

HORIZON-CL4-2022-TWIN-TRANSITION-01-17

Programme: Horizon Europe Title: Integration of hydrogen for replacing fossil fuels in industrial applications (IA) Is Processes4Planet Call: Yes Year: 2021 Publication Date: Tuesday, 22 June, 2021 Opening Date: Tuesday, 12 October, 2021 Deadline Date: Wednesday, 30 March, 2022 Deadline Model: Single-stage **Expected Outcomes:**

Climate neutral, circular and digitised production This destination will directly support the following Key Strategic Orientations, as outlined in the Strategic Plan:KSO C, 'Making Europe the first digitally led circular, climate-neutral and sustainable economy through the transformation of its mobility, energy, construction and production systems.'KSO A, 'Promoting an open strategic autonomy by leading the development of key digital, enabling and emerging technologies, sectors and value chains to accelerate and steer the digital and green transitions through human-centred technologies and innovations. 'KSO D, 'Creating a more resilient, inclusive and democratic European society, prepared and responsive to threats and disasters, addressing inequalities and providing high-quality health care, and empowering all citizens to act in the green and digital transitions.'Proposals for topics under this Destination should set out a credible pathway to the following expected impact of Cluster 4: Global leadership in clean and climate-neutral industrial value chains, circular economy and climate-neutral digital systems and infrastructures (networks, data centres), through innovative production and manufacturing processes and their digitisation, new business models, sustainable-by-design advanced materials and technologies enabling the switch to decarbonisation in all major emitting industrial sectors, including green digital technologies. Accelerating the twin green and digital transitions will be key to building a lasting and prosperous growth, in line with the EU's new growth strategy, the European Green Deal. Europe's ability to lead the twin transitions will require new technologies, with investment and innovation to match. Research and innovation will be fundamental to create the new products, services and business models needed to sustain or enable EU industrial leadership and competitiveness, and to create new markets for climate neutral and circular products. The shift towards a sustainable and inclusive economic model will be further enabled by the broader diffusion and uptake of digital and clean technologies across key sectors. As Europe transitions towards climate neutrality, some

sectors will have to make bigger and more transformative changes than others, due to their centrality in a variety of value chains and their large potential contribution to emissions reductions. Activities under this Destination focus on the twin green and digital transition providing a green productivity premium to discrete manufacturing, construction and energy-intensive industries, including process industries. This will make an essential and significant contribution to achieving climate neutrality in the European Union by 2050, and to the achievement of a circular economy. It will also enhance the Union's open strategic autonomy with regard to the underlying technologies. To achieve these goals, the activities in this Destination are complementary to those in Destination 2, which will enhance open strategic autonomy in key strategic value chains for a resilient industry. The gross added value of the European manufacturing sector is EUR 2,076 billion (2019). The sector employs more than 30 million people in the Union and represents 22% of the world's manufacturing output. The Union's trade surplus in manufactured goods is EUR 421 billion (2019). Similarly, the construction ecosystem (driven mainly by SMEs) offers 22 million jobs and contributes 10.5% of EU-27 global value added[['Updating the 2020 New Industrial Strategy: Building a stronger Single Market for Europe's recovery', COM(2021)350 final and associated Staff Working Documents]]. However, the manufacturing and construction sectors must significantly reduce their pollution and waste, and increase their recycling. Moreover, the potential of digital technologies is underused in manufacturing industry, e.g. 12% of EU enterprises use big data technologies and only 1 out of 5 SMEs is highly digitised, and in construction, which remains one of the least digitised sectors with a notable underinvestment in R&D.[[The digital intensity of the construction sector is below 10%, meaning that the sector has a very slow absorption rate of digital technologies, according to the Digital Transformation Scoreboard 2018,

