



RESEARCH & INNOVATION TO SUPPORT NET-ZERO INDUSTRIAL TECHNOLOGIES

16 March 2023

The [Green Deal Industrial Plan](#) aims to boost the competitiveness of Europe's net-zero industry and to accelerate the transition to climate neutrality. The Plan is based on four pillars: (1) a predictable and simplified regulatory environment; (2) faster access to funding; (3) developing skills for net-zero industry; and (4) open trade for resilient supply chains.

A key part of the first pillar is the [Net Zero Industry Act](#). This Regulation supports Europe's green transition and energy security. The Net Zero Industry Act will massively increase the technological development, manufacturing production and installation of net-zero products and energy supply in the EU over the next decade, including with an objective to annually capture and safely store 50 Million tonnes of CO₂ emissions permanently (CCS) from 2030.

With Horizon Europe, the EU is investing €40 billion in research and innovation (R&I) for the European Green Deal, including partnering with industry and Member States. EU investments in R&I help facilitate the flourishing of net-zero industrial value chains across Europe. R&I also ensure that these net-zero technologies lead to less use of resources, increased circularity in the use of raw materials, and a more sustainable life cycle, including in manufacturing.

Net-zero technologies include the machinery used for their production. The EU is strongly supporting advanced manufacturing technologies, with the highest share of world patent applications and the highest number of firms backed by venture capital. For example, 'Made in Europe' is a Horizon Europe Partnership with a total budget of up to €1.8 billion (€900 million from Horizon Europe) dedicated to keeping EU leadership in smart and sustainable production.

“*Europe has an opportunity to place a big bet on knowledge and foster a human-centric transformation of our economy and society as a whole.*

We must connect all the links in the value chains, unleashing the enormous potential of the R&I public and private partnerships offered by Horizon Europe.

We need to remove obstacles that are in the way of building pro-innovation ecosystems and technology infrastructures, and we must accelerate the time to market.

Our investments must bridge research and innovation, with education, to ensure real social innovation, involving citizens and providing the skills needed for the industries of the future.”

Mariya Gabriel, EU Commissioner for Innovation, Research, Culture, Education and Youth



Research and
Innovation

STEPPING UP EU RESEARCH AND INNOVATION TO STAY AHEAD OF THE GAME AND ACCELERATE THE ROLL-OUT OF THE EU'S STRATEGIC NET-ZERO TECHNOLOGIES

The Net Zero Industry Act addresses technologies that will make a significant contribution to decarbonisation. These include: solar photovoltaic and solar thermal, onshore wind and offshore renewable energy, batteries and storage, heat pumps and geothermal energy, electrolysers and fuel cells, biogas/ biomethane, carbon capture, utilisation and storage, and grid technologies, sustainable alternative fuels technologies, advanced technologies to produce energy from nuclear processes with minimal waste from the fuel cycle, small modular reactors, and related best-in-class fuels.

EU R&I has played a major role in the past decade to mature these technologies. Horizon Europe, the current EU Framework Programme for R&I will continue to support further leaps forward to make them more sustainable, efficient, safe and cost-competitive. In order to deliver on the European Green Deal and the Green Deal Industrial Plan, Horizon Europe and its Partnerships with industry and Member States support these technologies with a total budget of almost €6 billion for the period 2021-2027.



The Processes4Planet Partnership (total budget of up to €2.6 billion [€1.3 billion from Horizon Europe]) targets emerging technologies, as well as scaling up technologies already developed at higher technology readiness levels, which will help make European energy-intensive process industries cleaner and enhance their competitiveness, while achieving climate neutrality in Europe by 2050.”



The Clean Steel Partnership (total budget of up to €1.7 billion [€0.7 billion from Horizon Europe]) supports research up to industrial scale of breakthrough steelmaking technologies.



The Clean Energy Transition Partnership with Member States (total budget of up to €791.2 million [€210 million from Horizon Europe]), invests in a variety of clean energy technologies and system solutions to empower the clean energy transition, by pooling national and regional RDTI funding.



The Circular Bio-based Europe Joint Undertaking (total budget of up to €2 billion [€1 billion from Horizon Europe]) supports technologies advancing competitive circular bio-based industries.



