

## FROM IDEAS TO IMPACT: EU AND GLOBAL RESEARCH AND INNOVATION COLLABORATIONS FOR ACCELERATING CLEAN ENERGY TRANSITIONS

**Research and Innovation is crucial to accelerate clean energy transitions. Horizon Europe, the EU R&I framework programme invests in clean energy solutions including through collaborations with the public and private sectors through Horizon Europe partnerships and European missions.**

At international level, the Commission is part of Mission Innovation a global initiative catalysing a decade of action and investment in research, development, and demonstration to make clean energy affordable, attractive, and accessible for all.

Mission Innovation launched seven Missions which bring together dynamic and delivery-focused high ambition alliances between countries, corporations, investors, and research institutes that set global stretch goals and provide momentum to make sure more innovation happens, more rapidly. The Commission co-leads the missions on Clean Hydrogen and Urban Transitions, is core member of the missions Integrated Biorefineries and Net-Zero Industries and support member of the missions Carbon Dioxide Removal, Green-Powered Future and Zero-Emission Shipping.

**EU and global research and innovation collaborations accelerate clean energy transitions, including in the following priority areas:**



### Clean Hydrogen

In the EU, renewable hydrogen is one of the priority areas where innovative and market-ready technologies are needed to accelerate the phasing-out of fossil fuels and to ensure economic and social welfare to EU citizens. The EU aims to produce 10 million tonnes of renewable hydrogen per year domestically plus an additional 10 million tons of annual hydrogen imports by 2030. With Horizon Europe, the Commission invests EUR 1 billion in the Clean Hydrogen Partnership for research and innovation activities with industry. With the **REPowerEU Action Plan, the Commission invested an additional 200MEUR to double the number of Hydrogen Valleys across the EU by 2025.** The Mission Innovation Clean Hydrogen Mission brings together 20 countries and 6 international and private organisations to stimulate innovation, knowledge exchange, and international cooperation, and facilitate investment in specific areas of research, innovation, development, and demonstration to accelerate progress towards a global clean hydrogen economy. It aims **to reduce end-to-end clean hydrogen costs to USD \$2 per kg by 2030 and establish 100 hydrogen valleys globally by 2030.**



### Urban Transitions

As hotspots of emissions and mitigation, cities are main actors in reaching the targets of the European Green Deal: reduce emissions by at least 55% by 2030 and achieve climate neutrality in the EU by 2050. These ambitious targets add to a backdrop where cities already implement 70% of EU policies on the ground and deliver solutions and services closer to local businesses and citizens. **The European Mission on climate-neutral and smart cities is working with 100 European cities to become climate-neutral by 2030** allowing them to act as experimentation and innovation hubs to put all European cities in a position to become climate-neutral by 2050. 12 cities from associated countries also participate in the Mission, thus extending its activities to enlargement countries and the EU's neighborhood cities. Inspired by the EU Mission, the Mission innovation Urban Transitions Mission promotes integrated and collective action for net-zero cities. It brings together 6 countries and 11 international and private organisations and has **selected a cohort of 48 cities as first step towards building a cohort of 300 cities worldwide by 2024**, that will promote and demonstrate pathways to net-zero transitions across world regions.



## Renewable Energy

The clean energy transition is a key element of the European Green Deal. To achieve this goal, all renewable energy technologies must increase their contribution to the future technology mix. The EU has set ambitious targets for renewable energy: **by 2030, EU countries committed to sourcing 42.5% of its energy from renewable sources with a potential top to 45%.** This will require massive investments in renewable energy production, renewable and hydrogen infrastructures, and reinforcement of Europe's power grids. The Mission Innovation Green Powered Future Mission brings together 15 countries and 14 international and private organisations. It strives **to demonstrate that power systems can integrate up to 100% variable renewable energy by 2030** while ensuring cost-efficiency and security.



## Net-Zero Industries

The European Green Deal Industrial Plan aims to create a more autonomous and resilient EU industry, with the proposed Net-Zero Industry Act and Critical Raw Materials Act serving as its building blocks. The first aims to scale up clean technology manufacturing in the EU with **a proposed target to provide at least 40% of the EU's annual deployment needs for strategic net-zero technologies by 2030.** The latter aims to diversify the resilience of EU critical raw material supply chains and enhance circularity and sustainability. The Mission Innovation Net-Zero Industries Mission brings together 10 countries and 5 international and private organizations. With the same ambition, it seeks **to support the worldwide implementation of at least two large scale demonstration projects for each innovation field and sector**, to expedite the development of new and radical breakthrough low emissions technologies to Technology Readiness Level 8.