https://ec.europa.eu/information society/newsroom/image/document/2018-20... A key issue for the manufacturing sector is that its complex supply and value chains are heavily affected by the current pandemic crisis, and the sector needs to further develop resilience against financial and technical disruptions. In addition, the Union's process industries are important to its economy, its resilience and its environmental credentials. Process industries are responsible for a turnover of > 2 trillion, 8.5 million direct jobs and 20 million indirect jobs. They represent 0.5 million enterprises and 5 % of the EU27 GDP. The process industry however faces two key challenges: a strong global competition, and an environmental challenge. In particular, energy-intensive industries are resource intensive, using extensive amounts of raw materials (often imported and fossil based). In their operations, they generate large amounts of waste, 20% of global greenhouse gases (GHG) but also pollutants. The industries need to transform itself to decrease GHG and pollutant emissions, its resource utilisation and its overall environmental impact. It will have to achieve climate neutrality, near zero waste, zero pollution and zero landfill by 2050 at the latest. By 2030, decisive steps need to be taken given the long investment cycles these industries are facing. As the process industry is transforming primary raw materials into materials ready for use by the manufacturing industry, it will play a key role in the pathways toward circularity of materials by transforming industrial and end-oflife waste into secondary raw materials leading to the same quality output in the newly produced materials. In the first Work Programme, outcomes of R&I investments in the long-term will focus on the following impacts: Accelerate the twin green and digital transition of the manufacturing and construction sectors; Create a new green, flexible and digital way to build and produce goods. This will lead to sustainable, flexible, responsive and resilient factories and value chains, enabled by digitisation, AI, data sharing, advanced robotics and modularity. At the same time it will help reduce CO2 emissions and waste in these sectors, and enhance the durability, reparability and re-cycling of products/components. It will also ensure better and more efficient use of construction-generated data to sustain competitiveness and greening of the sector; Make the jobs of the humans working in the manufacturing and construction sectors more attractive and safer, and point the way to

opportunities for upskilling; Set out a credible pathway to contributing to climate neutral, circular and digitalised energy intensive industries; Increase productivity, innovation capacity, resilience, sustainability and global competitiveness of European energy intensive industries. This includes as many as possible new large hubs for circularity by 2025 (TRL 7 or above); developing sustainable ways for circular utilisation of waste streams and CO2/CO streams; and electrifying industry to enable and foster a switch to a renewable energy system; Contribute to a substantial reduction of waste and CO2 emissions, turning them into alternative feedstocks to replace fossil-based raw materials and decrease reliance on imports. In order to achieve the expected outcomes, for particular topics international cooperation is clearly not mandatory but advised with some regions or countries to get internationally connected and add additional specific expertise and value to the activities. In line with the European Green Deal objectives, research and innovation activities should comply with the 'do no significant harm' principle[[as per Article 17 of Regulation (EU) No 2020/852 on the establishment of a framework to facilitate sustainable investment (EU Taxonomy Regulation)]]. Compliance needs to be assessed both for activities carried out during the course of the project as well as the expected life cycle impact of the innovation at a commercialisation stage (where relevant). The robustness of the compliance must be customised to the envisaged TRL of the project. In this regard, the potential harm of Innovation Actions contributing to the European Green Deal will be monitored throughout the project duration. To achieve wider effects activities beyond R&I investments will be needed. Three co-programmed partnerships will enhance dissemination, community building and foster spillover effects: Made in Europe for the manufacturing sectors. Clean Steel and Processes4Planet for the energy intensive industries. This destination has strong links to other clusters in Pillar II, notably Cluster 5 for the activities related to the integration of renewables and thermal energy management in industry, and with the European Innovation Council and Pillar III of Horizon Europe given the strong role of SMEs in the development of the innovations planned. Synergies will be sought to access blended funding and finance from other EU programmes; testing and deployment activities under the Digital Europe Programme (DEP); links to the EIT (Manufacturing and Digital KICs); and links to the thematic smart specialisation platform on industrial modernisation. Much of the research and innovation supported under this Destination may serve as a cradle for the New European Bauhaus: this is about designing sustainable ways of living, situated at the crossroads between art, culture, social inclusion, science and technology. This includes R&I on manufacturing, construction, advanced materials and the circular economy approaches. Business cases and exploitation strategies for industrialisation: This section applies only to those topics in this Destination, for which proposals should demonstrate the expected impact by including a business case and exploitation strategy for industrialisation. The business case should demonstrate the expected impact of the proposal in terms of enhanced market opportunities for the participants and enhanced manufacturing capacities in the EU, in the short to medium term. It should describe the targeted market(s); estimated market size in the EU and globally; user and customer needs; and demonstrate that the solutions will match the market and user needs in a cost-effective manner; and describe the expected market position and competitive advantage. The exploitation strategy should identify obstacles, requirements and necessary actions involved in reaching higher TRLs, for example: matching value chains, enhancing product robustness; securing industrial integrators; and user acceptance. For TRLs 7-8, a credible strategy to achieve future full-scale manufacturing in the EU is expected, indicating the commitments of the industrial partners after the end of the project. Activities beyond R&I investments will be needed to realise the expected impacts: these include the further development of skills and competencies (also via the European Institute of Innovation and Technology, in particular EIT Manufacturing); and the use of financial products under the InvestEU Fund for further commercialisation of R&I outcomes. Where relevant, in the context of skills, it is recommended to