The Batteries4EU Partnership (total budget of up to €1.85 billion [€0.925 billion from Horizon Europe]) invests in battery and storage technologies to establish in Europe, by 2030, the best-in-the-world innovation ecosystem to boost a competitive, sustainable and circular European battery value chain.



The Clean Hydrogen Joint Undertaking (total budget of up to €2.4 billion [€1.2 billion from Horizon Europe]) invests in R&I for renewable hydrogen, covering the whole value chain, from production to end-use applications, including Hydrogen Valleys. Thanks to its predecessors, the EU is now a world leader in electrolyser technologies.

Energy-intensive industries, the second largest global source of energy-related CO₂ emissions, need specific technologies to integrate renewable energy, green hydrogen, and heat pumps (towards energy efficiency) to decarbonise. For this reason, the European Commission is examining deployment opportunities as part of the [ERA industrial technology roadmap for low-carbon technologies in energy-intensive industries](#), and is also engaging with the Process4Panet Partnership.

Since 2007, the **Strategic Energy Technology Plan** (SET Plan) has been instrumental in fostering collaboration among EU countries, industry, and research institutions to facilitate the achievement of the EU's climate and energy goals, and to strengthen industrial competitiveness throughout the EU. It has established ambitious R&I targets to be reached in the next decade in energy efficiency and low-carbon energy technologies. The European Green Deal is an opportunity for a revamped SET Plan to mobilise the R&I investments in Europe towards achieving climate-neutrality by mid-century.

EU R&I RESULTS IN THE STRATEGIC NET ZERO TECHNOLOGIES



SOLAR PHOTOVOLTAIC AND SOLAR THERMAL TECHNOLOGIES

The massive deployment of **solar energy** in the EU, as proposed in [REPowerEU](#), requires a drastic upscaling of the manufacturing of innovative and sustainable solar photovoltaics (PV). [IBC4EU](#) (EU funding of €13.5 million) will develop cost-effective production equipment for interdigitated back contact solar cell and module technology. It will also use **eco-design approaches to reduce the need for scarce materials**. [SEAMLESS-PV](#) (EU funding of €12.6 million) will develop advanced flexible automated PV equipment manufacturing based on high efficiency c-Si technologies, and upscale new manufacturing processes that enable the seamless integration of PV in final applications.



ONSHORE AND OFFSHORE WIND TECHNOLOGIES

The fast-growing European **wind energy** market calls for the demonstration of innovative materials, supply cycles, and recycling technologies to increase the overall circularity of wind energy technology and to reduce the primary use of critical raw materials. [Blades2Build](#) (EU funding of €12.4 million) will explore and demonstrate how to **recycle, repurpose, and reuse wind turbine blade waste** in an economically viable and more sustainable way. [INFINITE](#) (EU funding of €15.5 million) demonstrates a 4.8 MW, scalable, modular, and self-installing **floating offshore wind** system at 100m water depth using innovative anchoring technology and showing huge potential for industrialisation.



GRID TECHNOLOGIES

Smart grids represent an electricity network that can intelligently integrate generators, consumers and energy storage in order to efficiently deliver electricity. [TESTBED](#) and [TESTBED2](#) project (EU funding of €1.6 million, total) will increase grid efficiency and carbon emission savings for the supply of renewable energy to electric power grids.



ELECTROLYSERS AND FUEL CELLS

Renewable hydrogen can replace fossil fuels as a feedstock to decarbonise industrial processes such as steel, glass and aluminium manufacturing or the production of fertilisers and chemicals. Important cost reductions and increased lifetime in the different electrolysis technologies can be realised **using new materials and of innovative manufacturing techniques for mass-production**.

[SUSTAINCELL](#) (EU funding of €9.9 million) will support the European renewable hydrogen industry in the development of **next generation electrolyser and fuel cell technologies**.

