Demonstrating sustainable value creation from industrial CO2 by its thermophilic microbial conversion into acetone

Project type: IA – Innovation Action
Start date of the project: 01/10/2021
Duration: 60 months

STRATEGIC INTELLIGENCE BULLETINS 03

Due date		**Delivery date**	July 2022
Work package	WP 6 – Exploitation, Replication, Communication and Dissemination		
Responsible Author(s)	AXELERA		
Contributor(s)	AXELERA		
Dissemination level	PYROCO2 Consortium and AXELERA Cluster		

Version and amendments history

Version	Date	Created/Amended by	Changes
01	29/07/2022		

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

TABLE OF CONTENTS

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 101037009.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

FOREWORD

In the current geopolitical and energy crisis which brings more and more uncertainties concerning the energy supply for the European Union, new ways of producing, storing and reusing energy will be vital.

CO2 capture and utilization (CCU) will be one of the potential ways to reduce our energy dependence. Methods such as methanation or green hydrogen production can help us to produce methane from industrial CO2 and H_2 from renewable energy. Fuels made from CCU can be an opportunity for some sectors as aviation and maritime to reduce their dependence on fossil fuels.

The production of a climate-positive acetone out of industrial CO2 and renewable electricity derived hydrogen is an example of a production of new product without relying on fossil fuel. (PYROCO2 Project)

We are delighted to present the third strategic intelligence bulletin with the latest news about CCUS topic in Europe.

Do not hesitate to send us any comments to improve this document by writing or sharing information that could be relevant for the next bulletin to marcos.versiani@axelera.org

Have a good read!

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

MARKET INFORMATION

LanzaTech, Danone find new method to make PET bottles from captured carbon

NS Packaging Staff Writer, May 2022

A consortium of LanzaTech and food & beverages firm Danone has discovered a new technology to generate monoethylene glycol (MEG), a building block for PET, resin, fibres and bottles. The new technology converts carbon emissions from steel mills or gasified waste biomass directly into MEG. The carbon capture technique leverages the patented designed microbe to convert carbon emissions into MEG directly through fermentation without the need for ethanol intermediate to simplify the MEG supply chain. For more information

---

VTT and Neste to Build an Integrated Power-to-Liquids (e-fuels) Demonstration Facility in Finland

Neste Corporation, June 2022

VTT and Neste have agreed to build a technology demonstration facility at VTT Bioruukki Pilot Centre, Espoo. The work has started by first modifications to the research infrastructure at VTT Bioruukki. During 2022 and early 2023, electrolysis, CO2 capture, and synthesis units located in sea containers will be connected to each other and VTT Bioruukki research infrastructure. The E-fuel project pilot runs are expected to be completed during 2023. Establishing the infrastructure for Power-to-Liquids production contributes to the strengthening of co-operation between Neste and VTT in e-fuel production development from pilot to commercial scale. For more information

---

GRTgaz has started the production of e-methane on its Jupiter 1000 site, in France.

GRTgaz press release, July 2022

GRTgaz has been converting wind-generated electricity into renewable hydrogen for injection into the gas network system since 2020. The demonstrator is taking a new step forward stage: it is starting to produce e-methane, a synthetic gas produced from renewable hydrogen and recycled CO2, in order to inject it into the GRTgaz network. News

---

Decarbonising Aviation: Elyse Energy and Its Partners Launch the Biojet Project

IFP Energies Nouvelles July, 2022

Elyse Energy, the European low-carbon fuel specialist, announces the development of the BioTJet industrial project to produce sustainable aviation fuels in partnership with IFP Energies nouvelles, AVRIL and BioNext. BioTJet capitalizes on the BioTfueL® process, tested and validated in the framework of the eponymous project conducted from 2010 to 2021. For more information

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

Critical Role for CCUS Highlighted in Latest IPCC Report. What's Next? International energy forun (IEF)

May 2022

The UN Intergovernmental Panel on Climate Change (IPCC) has highlighted carbon capture as an essential part of keeping climate targets alive in its latest report. For more information

