



APRE

Agenzia per la Promozione
della Ricerca Europea

Horizon Europe: Challenges and funding opportunities in the field of Clean Hydrogen

13/04/2021

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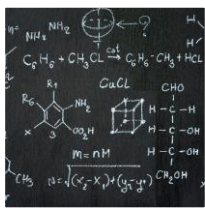
What is Horizon
Europe?



Horizon Europe

Horizon Europe is the EU's funding programme for research and innovation from 2021-2027 with budget of €95.5 billion.

Science & technology



- Fuel EU's scientific and technological excellence and the strengthen the ERA

Society



- tackle policy priorities, including green and digital transitions and SDGs

Economy



- boost Europe's innovation uptake, competitiveness and jobs



HE Rules for Participation



Entities eligible for participation



Art. 18: «Any legal entity, regardless of its place of establishment, including legal entities from non associated third countries or international organisation may participate in actions under the Programme, provided that the conditions laid down in this Regulation have been met together with any conditions laid down in the work programme or call»

New eligibility condition: Gender Equality Plan (applicable only from 2022 on)

Participants that are public bodies, research organisations or higher education establishments from Members States and Associated countries **must have a gender equality plan**, covering minimum process-related requirements.

- A self-declaration will be requested at proposal stage (for all types of participants).
- Included in the entity validation process (based on self-declaration)



Entities eligible for funding

EU COUNTRIES

- Member States (MS) including their outermost regions
- The Overseas Countries and Territories (OCTs) linked to the MS.

NON-EU COUNTRIES

- Countries associated to Horizon Europe (AC)
- Low and middle income countries: See [HE Programme Guide](#).
- Other countries when announced in the call or exceptionally if their participation is essential

SPECIFIC CASES

- Affiliated entities established in countries eligible for funding.
- EU bodies
- International organisations (IO):
 - International European research organisations are eligible for funding.
 - Other IO are not eligible (only exceptionally if participation is essential)
 - IO in a MS or AC are eligible for funding for Training and mobility actions and when announced in the call conditions