## Zero-Emissions Shipping

Shipping and shipbuilding are a high priority for Europe. EU measures to decarbonise the maritime sector, currently one of the largest emitters of greenhouse gases, include setting milestones for zero-emission marine vessels to be market ready by 2030 (2020 Strategy for Sustainable and Smart Mobility), extending the EU Emission Trading System to the maritime transport sector, and promoting the use of sustainable alternative fuels (FuelEU Maritime Regulation). In line with such efforts, at the international level the Zero-Emission Shipping Mission, bringing together 14 countries and 2 international and private organisations is working **to demonstrate commercially viable zero-emission ships by 2030.**



## Carbon Dioxide Removal

Carbon removals are a crucial component of our climate strategy. Carbon dioxide must be actively removed from the atmosphere and stored, through technology or natural carbon sinks. For this reason, the EU Communication on Sustainable Carbon Cycles provides a roadmap to promote carbon removal technologies and carbon farming practices. To enhance the growth of carbon removals future Union strategy will establish a market for the capture, transport, storage, and utilisation of CO<sub>2</sub> by 2030. Internationally, the Carbon Dioxide Removal Mission, bringing together 12 countries and 6 international and private organisations aims enable carbon dioxide removal (CDR) technologies **to achieve a net reduction of 100 million tonnes of CO<sub>2</sub> per year by 2030.**



## Integrated Biorefineries

Low-carbon and renewable alternatives to fossil-based fuels, chemicals, and materials have a fundamental role today, especially in the transport and chemicals sectors, which account for nearly one-third of global emissions. The EU supports the decarbonisation of hard to abate sectors, including the aviation and waterborne sectors through the EU regulatory framework (for instance the REFuelEU Aviation Regulation, the FuelEU maritime Regulation and the EU Emissions Trading System), R&I investment programmes such as Horizon Europe and through Horizon Europe partnerships with industry. The Integrated Biorefineries Mission aims to demonstrate innovative solutions to accelerate the commercialisation of integrated biorefineries, bringing together 6 countries and 2 international organisations aims **to develop and demonstrate innovative solutions to accelerate the commercialisation of integrated biorefineries, with a target of replacing 10% of fossil-based fuels, chemicals and materials with bio-based alternatives by 2030.**

## EU R&I FLAGSHIP PROJECTS, SUPPORTED BY HORIZON EUROPE, DEMONSTRATING SOLUTIONS IN THE PRIORITY AREAS OF THE MISSION INNOVATION MISSIONS.



### Hydrogen Energy Applications for Valley Environments in Northern Netherlands

This large-scale demo project will bring together production, distribution, storage and local end-use of H<sub>2</sub> into a fully integrated and functioning "H<sub>2</sub> valley" (H<sub>2</sub>V), which can serve as a blueprint for replication across Europe and beyond. Based on the deployment & integration of existing & planned project clusters across six locations in the Netherlands, the project is expected to have a profound impact on the region's energy landscape. By showcasing the integration of renewable energy sources and the coupling of electricity and gas infrastructures, the project demonstrates a comprehensive approach to decarbonizing industry, power generation, transport, and heating systems throughout the entire region.

<b>Budget</b>	Total cost <b>€96 191 883,93</b> EU contribution <b>€20 000 000,00</b>
<b>Countries</b>	Coordinated by the Netherlands
<b>Duration</b>	1 Jan 2020 – 31 Dec 2025



### Steel + Ethanol

The STEELANOL project, funded under Horizon 2020 to contribute to competitive low-carbon energy, aims to demonstrate new technologies to produce advanced biofuel. It proposes an innovative fermenting process of exhaust gases emitted by the steel industry that are currently used for electricity production or burned. Its main objective is to demonstrate the cost-effective production of sustainable bioethanol and evaluate its potential as a fuel derivative for the transport sector. The environmental performance of the produced bioethanol will be evaluated by a Life-Cycle Assessment, enabling a comparison with other fuels.