develop training material to endow workers with the right skillset in order to support the uptake and deployment of new innovative products, services, and processes developed in the different projects. This material should be tested and be scalable, and can potentially be up-scaled through the European Social Fund Plus (ESF+). This will help the European labour force to close the skill gaps in the relevant sectors and occupational groups and improve employment and social levels across the EU and associated countries. The topics serving these objectives are structured as follows: Green, flexible and advanced manufacturingAdvanced digital technologies for manufacturingA new way to build, accelerating disruptive change in constructionHubs for circularity, a stepping stone towards climate neutrality and circularity in industryEnabling circularity of resources in the process industries, including waste, water and CO2/COIntegration of Renewables and Electrification in process industry.

(Ref: European Commission)

Scope:

Projects are expected to contribute to the following outcomes: Utilise CO/CO2 streams to produce added value products and/or intermediates of wide industrial interest (e.g. polymers, resins, chemicals, food/feed ingredients, minerals, etc.). Excluding fuels and/or energy carriers; Enhance the market for CO/CO2 based products providing economically viable and sustainable alternatives to existing products with strong market interest in one or more applications (e.g. consumer products, feed/food ingredients, automotive, construction, etc.);Develop concepts enabling 100% utilisation of RES (e.g. electrified processes, concentrated solar, etc.), coping with potential fluctuations in the energy supply; Achieve at least 60% GHG emissions mitigation in the overall lifecycle compared to existing processes for the same products (or relevant benchmark);Develop mature technologies for separation/purification of CO/CO2 containing waste streams to allow the integration in the targeted industry sector/sectors.Relevant indicators and metrics, with baseline values, should be clearly stated in the proposal.Scope: The proposals submitted under this topic are expected to provide concepts for utilisation of CO/CO2 streams from point sources (e.g. large industrial installations such as steel, cement and chemical plants) converting them into added value products and/or intermediates and chemicals of wide interest (plastics, resins, composites, chemicals). The topic excludes explicitly fuels and renewable energy storage concepts. The technologies proposed should support cross-sectorial concepts and sector integration paradigms. They should also be able to work efficiently in a renewable based energy system, coping with potential fluctuations in the energy supply or be fully self-sustained from an energy standpoint. The concepts proposed are expected to: Process significant amounts CO/CO2 containing waste streams from energy intensive industries, including efficient approaches for the pre-treatment of the gaseous stream (e.g. cleaning, compression, drying, concentration, etc.) if needed; Target a range of products and/or intermediates with a wide variety of applications in different sectors (e.g. construction, automotive, food/feed, etc.) to replace existing ones (e.g. fossil based or from virgin raw materials);Consider clearly industrial specifications and relevant market requirements:Demonstrate that targeted products and/or intermediates can fully replace existing counterparts. The prevention of upcycling of hazardous substances, including their separation and disposal should be considered: Demonstrate the improved environmental footprint of the proposed products and processes, as well as other positive impacts using relevant methodologies (e.g. LCA, LCSA, etc.); Provide elements related to the replicability and scalability of the technology, along with the potential for applicability in other Energy intensive industry sectors; Demonstrate the proposed concepts in an industrially relevant environment and at an appropriate scale. The integration of the

proposed technology in existing value chains and the relevance to several European contexts would be an added value;Proposals should consider the co-design of learning resources together with local and regional educational organisations for current and future generations of employees, with the possibility of integrating them in existing curricula and modules for undergraduate level and lifelong learning programmes. Learning resources should integrate the identification of new skills and should propose innovative learning-teaching methods that meet regional social needs and have a high potential for replication.Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.This topic implements the co-programmed European partnership Processes4Planet.Specific Topic Conditions:Activities are expected to start at TRL 5 and achieve TRL 7 by the end of the project – see General Annex B.Cross-cutting Priorities:Co-programmed European Partnerships.

Types of action: IA Specific conditions/Comments:

CLIMATE NEUTRAL, CIRCULAR AND DIGITISED PRODUCTION 2022 (HORIZON-CL4-2022-TWIN-TRANSITION-01)

See budget overview.

Short name: HORIZON-CL4-2022-TWIN-TRANSITION-01-17 - Integration of hydrogen for replacing fossil fuels in industrial applications Type: P4Planet