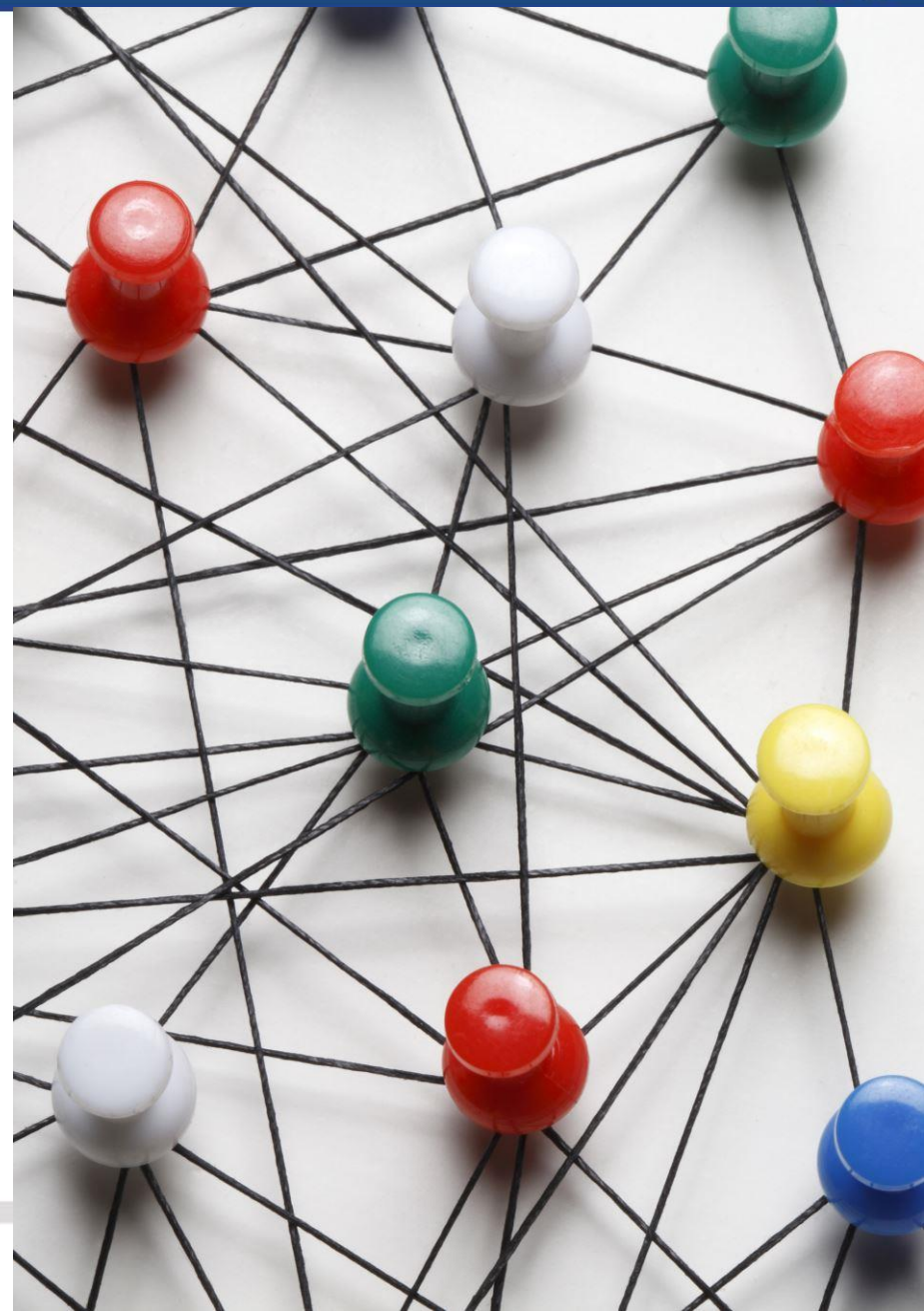


Minimum requirements

Art. 18: «Entities shall be part of a consortium that shall include at least three independent legal entities each established in a different Member State or associated country and with at least one of them established in a Member State, unless the work programme provides otherwise”

SPECIAL/ADDITIONAL CONDITIONS

MAY BE OUTLINED IN THE WORK PROGRAMME (No of participants, type of participants)

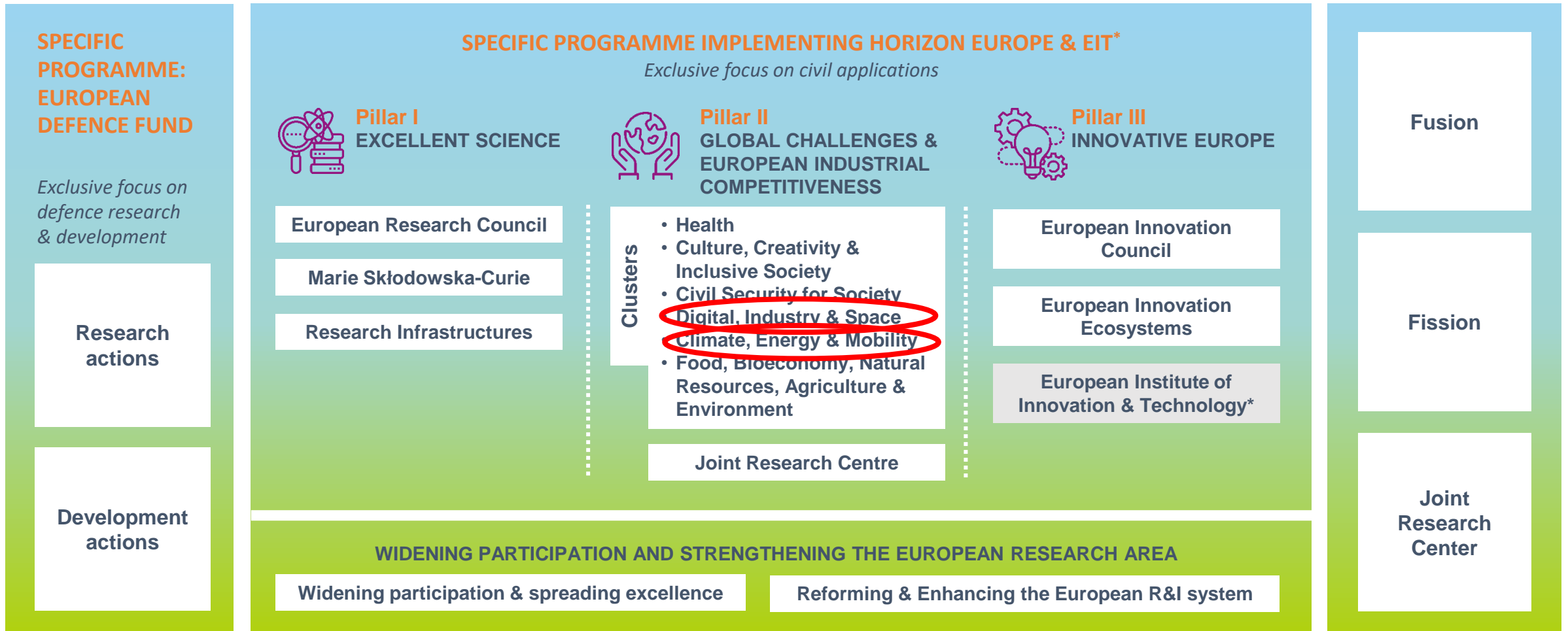




HE Structure

HORIZON EUROPE

EURATOM



* The European Institute of Innovation & Technology (EIT) is not part of the Specific Programme

European Partnerships

- bring the **European Commission and private and/or public partners** together to address Europe's most pressing challenges through concerted research and innovation initiatives.
- help to **avoid the duplication of investments** and contribute to reducing the fragmentation of the research and innovation landscape in the EU.