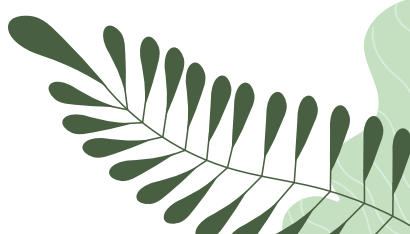
[HEAVENN](#) (EU funding of €20 million) is a large-scale programme of demo projects bringing together core elements: **production, distribution, storage and local end-use of renewable hydrogen into a fully integrated and functioning 'Hydrogen Valley'** that can serve as a blueprint for replication across Europe and beyond.

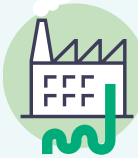
[GreenHyScale](#) (EU contribution of €30 million) aims to accelerate the **large-scale production of green hydrogen** by building and operating the **first 100 MW green electrolysis plant** to be erected in GreenLab at Skive, Denmark, and replicable in the rest of the world for greater impacts.



BATTERY/STORAGE TECHNOLOGIES

The production capacity for **batteries** needs to increase 10-fold by 2030. [LIPLANET](#) (EU funding of €1.9 million) contributed to **building a more competitive lithium battery cell manufacturing ecosystem** and increase the production of lithium battery cells towards industrial scale by bringing together the most relevant European lithium battery cell pilot lines. [SOLIDIFY](#) (EU funding of €7.8 million) is developing a unique manufacturing process and solid-electrolyte material to fabricate lithium-metal solid-state batteries.





HEAT PUMPS AND GEOTHERMAL ENERGY TECHNOLOGIES

The fight against global warming necessitates us finding ways to **reduce the costs of heating, cooling, and electricity in cities**. **TRI-HP** (EU funding of € 4.9 million) will offer tailored solutions for **European multi-family buildings**. The Trigereneration systems use heat pumps with natural refrigerants and a wide range of renewable sources. **PUSH2HEAT** (EU funding of €7.8 million) funds many demonstrators in different Member States to push forward the market potential of heat upgrade technologies.

Geothermal energy has large potential as a clean renewable energy source. The conventional technology is mainly based on **heat extraction from hot permeable aquifers**. Such aquifers are hard to find, limit the applications and imply high cost and risks. **HOCLOOP** (EU funding of €4.9 millions) aims to mitigate this challenge. The solution is based on **new drilling technology** and solves the challenges of conventional construction of geothermal wells.



NUCLEAR ENERGY

Small Modular Reactors are opening new perspectives for decarbonising industrial processes. With very high temperature reactors (VHTR, more than 800°C), nuclear technologies will have applications for the petrochemical industry (ethylene, styrene), for steam electrolysis, for thermochemical hydrogen production, and for direct steelmaking. **TANDEM** (EU funding of €3.4 million) aims to facilitate the safe, secure and efficient integration of SMRs into smart low-carbon hybrid energy systems.

Sustained EU investments of around €100 million per year aim to make **fusion energy** a reality – a new, clean and carbon-free energy source that can be used for the long-term decarbonisation of energy-intensive industries.



BIOMETHANE TECHNOLOGIES

HYFUELUP (EU funding of €10.3 million) will develop an **advanced technology for biomethane production** using gasification and methanation. The biomethane produced will then be liquefied and used for the decarbonisation of **long-distance road freight transport and maritime transportation**.

METHAREN (EU funding of €10.4 million) aims to demonstrate a **cost-effective, innovative, more sustainable, and circular biomethane production system** that enables intermittency management of renewable energy sources. It aims to demonstrate a 50% reduction in greenhouse gas emissions compared to the current process.



CO2 CAPTURE, UTILISATION AND STORAGE (CCUS) TECHNOLOGIES

Carbon capture, utilisation, and storage (CCUS) will also play an important role in decarbonising hard to abate industrial emissions. **C4U** (EU funding of €12.5 million) addresses all the **essential elements required for the optimal integration of CO2 capture in the iron and steel industry as part of the CCUS chain**. **Steelanol** (EU funding of €10.2 million) is based on producing ethanol via an innovative gas fermentation process using exhaust gases emitted by the steel industry. The **demonstrator will recycle carbon-rich steel industrial gases and transform them into sustainable ethanol** to further reduce carbon emissions.

More information:

https://ec.europa.eu/info/research-and-innovation/research-area/energy-research-and-innovation_en