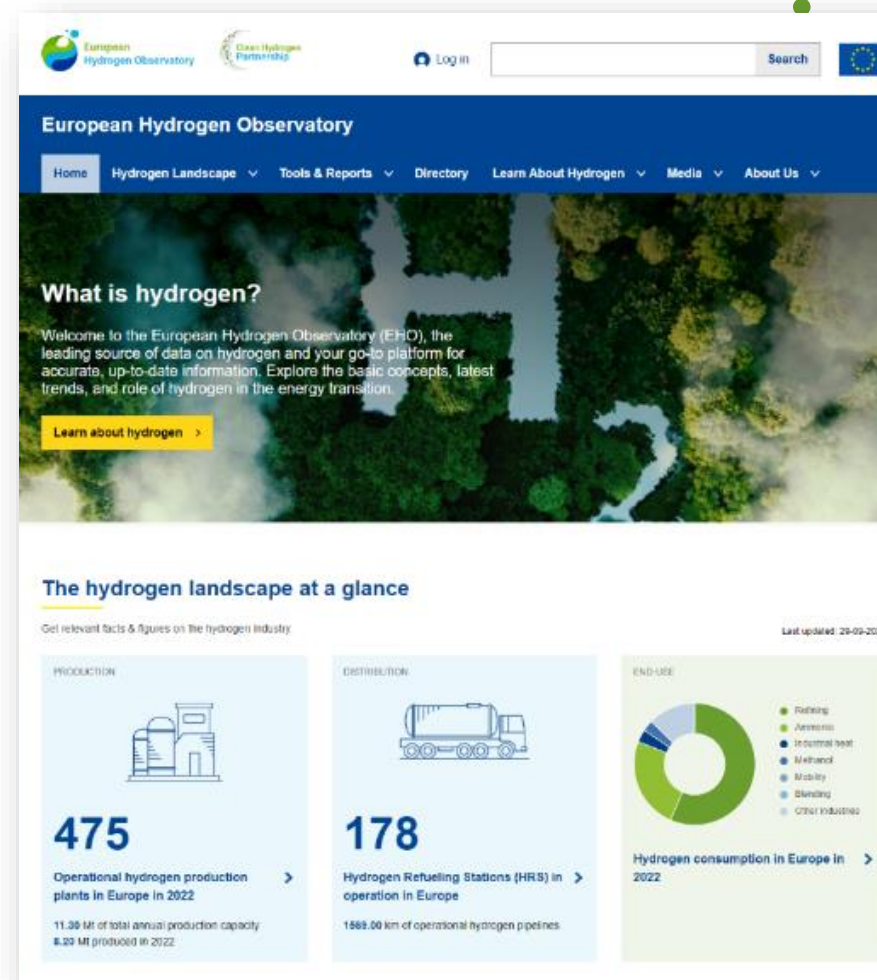
- Many new data sets regarding all the steps in the hydrogen value chain;
- Customisable and interactive geomap;
- Levelised Cost of Hydrogen Calculator;
- Reports;
- News and events interface;

Target audience:

- Industry
- Policy makers
- Academics
- Opinion leaders
- Citizens

<https://observatory.clean-hydrogen.europa.eu>

EUROPEAN PARTNERSHIP





EUROPEAN HYDROGEN WEEK

Save the Date 18 - 22 November 2024!
Brussels Expo, Brussels

SECURE YOUR 2024 PRESENCE



Over 8000
sqm



High-Level
Policy Conference



B2B Forum



Networking
Evenings



6000
Visitors



Trade show



Side events
& B2B meetings



Startups



Showcases &
Demos