Co-programmed

Based on Memoranda of Understanding / contractual arrangements; implemented independently by the partners and by HE

Co-funded

Based on a joint programme agreed and implemented by partners; commitment of partners for financial and in-kind contributions

Institutionalised

Based on long-term dimension and need for high integration; partnerships based on Articles 185 / 187 of TFEU and the EIT-Regulation supported by HE

Overview of Horizon Europe Partnerships

PILLAR II - Global challenges & European industrial competitiveness

CLUSTER 1: Health	CLUSTER 4: Digital, Industry & Space	CLUSTER 5: Climate, Energy & Mobility	CLUSTER 6: Food, Bioeconomy, Agriculture, ...
Innovative Health Initiative	Key Digital Technologies	Clean Hydrogen	Circular Bio-based Europe
Global Health Partnership	Smart Networks & Services	Clean Aviation	Rescuing Biodiversity to Safeguard Life on Earth
Transformation of health systems	High Performance Computing	Single European Sky ATM Research 3	Climate Neutral, Sustainable & Productive Blue Economy
Chemicals risk assessment	European Metrology (Art. 185)	Europe's Rail	Water4All
ERA for Health	AI-Data-Robotics	Connected and Automated Mobility (CCAM)	Animal Health & Welfare*
Rare diseases*	Photonics	Batteries	Accelerating Farming Systems Transitions*
One-Health Anti Microbial Resistance*	Made in Europe	Zero-emission waterborne transport	Agriculture of Data*
Personalised Medicine*	Clean steel – low-carbon steelmaking	Zero-emission road transport	Safe & Sustainable Food System*
Pandemic Preparedness* <i>Co-funded or co-programmed</i>	Processes4Planet	Built4People	
	Global competitive space systems**	Clean Energy Transition	
		Driving Urban Transitions	

PILLAR III - Innovative Europe

EIT	SUPPORT TO INNOVATION ECOSYSTEMS
InnoEnergy	Innovative SMEs
Climate	
Digital	
Food	
Health	
Raw Materials	
Manufacturing	
Urban Mobility	
Cultural and Creative Industries	

CROSS-PILLARS II AND III

European Open Science Cloud

- Institutionalised Partnerships (Art 185/7)
- Institutionalised partnerships / EIT KICs
- Co-Programmed
- Co-Funded