<b>Budget</b>	Total cost <b>€14 560 736,75</b> EU contribution <b>€10 192 515,73</b>
<b>Countries</b>	Coordinated by Spain
<b>Duration</b>	1 May 2015 – 31 Mar 2024



### Digital Urban European Twins

The DUET project aims to revolutionise decision-making processes in cities, through the creation of digital twins, which are computer replicas of city systems. Digital twins allow city planners and officials to test their ideas and make more informed decisions using large open data sources and advanced technologies. The project's main objective is to leverage advanced technologies, such as cloud computing and high-performance computing, to transform the traditional public policy-making. DUET will have a significant impact on city management and will make public sector decision-making more democratic and effective. Today, the DUET Digital Twin platform (City Twin) can already be accessed by anyone at <https://citytwin.eu/>.

<b>Budget</b>	Total cost <b>€4 516 957,50</b> EU contribution <b>€3 965 032,50</b>
<b>Countries</b>	Coordinated by Belgium
<b>Duration</b>	1 Dec 2019 to 30 Nov 2022



### Improvements to Integrate High Pressure Alkaline Electrolysers for Electricity/H<sub>2</sub> production from Renewable Energies to Balance the Grid

ELYGRID aims to leverage wind power to produce and store hydrogen, which can compensate for the intermittency of Renewable Energy Sources and ensure a stable energy supply by linking wind turbines to electrolyzers, storage facilities and fuel cells. ELYGRID focused on developing megawatt-scale alkaline electrolyzers with capacities exceeding 0.5 MW to reduce the cost of hydrogen production through electrolysis coupled with RESs. By improving efficiency of electrolyzers and reducing its costs by a quarter, the project contributed to reduce the cost of hydrogen production.

<b>Budget</b>	Total cost <b>€3 701 178,33</b> EU contribution <b>€2 105 017,00</b>
<b>Countries</b>	Coordinated by Spain
<b>Duration</b>	1 Nov 2011 – 31 Dec 2014



### Smart European Shipbuilding project

The EU-funded SEUS project aims to bolster European shipyards by creating a framework that integrates advanced shipbuilding life-cycle management with computer-aided design, manufacturing, engineering, and product data software. SEUS will introduce innovative practices for knowledge management, data-driven AI design and intelligent technology. The goal is to enhance efficiency across all production stages, from engineering to assembly and construction of shipyards. The project will create by 2026 a digital platform that will provide software tools that allow the efficient design, construction, and operation of ships, saving up to 30% of time in engineering and up to 20% time in assembly and construction.

<b>Budget</b>	Total cost <b>€8 590 667,50</b> EU contribution <b>€6 992 201,50</b>
<b>Countries</b>	Coordinated by Norway
<b>Duration</b>	1 Jan 2023 – 31 Dec 2026



### Creating the technology for safe, long-term carbon storage in the subsurface

The EU-funded CarbFix2 project provides a ground-breaking approach to reduce carbon emission by converting CO<sub>2</sub> into stable carbonate rocks, effectively removing it from the atmosphere. It builds upon the success of its predecessor, the CarbFix project, well-known for its safe and efficient geologic carbon storage method. CarbFix2 improved the technology by co-injecting impure CO<sub>2</sub> and other water-soluble polluting gases into the subsurface, developing a geological carbon storage method using seawater injection into submarine basalts and integrating the CarbFix method with air-capture technology.

<b>Budget</b>	Total cost <b>€2 200 318,75</b> EU contribution <b>€2 200 318,00</b>
<b>Countries</b>	Coordinated by Iceland
<b>Duration</b>	1 Aug 2017 – 31 Jan 2021

MORE INFORMATION

<http://mission-innovation.net/>

DG RTD ENERGY PAGES  
[Energy \(europa.eu\)](https://energy.europa.eu)

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### Hybrid Biomethane Production from Integrated Biomass Conversion

HYFUELUP is an EU-funded project that aims to develop an innovative pathway for the efficient and cost-effective production of biomethane. The project combines thermochemical technologies, which convert biomass into gas, with renewable hydrogen, which enhances the gas quality. The project will integrate these technologies at a pre-commercial scale and establish a complete value chain for biomethane production and distribution. This comprehensive approach will contribute to wider adoption of biomethane in the transport and energy sectors. It is expected that the technology developed in HYFUELUP can be replicated throughout the world, leading to a significant reduction in greenhouse gas emissions (over 90% reduction compared to natural gas).

<b>Budget</b>	Total cost <b>€11 573 443,92</b> EU contribution <b>€10 294 334,44</b>
<b>Countries</b>	Coordinated by Portugal
<b>Duration</b>	1 Nov 2022 – 31 Oct 2026



**MISSION  
INNOVATION**  
CATALYSING CLEAN ENERGY  
SOLUTIONS FOR ALL



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