

e-CODUCT Horizon Europe Project: Conversion of greenhouse gases into valuable chemicals through electrothermal catalysis



Figure 1: e-CODUCT project partners at the 18M General Assembly meeting 4-5th of March 2024 in Caen, France.

24. July 2024 – The innovative e-CODUCT project, funded under Horizon Europe, is at the forefront of converting greenhouse gases and industrial waste streams into valuable products using a cutting-edge electrothermal reactor. The project aims to develop a breakthrough technology that enables the simultaneous reduction of carbon dioxide (CO₂) and hydrogen sulphide (H₂S) to produce marketable green end products in the form of fuels and useful chemicals: methanol (CH₃OH) and sulphur (S).

The e-CODUCT project is developing a pilot plant to demonstrate the conversion of common industrial waste streams, CO₂ and H₂S, into value-added products, using renewable power. This technology aligns with the European Green Deal and will improve environmental performance in various industrial sectors. The technology's ability to efficiently process mixed gas streams and its integration potential into current industrial processes emphasize its economic and environmental benefits, which have been confirmed by a comprehensive techno-economic assessment and life cycle analysis.

The CO₂ emissions should be decreased thanks to the specificity of the reactions. This will be a first-of-a-kind electrified process for CO₂ conversion into platform molecules with demonstrated techno-economic, environmental feasibility and scalability studies.

DEVELOPMENT OF A NOVEL ELECTROTHERMAL FLUIDISED BED REACTOR

The consortium has finalised the reactor design and demonstrated the feasibility of the electrothermal fluidised bed (ETFB) reactor prototype. Challenges in construction, raised by highly corrosive atmosphere and high operating temperatures (>1000 °C), have been successfully overcome by selecting special high-performance materials for ETFB reactor manufacturing. To progress on the integrated pilot, a first version of P&ID has been consolidated. Then, a preliminary HAZOP has been performed. A mass and energy balance sheet of core e-CODUCT technology, with a black box diagram model, TEA and LCA models and an industrial planning tool are under development.

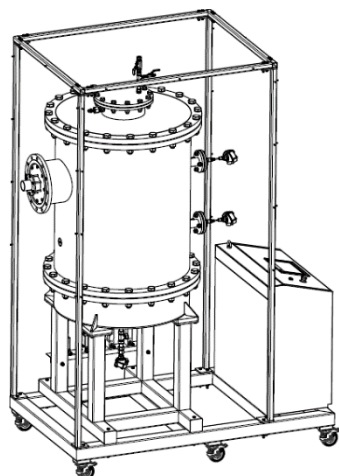


Figure 2: Pilot-scale ETFB reactor design (left) and fluidization tests in the reactor prototype (right).

CONVERSION OF CO₂ AND H₂S INTO VALUABLE CHEMICALS USING RENEWABLE ENERGY

Catalytic tests have demonstrated the conversion of acid gas (H₂S and CO₂ mixture) into COS under mild conditions, leading to the selection of high performing catalysts able to generate a pure stream of products. The catalysts are shaped into extrudates with optimized formulation to be used in industrial reactors. Then, COS is decomposed to CO and S using newly developed ETFB reactor technology. CO is furthermore valorised continuously into platform molecules, such as methanol (CH₃OH) in a high-pressure fixed-bed catalytic reactor, while S is directly recovered as marketable product.

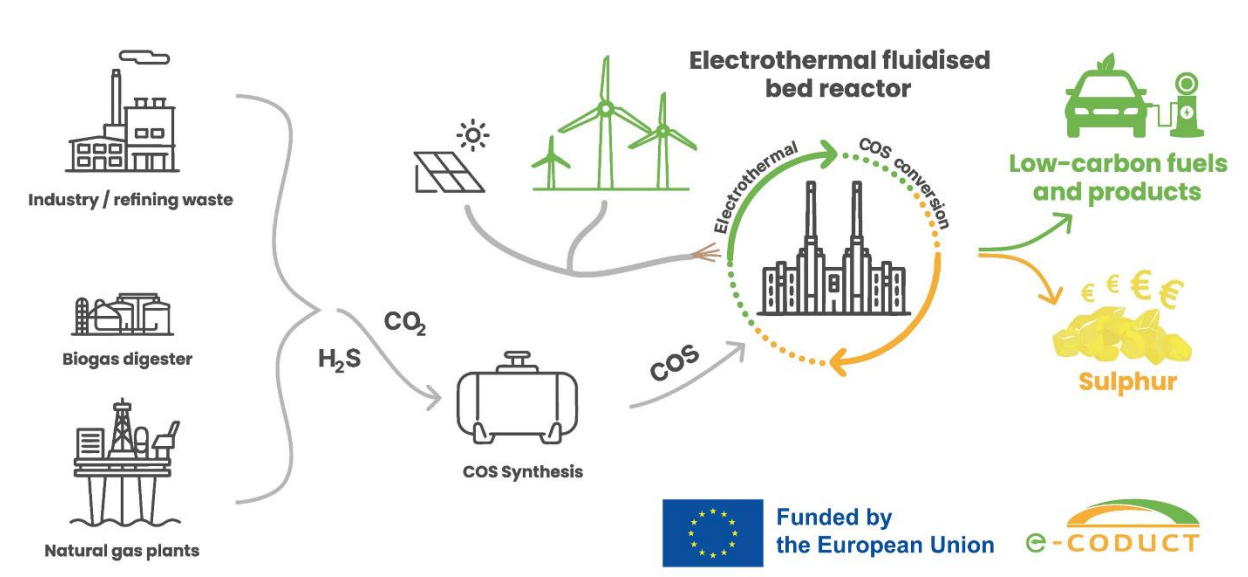


Figure 3: E-CODUCT process for conversion of acid gas (CO₂ and H₂S) into valorized CO and S.

The e-CODUCT project was launched in September 2022 and brings together a consortium of nine leading European research institutions and industry partners from five European countries (Belgium, Slovenia, the Netherlands, France and Germany) to create a sustainable solution for greenhouse gas mitigation. The e-CODUCT project is coordinated by Ghent University and funded under Horizon Europe Grant Agreement n°101058100.

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