* Calls with opening dates in 2023-24

** Calls with opening dates not before 2022



European Commission

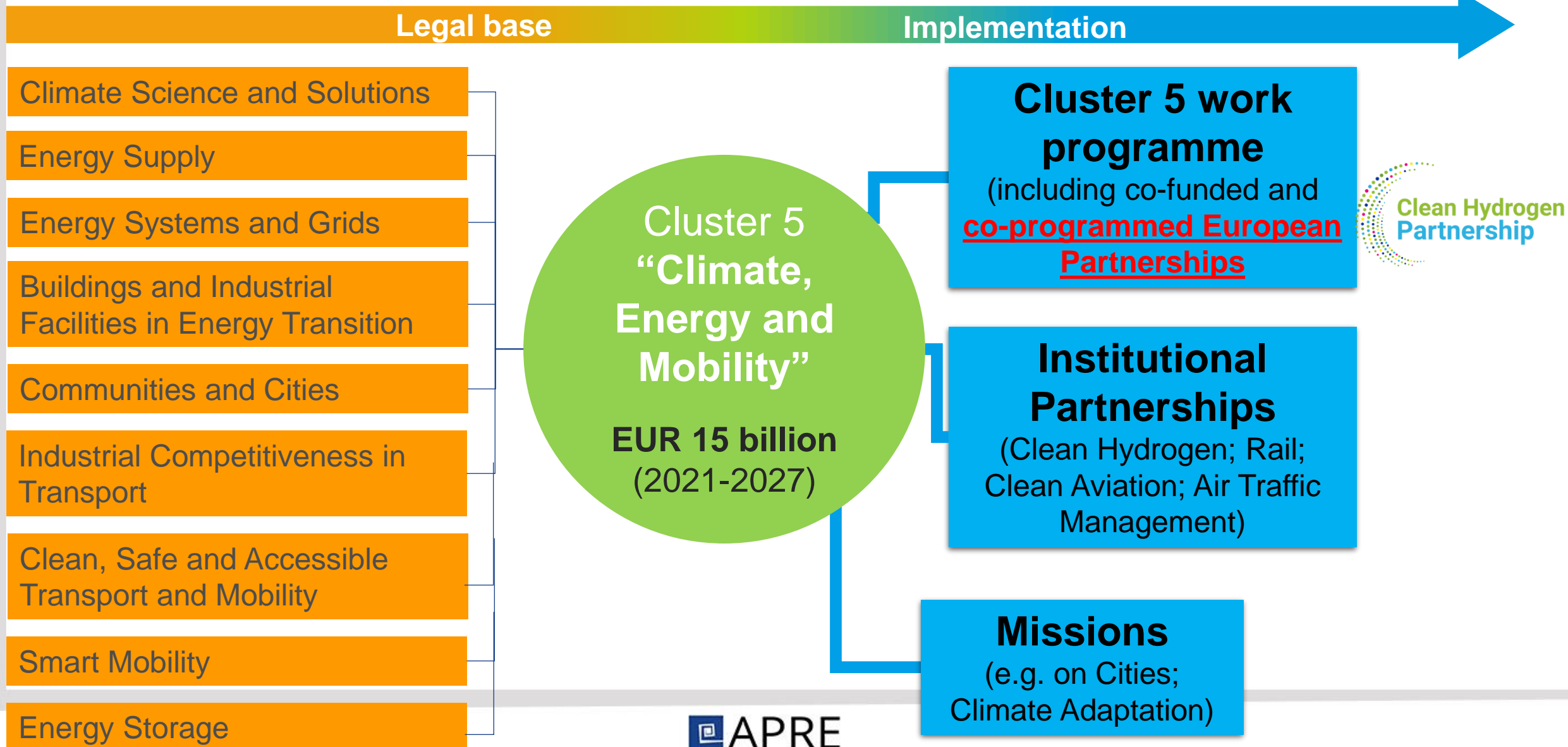


Open Funding opportunities

in Cluster 5



Cluster 5 - overview





CL5 Work Programme



EN

Horizon Europe

Work Programme 2021-2022

8. Climate, Energy and Mobility

(European Commission Decision C(2021)9128 of 15 December 2021)

Horizon Europe - Work Programme 2021-2022 Climate, Energy and Mobility

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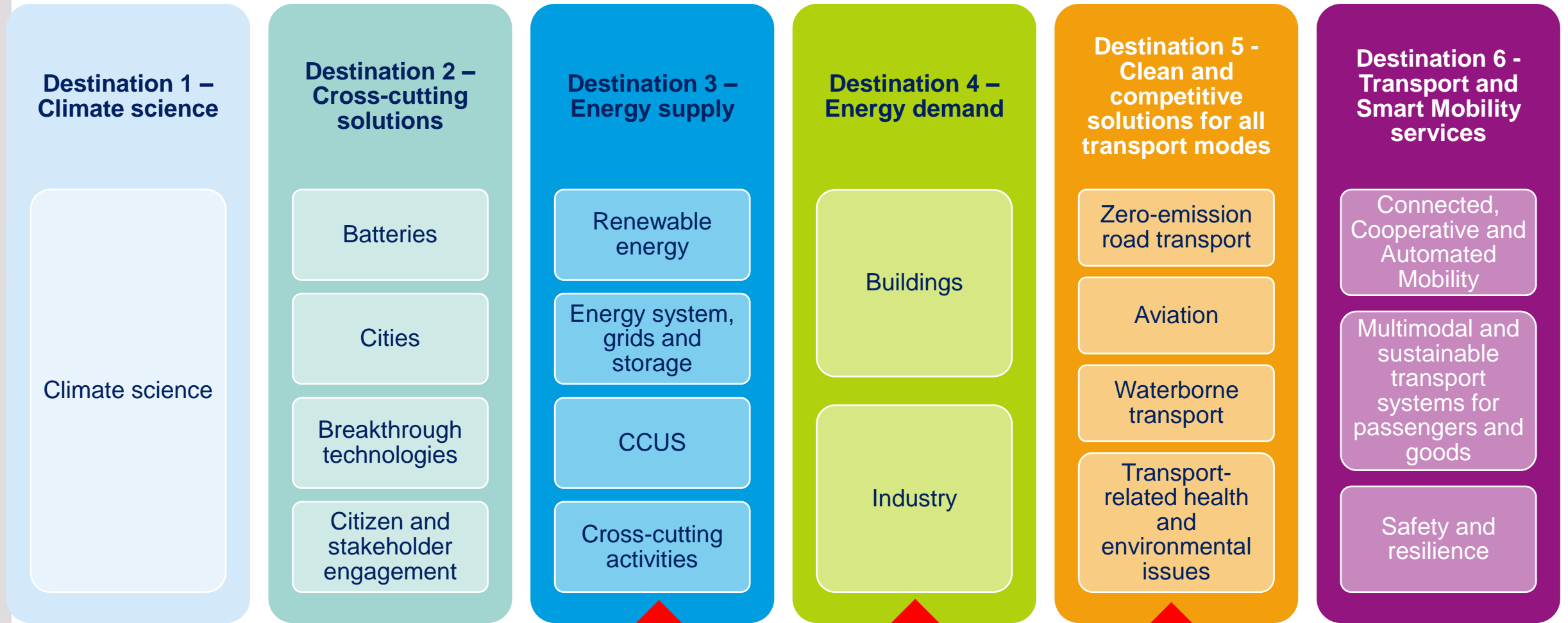
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Horizon Europe - Work Programme 2021-2022 Climate, Energy and Mobility