---

Green Hydrogen Is Cheaper Than LNG in Europe

The wall street journal, July 2022

Green hydrogen now costs less than natural gas in eight European countries. Liquefied natural gas prices will come back to earth, but not without leaving a lasting impact on the multipurpose wonderfuel. High LNG prices mean green hydrogen—produced by a renewable-powered electrolyzer splitting water—is cheaper to burn than natural gas in France, Germany, Italy, Poland, Spain, Sweden, Turkey and the U.K., according to research by BloombergNEF. The fuels' costs are often compared for two reasons: So-called gray and blue hydrogen can be produced using natural gas, and green hydrogen can be a clean substitute for some gas-powered processes. For more information

---

CCU Experts Met in Brussels to Develop a "European Roadmap for CCU"

CO2 Value Europe, July 2022

The roadmap exercise is aimed at developing a structured plan to guide stakeholders by laying down the actions that need to be undertaken to help CCU realize its potential. It will focus on the development of CCU in Europe by at least 2030. For more information

---

Veolia And Metsä Fibre Produce Bio-Methanol From Pulp Mill Waste

Bio Market Insights , June 2022

Veolia and Metsä Fibre announced a long-term partnership agreement on the refining of crude methanol generated in pulp production at the Äänekoski bioproduct mill into commercial biomethanol. As part of this cooperation, Veolia will build a crude methanol refinery connected with Metsä Fibre's Äänekoski bioproduct mill. The €50-million investment is supported by a grant from the Finnish ministry of economy and employment. For more information

---

Presentations and video recording of the CCUS SET-Plan event held on April 1st 2022 available

SET Plan CCUS, April 2022

On the 1st of April 2022, the event "CCUS SET-Plan: progress and future perspectives" took place to gather various stakeholders of the CCUS community in Europe to discuss:

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

- How the EU Commission is supporting the deployment of CCS and CCU with policies and funding instruments
- The progress in the development of some flagship CCS and CCU projects in Europe
- The main achievements of the CCUS SET-Plan and future perspectives

The material of the event is now publicly available and can be found at the links below. Link

Air Liquide to build two new hydrogen production units with carbon capture technology

Gas World , July 2022

Shanghai Chemical Industry Park Industrial Gases (SCIPIG), a subsidiary of Air Liquide, will invest over €200 million to build two hydrogen production units in Shanghai Chemical Industry Park (SCIP). These units will replace the current supply, coming from a third party coal-based gasification unit, and will be equipped with CO2 capture and recycle technology alongside being connected to the existing SCIPIG local network. Air Liquide plan to have the first phase of operation, complete by the year end 2023, with the ability to avoid the emission of 350,000 tons of CO2 per year. For more information

TECHNOLOGY WATCH

State of the Art: CCS Technologies 2022

Global CCS Institute, May 2022

This inaugural Technology Compendium is intended to showcase the breadth and depth of commercially-available CCS technologies worldwide. Contributions to this Compendium have come from some of the world's most prominent technology providers, as well as promising emerging firms. For more information

Canada Nickel identifies new method for accelerated CO2 capture

Global Mining Review, July 2022

Canada Nickel Company Inc. has announced the results of a laboratory test program for a new method of accelerated carbon capture – In Process Tailings Carbonation (IPT Carbonation) that the company believes has transformative potential. The laboratory scale test program demonstrates that this accelerated carbon capture process could allow Crawford tailings to absorb enough carbon dioxide (CO2) to achieve net zero carbon emissions within 36 hours, and generate up to 21 t of CO2 credits per ton of nickel produced within just six days, rather than the multiple months involved in existing passive tailings approaches. At Canada Nickel's Crawford Project, this translates into an

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

average of approximately 710 000 tpy of CO2 credits and 18 million total t of CO2 credits over the preliminary economic assessment (PEA) life-of-mine. Mark Selby, Chair and CEO of Canada Nickel, commented: “These laboratory scale test results demonstrate a potentially transformative process to turn a nickel mine into a net generator of carbon credits rather than a generator of carbon emissions. Our active and accelerated process has the potential to operate at least 8 – 12 times faster than current passive approaches, delivering carbon capture at a multiple of what industry leaders are currently able to achieve. Our process also allows easier quantification and verification of the amount of carbon captured.” For more information

---

CO2 reduction potential of the chemical industry through CCU

Renewable Carbon initiative, May 2022

This study investigates the CO2 emission reductions that can be achieved in the global chemical and derived material industries if the entire demand for embedded carbon is met solely and exclusively via CO2 instead of from fossil sources.

For more information

CCUS scenarios for the cement industry: Is CO2 utilization feasible?

