

Consortium

The ICO₂NIC consortium includes 11 partners from 8 countries, all working together to explore sustainable solutions for turning industrial CO₂ waste streams into feedstock to produce high-value products.



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ICO₂NIC



The ICO₂NIC project has received funding from the European Commission under the Horizon Europe program Ref: 101177459.

Innovative Electrochemical CO₂ Conversion to Versatile Feedstock

ICO₂NIC Project

Our Vision

The ICO₂NIC project (Innovative electrochemical CO₂ Conversion to Versatile Feedstock) is an EU-funded project advancing CO₂ capture and electrochemical conversion to improve economic sustainability.

Converting industrial CO₂ waste streams into chemical products in an economical and energy-efficient manner is essential for sectors to meet EU climate targets and boost their competitiveness. Many production processes still rely heavily on fossil energy carriers and non-renewable raw materials. Carbon Capture and Utilisation (CCU) can reduce the carbon footprint of products derived from these resources. Additionally, electrifying conversion processes and integrating renewable energy sources can significantly lower CO₂ emissions and energy consumption across sectors.

The ICO₂NIC project aims to optimise the cost- and energy-efficient capture, purification, and conversion of CO₂ into valuable chemicals and products, showcasing a Carbon Capture and Utilisation (CCU) approach that delivers economic benefits to industrial CO₂ emitters, end-users, and technology providers.

The 4-year project will combine advancements in CO₂ capture technology based on polymer membranes with a new gas diffusion electrochemical cell to convert CO₂ into formic acid. This formic acid will then be processed through biochemical processes to produce high-value goods and materials, including microbial oils and proteins. Microbial oils will be used in surfactants, beauty care products, and sustainable aviation fuels, while microbial proteins will be utilised for fish feed. ICO₂NIC will create opportunities for substantial long-term CO₂ capture in the refinery sector, supporting decarbonisation efforts.

Objectives

Technology Development

Pioneer technology to turn industrial CO₂ emissions into valuable products like formic acid through efficient capture, clean conversion, and advanced digital control – turning CO₂ into a useful resource.

Technology Integration and Demonstration

Operate a demonstration unit at a refinery to capture CO₂ from flue gas and convert it into formic acid using membrane-based CO₂ capture and electrochemical conversion. ICO₂NIC will test the final products—such as sustainable fuels, cleaning agents, and protein-rich feed—in real-world applications, validating their potential as greener alternatives with industry partners.

Technology Evaluation

Implement a detailed process modelling and techno-economic analysis to support the scaling of the ICO₂NIC demonstrator to an industrial scale, targeting 27.6 kt of annual formic acid production by 2035. A comprehensive Life Cycle Assessment (LCA) will provide critical insights to optimise sustainability and economic performance, reduce technology risks, and accelerate the scale-up of the CO₂-to-formic acid conversion process of ICO₂NIC technologies.

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Our Scalable CO₂ Transformation Pathway



MEMBRANE-BASED
CO₂ CAPTURE



ELECTROCHEMICAL
CO₂ CONVERSION



BIOLOGICAL
PROCESSING



VERSATILE
FEEDSTOCK OUTPUT



SUSTAINABLE
APPLICATIONS

ICO₂NIC Concept

One of ICO₂NIC's main goals is to achieve emission reductions in the process industries, serving as a critical step toward global Net Zero. To this end, the project will build an integrated CO₂ capture, purification and conversion demonstrator at a petrochemical refinery to validate the circularity of the ICO₂NIC CCU concept. By making CCU economically viable, the ICO₂NIC approach will incentivise global emitters to capture and convert waste CO₂, accelerating the transition to a low carbon future.