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CL5 WP - Destination





Destination 3: Sustainable, secure and competitive energy supply

Renewable energy

- Fostering European global leadership in **affordable, secure and sustainable renewable energy technologies and services** by improving their competitiveness in global value chains and their position in growth markets, notably through the **diversification of the renewable services and technology portfolio**
- **24 topics in 2022** (368 M€)
- **Issues:** disruptive technologies, cost reduction, improved efficiency, de-risking, integration, export potential, sustainability, market uptake

Energy system, grids and storage

- Ensuring cost-effective **uninterrupted** and **affordable** supply of energy to households and industries in a scenario of **high penetration of variable renewables** and other new low carbon energy supply.
- Managing smart and cyber-secure **energy grids** and optimisation the interaction between producers, consumers, networks, infrastructures and vectors
- **7 topics in 2022** (181 M€)
- **Issues:** energy sector integration, energy system planning and operation, active consumer, markets and energy communities, digitization

Carbon Capture, Utilization and Storage

- **Accelerating** the development of Carbon Capture, Use and Storage (CCUS) as a CO₂ emission mitigation option in **electricity generation and industry applications** (including also conversion of CO₂ to products)
- **1 topic in 2022** (58 M€)
- **Issues:** CCUS hubs, application in industry, CO₂ capture





Hydrogen-related topics

TOPIC CODE	TOPIC TITLE	OPENING DATE	DEADLINE	BUDGET PER GRANT Mil €	Number of projects expected to be funded
HORIZON-CL5-2022-D3-01-11	Demonstration of innovative forms of storage and their successful operation and integration into innovative energy systems and grid architectures	14/10/2021	26/04/2022	7.00 to 8.00	4
HORIZON-CL5-2022-D3-01-13	Energy system modelling, optimisation and planning tools	14/10/2021	26/04/2022	Around 6.00	1
HORIZON-CL5-2022-D3-01-15	Decarbonising industry with CCUS	14/10/2021	26/04/2022	Around 29.00	2
HORIZON-CL5-2022-D3-02-08	Demonstration of complete value chains for advanced biofuel and non-biological renewable fuel production	26/05/2022	27/10/2022	Around 10	2



Destination 4 - Efficient, sustainable and inclusive energy use

Buildings

- **Technological and socio-economic breakthroughs** for achieving climate neutrality and the transition to zero pollution of the building stock by 2050, based on **inclusive and people-centric R&I**
- **10 topics in 2022** (140 M€)
- **Issues:** Energy performance assessment and monitoring, industrialization of deep renovation, integrated technology solutions, prefabricated renovation packages, demand response, renewable intensive homes, smart buildings, design, materials, sustainability of life-cycle
- Implementing co-programmed Partnership “People-centric, Sustainable Built Environment” (Built4People)



Industry

- Increased energy efficiency in industry and **reducing industry’s Greenhouse Gas (GHG) and air pollutant emissions** through recovery, upgrade and/or conversion of industrial excess (waste) heat and through electrification of heat generation
- **2 topics in 2022** (18 M€)
- **Issues:** heat upgrade technologies, industrial excess (waste) Heat-to-Power conversion



Hydrogen-related topics

TOPIC CODE	TOPIC TITLE	OPENING DATE	DEADLINE	BUDGET PER GRANT Mil €	Number of projects expected to be funded
HORIZON-CL5-2022-D4-02-05	More sustainable buildings with reduced embodied energy / carbon, high life-cycle performance and reduced life-cycle costs (Built4People)	06/09/2022	24/01/2023	6.00 to 9.50	2

Specific conditions: The funding rate is up to 60% of the eligible costs, except for non-profit legal entities, where the funding rate is up to 100% of the total eligible costs.



Destination 5 - Clean and competitive solutions for all transport modes

Zero-emission road transport

- Transforming road transport to **zero-emission mobility** through a world-class European research and innovation and industrial system, ensuring that **Europe remains world leader** in innovation, production and services in relation to road transport
- **4 topics in 2022** (105 M€)
- **Issues:** regional medium freight haulage, power electronics, optimised smart EV charging, sustainable circularity, heavy duty vehicles, busses
- Implementing **co-programmed Partnership** “Towards zero emission road transport” (2ZERO)

Aviation

- Accelerating the **reduction of all aviation impacts and emissions** (CO₂ and non-CO₂, including manufacturing and end-of-life, noise), developing aircraft technologies for deep reduction of greenhouse gas emissions, and **maintaining European aero-industry’s global leadership position**
- **3 topics in 2022** (45 M€)
- **Issues:** long-term research, silent and ultra-low local air pollution aircraft, digital aviation technologies, policy-related research

Waterborne transport

- Accelerate the development and prepare the deployment of **climate neutral and clean solutions** in the shipping sector, **reduce its environmental impact** (on biodiversity, noise, pollution and waste management), improve its **system efficiency**, leverage digital and EU satellite-navigation solutions and contribute to the **competitiveness** of the European waterborne sector
- **6 topics in 2022** (96 M€)
- **Issues:** climate neutral fuels, electrification, energy efficiency and drastically lower fuel consumption of vessels, port infrastructure, inland waterway vessels, automated shipping
- Implementing **co-programmed Partnership** “Zero Emission Waterborne Transport” (ZEWT)