Journal of CO2 Utilization, July 2022

The best CCUS option for each cement plant is dependent on the plant location, as the local market demands, waste heat availability within the plant, and local availability of geological storage sites, amongst other factors, will influence the economics of the CCUS chain. In this work, four illustrative CO2 capture, utilization and storage chains are investigated in order to evaluate the economic feasibility of CCUS technologies in connection to the cement industry

For more information

Carbon-negative production of acetone and isopropanol by gas fermentation at industrial pilot scale

Liew, F.E., Nogle, R., Abdalla, T. et al, March 2022

This article describes the development of a carbon-negative fermentation route to producing the industrially important chemicals acetone and isopropanol from abundant, low-cost waste gas feedstocks, such as industrial emissions and syngas. Using a combinatorial pathway library approach, we first mined a historical industrial strain collection for superior enzymes that we used to engineer the autotrophic acetogen Clostridium autoethanogenum. Next, we used omics analysis, kinetic modeling and cell-free prototyping to optimize flux. Finally, we scaled-up our optimized strains for continuous production at rates of up to ~3 g/L/h and ~90% selectivity. For more information

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 101037009.

Sustainability analysis framework based on global market dynamics: A carbon capture and utilization industry case

Kyung Hwan Ryu, Boeun Kim, Seongmin Heo, July 2022

Abstract:. Carbon capture and utilization (CCU) is attracting much attention as an option for reducing global CO2 emission since it can convert CO2 into more stable and valuable products. One of the most important issues in CCU research is the balance between the global market demand and the supply of the products which can be produced from CO2. However, the majority of previous research did not consider the product supply from the existing plants, and the price reduction caused by the additional supply from CCU processes to be built. To this end, in this work, a systematic analysis framework is proposed to identify optimal deployment strategy for CCU industry with the considerations for global market conditions. To demonstrate the application of the proposed framework, several case studies are designed and performed using the following design variables: time, CO2 processing scale, objective function, and level of market competition. In these case studies, the following representative CCU products are considered, which are obtained from chemical conversion of CO2: gasoline, diesel, methanol, dimethyl ether, dimethyl carbonate and succinic acid. Our analysis results showed that the optimal product portfolio for CCU industry exhibits a complex nonlinear temporal evolution with methanol and dimethyl ether being the best product for the short-term and long-term, respectively. It was also shown that the proposed framework can be used to systematically calculate the maximum capacity of CCU industry, which was estimated to be approximately 350 Mton CO2/yr by the calendar year of 2050 given the current levels of CCU technologies. For more information

---

Aviation and Climate: The state-of-the-Art

Scott Delbecq, Jerome Fontane, Nicolas Gourdain, Hugo Mugnier , Thomas Planes`and Florian Simatos, April 2022

Abstract: As a human activity, the aviation sector is a contributor to climate change due the CO2 emissions and also non CO2 effects which result from the interactions of the engine effluents with the atmosphere. The understanding and quantification of the impact of the aviation sector on climate is an intricate topic, whose evaluation largely depends on the scope considered. Furthermore, identifying the possible and efficient levers to mitigate such impact is of interest. This paper proposes a short review of the scientific literature regarding aviation and climate. Furthermore, it proposes an analysis of prospective decarbonisation scenarios for the sector in the context of the Paris Agreement. The results indicate that the ability of the aviation sector to reduce its CO2 emissions by 2050 thanks to technological levers (including progresses in aerodynamics and propulsion) alone depends on the objective for the limitation of temperature increase by 2100. For an objective of +1.5 °C, if air traffic grows at the rate predicted by the aviation industry, it will consume a larger share of the carbon budget than its current share of CO2 emissions. Also, the results are compelling in regard of the low-carbon energy availability for the aviation sector. For more information

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

Decarbonizing Aviation report: All Aboard
Institute Montaigne, January 2022

This report presents the impact of the aviation industry on CO2 emissions as well as several recommendation action that must be done over the next years to facilitate the decarbonization on the aviation sector . The report state that decarbonization levers exist and must all be activate to enable the aviation industry to make its transition. Decarbonizing air transport is part of a wider energy transition that involves a massive production of decarbonized electricity to replace fossil fuels. For more information

---

A review of recent advances in engineering bacteria for enhanced CO2 capture and utilization
International Journal of Environmental Science and Technology , June 2022