Transport - Health and environment

- Devising more effective ways for **reducing emissions and their impacts** through improved scientific knowledge
- **1 topic in 2022** (7 M€)
- **Issues:** retrofit solutions for tailpipe and brake polluting emissions, noise and particle emissions, smog prevention



Hydrogen-related topics

TOPIC CODE	TOPIC TITLE	OPENING DATE	DEADLINE	BUDGET PER GRANT Mil €	Number of projects expected to be funded
HORIZON-CL5-2022-D5-01-08	Modular multi-powertrain zero-emission systems for Heavy Duty Vehicles (BEV and FCEV) for efficient and economic operation (2ZERO)	02/12/2021	26/04/2022	15 to 20	3

Specific conditions: The funding rate is up to 60% of the eligible costs, except for non-profit legal entities, where the funding rate is up to 100% of the total eligible costs.



Clean Aviation Partnership

Call 2022



The Clean Aviation JU

The Clean Aviation JU will develop disruptive **new aircraft technologies** to support the European Green Deal, and climate neutrality by 2050.

- The Clean Aviation programme is built on three key thrusts, each with targeted R&I and demonstration efforts driving the **energy efficiency and the emissions reduction of future aircraft**:
 - Hybrid electric regional aircraft
 - Ultra-efficient short/short-medium range aircraft
 - Disruptive technologies to enable hydrogen-powered aircraft
- Each thrust will develop technologies and enablers and de-risk the identified technologies and solutions, where further maturation, validation and demonstration is required to maximise impact.





Hydrogen in Clean Aviation

- ✚ Clean Aviation aims to mature and demonstrate all relevant systems ready to be integrated into future aircraft:
 - liquid hydrogen storage on-board,
 - fuel distribution systems,
 - fuel-cell-based propulsion drive trains or direct combustion of hydrogen into turboprop or turbofan engines.
- ✚ This comprises the selection and validation of the most suitable **concepts, materials and designs** to provide the required **performance, lifetime, costs, and safety**. Beyond that, the integration of these systems into the aircraft platform requires a deep understanding of **operational, maintenance, and certification aspects**.
- ✚ To ensure the **impact of clean hydrogen propulsion**, systems will be **scalable for different propulsion architectures** (fuel cell or use in gas turbines/H₂-burn architectures) as well as **aircraft sizes** (commuter, regional, and short/medium range). In this light, early deployment may take place through the application of a hydrogen fuel cell for hybrid electric commuter or small regional aircraft in the next decade.
- ✚ Related calls for proposals are available at: <https://www.clean-aviation.eu/index.php/clean-aviation/participation/calls-for-proposals>



1st Call for Proposals: List and description of topics

ANNEX to CAJU-GB-2022-03-16 Amended Work Programme and
Budget 2022-2023

Revision History Table		
Version n*	Issue Date	Reason for change
P1	16/03/2022	Adopted by the Governing Board via decision on adoption of the Amended Work Programme and Budget 2022-2023.

Important notice on FAQ

Applicants are invited to submit their questions (technical and administrative) via the functional mailbox: CFP-2022-01@clean-aviation.eu

Questions will be analysed and, when appropriate, the Q&A will be published via the F&T Portal.

The FAQ session will open with the **launch of the Call, foreseen on 23 March 2022**.
Q&As are linked to the topics concerned. Applicants are therefore invited to check the topic documentation in the F&T Portal.

The closure date of the FAQ will be clearly stated on the F&T Portal.

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Hydrogen-related topics: Hydrogen-Powered Aircraft (HPA)

TOPIC CODE	TOPIC TITLE	OPENING DATE	DEADLINE	BUDGET PER GRANT Mil €	Number of projects expected to be funded
HORIZON-JU-CLEAN-AVIATION-2022-01-HPA-01	Direct Combustion of Hydrogen in Aero-engines	12/04/2022	23/06/2022	up to 115	1
HORIZON-JU-CLEAN-AVIATION2022-01-HPA-02	Multi-MW Fuel Cell Propulsion System for Hydrogen-Powered Aircraft	12/04/2022	23/06/2022	50	1
HORIZON-JU-CLEAN-AVIATION2022-01-HPA-03	Large Scale Lightweight Liquid Hydrogen Integral Storage Solutions	12/04/2022	23/06/2022	10	1
HORIZON-JU-CLEAN-AVIATION2022-01-HPA-04	Near Term Disruptive Technologies for Hydrogen-Powered Aircraft Subtopic 1. Ground test demonstration of a scaled integrated flight ready Fuel Cell Power Train (~ 500 kW, based on SoA components). Subtopic 2. Flight test demonstration of a small scale but relevant size (min 100 kg LH2) integral tank.	12/04/2022	23/06/2022	EUR 4 million for sub-topic 1 and EUR 3 million for sub-topic 2	1 per subtopic (2 in total)



Europe Rail Partnership

Call 2022



Europe's Rail Joint Undertaking (EU-Rail)

- ▣ The vision of EU-Rail is to deliver, via an integrated system approach, a high capacity, flexible, multi-modal and reliable integrated European railway network by eliminating barriers to interoperability and providing solutions for full integration, for European citizens and cargo.
- ▣ This partnership aims to accelerate research and development in innovative technologies and operational solutions. This will support the fulfilment of European Union policies and objectives relevant for the railway sector and the competitiveness of the rail sector and the European rail supply industry. In this way, EU-Rail will accelerate the penetration of integrated, interoperable and standardised technological innovations necessary to support the Single European Railway Area (SERA).
- ▣ **HYDROGEN IN EU-RAIL: Boosting alternatives to the use of fossil fuels are unavoidable for the overall European rail system. Every potential solution, mainly energy storage system and hydrogen (H2) have to be considered.**
- ▣ Related calls for proposals are available at:
<https://shift2rail.org/participate/call-for-proposals/>



WORK PROGRAMME 2022-2024 adopted by the EU-Rail Governing Board on 1 March 2022

In accordance with Council Regulation (EU) 2021/2085 and with Article 33 of the Europe's Rail Financial Rules S2R Decision n° 11/2019.

The Annual Work Plan is made publicly available after its adoption by the Governing Board.

NOTICE RELATED TO S2R JU SUCCESSOR

On 30 November 2021, Council Regulation (EU) 2021/2085 of 19 November 2021, establishing the Joint Undertakings under Horizon Europe and repealing Regulations (EC) No 219/2007, (EU) No 557/2014, (EU) No 558/2014, (EU) No 559/2014, (EU) No 560/2014, (EU) No 561/2014 and (EU) No 642/2014, entered into force. In accordance with this Regulation, the Europe's Rail Joint Undertaking (EU-Rail) became the legal and universal successor in respect of all contracts, including employment contracts, procurement contracts and grant agreements, liabilities and acquired property of the Shift2Rail Joint Undertaking (S2R JU). Therefore, if reference is made to S2R JU's contracts/agreements/assets/liabilities in this Work Programme, they should be understood as those of EU-Rail's. In addition, in accordance with Article 174(12), at its first meeting on 21 December 2021, the Governing Board adopted Decision 2/2021 listing the decisions adopted by the Governing Board of S2R that shall continue to apply for EU-Rail.

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Hydrogen-related topics: Hydrogen-Powered Aircraft (HPA)

TOPIC CODE	TOPIC TITLE	OPENING DATE	DEADLINE	BUDGET PER GRANT Mil €	Number of projects expected to be funded
HORIZON-ER-JU-2022-FA4-01	A sustainable and green rail system	10/03/2022	23/06/2022	38.3	1



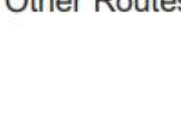
Clean Hydrogen Partnership

Call 2022

SRIA: Research & Innovation Activities



Clean Hydrogen Partnership



Large Scale Storage

Hydrogen in natural gas grid

Liquid Hydrogen Carriers

Hydrogen Transport

Compression, Purification, Metering

Hydrogen Refuelling Stations



Building Blocks



Transport Applications

Aeronautic



Stationary Applications



Heavy Duty



Waterborne



Rail



Stationary Fuel Cells



Turbines, Boilers, Burners



Cross-cutting



Hydrogen Valleys



Supply chain



Strategic Research Challenges

Production



Distribution and Storage

End-use

Horizontal Activities



Renewable Hydrogen Overview

Topic	Type of Action	Ind. Budget (M€)	Deadline
HORIZON-JTI-CLEANH2-2022-01-07: Bringing renewable hydrogen MW scale off-grid installations closer to technical and financial maturity	IA	9	31/05/2022
HORIZON-JTI-CLEANH2-2022-01-08: Integration of multi-MW electrolysers in industrial applications	IA 	18	20/09/2022
HORIZON-JTI-CLEANH2-2022-01-09: Scaling-up technologies for SOEL	RIA	2 x 3	31/05/2022
HORIZON-JTI-CLEANH2-2022-01-10: Demonstrating offshore production of renewable hydrogen	IA 	20	20/09/2022



Hydrogen Storage and Distribution Overview

3

Topic	Type of Action	Ind. Budget (M€)	Deadline
HORIZON-JTI-CLEANH2-2022-02-01: Compatibility of Distribution non-steel metallic gas grid materials with hydrogen	RIA	2,5	20/09/2022
HORIZON-JTI-CLEANH2-2022-02-02: Hydrogen and Hydrogen/Natural gas mixture leak detection system for continuous monitoring and safe operation of HRS and future Hydrogen/Natural gas mixture networks	RIA	2,5	31/05/2022
HORIZON-JTI-CLEANH2-2022-02-03: Validation of a high-performance hydrogen liquefier prototype	RIA	5	31/05/2022
HORIZON-JTI-CLEANH2-2022-02-04: Ammonia to Renewable Hydrogen: efficient system for ammonia cracking	RIA	3	20/09/2022
HORIZON-JTI-CLEANH2-2022-02-05: Efficient system for dehydrogenation of liquid organic hydrogen carriers	RIA	3	20/09/2022
HORIZON-JTI-CLEANH2-2022-02-06: Development of large scale LH2 containment for shipping	RIA	6.5	20/09/2022

EUROPEAN PARTNERSHIP






Hydrogen Storage and Distribution Overview

4

Topic	Type of Action	Ind. Budget (M€)	Deadline
HORIZON-JTI-CLEANH2-2022-02-07: Increased hydrogen capacity of GH 2 road trailers	RIA	2,5	31/05/2022
HORIZON-JTI-CLEANH2-2022-02-08: Development of novel or hybrid concepts for reliable, high capacity and energy-efficient H2 compression systems at real-world scale	IA	5	31/05/2022
HORIZON-JTI-CLEANH2-2022-02-09: Sampling methodology and quality assessment of HRS	RIA	4	31/05/2022
HORIZON-JTI-CLEANH2-2022-02-10: Implementing new/optimised refuelling protocols and components for high flow HRS	RIA	2 x 4	31/05/2022
HORIZON-JTI-CLEANH2-2022-02-11: Development and demonstration of mobile and stationary compressed hydrogen refuelling solutions for application in inland shipping and short-distance maritime operations	IA	7	20/09/2022



Transport Overview

Topic	Type of Action	Ind. Budget (M€)	Deadline
HORIZON-JTI-CLEANH2-2022-03-01: Development and optimisation of reliable and versatile PEMFC stacks for high power range applications	RIA	2 x 3,5	20/09/2022
HORIZON-JTI-CLEANH2-2022-03-02: Innovative and optimised MEA components towards next generation of improved PEMFC stacks for heavy duty vehicles	RIA	2 x 3	31/05/2022
HORIZON-JTI-CLEANH2-2022-03-03: Large scale demonstration of European H2 Heavy Duty Vehicle along the TEN-T corridors	IA 	30	31/05/2022
HORIZON-JTI-CLEANH2-2022-03-04: Liquid hydrogen tanks for heavy-duty vehicles	RIA	2 x 2,5	31/05/2022
HORIZON-JTI-CLEANH2-2022-03-05: Large scale demonstration of hydrogen fuel cell propelled inland waterway vessels	IA 	15	31/05/2022
HORIZON-JTI-CLEANH2-2022-03-06: Development and optimisation of a dedicated Fuel Cells for Aviation: from dedicated stack (100s kW) up to full system (MWs)	RIA	20	31/05/2022



Transport Overview

Topic	Type of Action	Ind. Budget (M€)	Deadline
HORIZON-JTI-CLEANH2-2022-03-07: Development of specific aviation cryogenic storage system with a gauging, fuel metering, heat management and monitoring system	RIA	10	31/05/2022
HORIZON-JTI-CLEANH2-2022-03-08: Development and optimisation of a dedicated Fuel Cells for Aviation: disruptive next-gen high temperature Fuel Cells technology for future aviation	RIA	5	31/05/2022



Clean Heat and Power Overview

3

Topic	Type of Action	Ind. Budget (M€)	Deadline
HORIZON-JTI-CLEANH2-2022-04-01: Design and industrial deployment of innovative manufacturing processes for solid oxide fuel cells systems and fuel cell components	IA	7	20/09/2022
HORIZON-JTI-CLEANH2-2022-04-02: Ammonia powered fuel cell system focusing on superior efficiency, durable operation and design optimisation	RIA	4	31/05/2022
HORIZON-JTI-CLEANH2-2022-04-03: Reversible SOC system development, operation and energy system (grid) integration	RIA	5.5	31/05/2022
HORIZON-JTI-CLEANH2-2022-04-04: Dry Low NOx combustion of hydrogen-enriched fuels at high-pressure conditions for gas turbine applications	RIA	2 x 4	31/05/2022



Cross-cutting Issues Overview

Topic	Type of Action	Ind. Budget (M€)	Deadline
HORIZON-JTI-CLEANH2-2022-05-01: Public understanding of hydrogen and fuel cell technologies	CSA	1	20/09/2022
HORIZON-JTI-CLEANH2-2022-05-02: Safety of cryogenic hydrogen transfer technologies in public areas for mobile applications	RIA	2	31/05/2022
HORIZON-JTI-CLEANH2-2022-05-03: Safe hydrogen injection management at network-wide level: towards European gas sector transition	RIA	3	20/09/2022
HORIZON-JTI-CLEANH2-2022-05-04: Development of validated test methods and requirements for measuring devices intended for measuring NG/H2 mixtures	RIA	2	31/05/2022
HORIZON-JTI-CLEANH2-2022-05-05: Research & Innovation co-operation with Africa on hydrogen	CSA	1	31/05/2022



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