Carbon dioxide (CO2) is emitted into the atmosphere due to some anthropogenic activities, such as the combustion of fossil fuels and industrial output. As a result, fears about catastrophic global warming and climate change have intensified. In the face of these challenges, conventional CO2 capture technologies are typically ineffective, dangerous, and contribute to secondary pollution in the environment. Biological systems for CO2 conversion, on the other hand, provide a potential path forward owing to its high application selectivity and adaptability. Moreover, many bacteria can use CO2 as their only source of carbon and turn it into value-added products. The purpose of this review is to discuss recent significant breakthroughs in engineering bacteria to utilize CO2 and other one-carbon compounds as substrate. In the same token, the paper also summarizes and presents aspects such as microbial CO2 fixation pathways, engineered bacteria involved in CO2 fixation, up-to-date genetic and metabolic engineering approaches for CO2 fixation, and promising research directions for the production of value-added products from CO2. This review's findings imply that using biological systems like modified bacteria to manage CO2 has the added benefit of generating useful industrial byproducts like biofuels, pharmaceutical compounds, and bioplastics. For more information

---

Techno-Economic Assessment & Life Cycle Assessment Guidelines for CO2 Utilization (Version 2.0)
Global CO2 Initiative, Ann Arbor, March 2022

The present TEA and LCA Guidelines for CCU are intended to substantially reduce ambiguity in methodological choices and to enhance the transparency and comparability of both TEA and LCA results. The primary aim is to make CCU assessments more systematic, transparent, and comparable. The development of version 1.0 [4] of the Guidelines involved several stages, including an extensive literature study, guidance and requests from several stakeholder workshops, and multiple discussion rounds of peer review, allowing for close participation of the CCU community and ensuring high scientific. For more information

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

EU POLICIES & LEGISLATION

REPowerEU: A plan to rapidly reduce dependence on Russian fossil fuels and fast forward the green transition

European Commission, May 2022

The European Commission presented the REPowerEU Plan, its response to the hardships and global energy market disruption caused by Russia's invasion of Ukraine. There is a double urgency to transform Europe's energy system: ending the EU's dependence on Russian fossil fuels, which are used as an economic and political weapon and cost European taxpayers nearly €100 billion per year, and tackling the climate crisis. For more information

---

Position paper on CCU in the EU Policy Landscape: summary

CO2 Value Europe, May 2022

Summary of position paper from CO2 value Europe related the following subjects : RED II Delegated Act on the access to renewable electricity, EU Taxonomy for sustainable activities, Fit-for-55 proposals, Emission Trading System (ETS), ReFuelEU Aviation, FuelEU Maritime , Energy Taxation Directive (ETD) Revision , Restoring Sustainable Carbon Cycles and Carbon Removal Certification Mechanism. For more information

---

Feasibility of REPowerEU 2030 targets, production potentials in the Member States and outlook to 2050

Gas for Climate, July 2022

Biomethane can play an important role in meeting the European Union (EU) 2030 GHG reduction target and achieving net-zero emissions by 2050. Additionally, biomethane increases European energy security by reducing the dependency on Russian natural gas and can alleviate part of the energy cost pressure on households and companies. The European Commission fully recognizes these benefits and thus set a target of 35 billion cubic meters (bcm) of annual biomethane production by 2030 in its recent REPowerEU plan. Today, 3 bcm of biomethane and 15 bcm of biogas are produced in the EU-27.
. For more information

Decarbonization of natural gas systems in the EU – Costs, barriers, and constraints of hydrogen production

Renewable and Sustainable Energy Reviews , July 2022

Abstract: The European Union (EU) imports a large amount of natural gas, and the injection of renewable hydrogen (H2) into the natural gas systems could help decarbonize the sector. The new geopolitical and energy market situation demands urgent actions in the clean energy transition and energy independence from fossil fuels. This paper aims to investigate techno-economic analysis,

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

barriers, and constraints in the EU policies/frameworks that affect natural gas decarbonization. First, the study examines the levelized cost of hydrogen production (LCOH). The LCOH is evaluated for blue and grey hydrogen, i.e., Steam Methane Reforming (SMR) natural gas as the feedstock, with and without carbon capture, and green hydrogen (three type electrolyzers with electricity from the grid, solar, and wind) for the years 2020, 2030, and 2050. Second, the study evaluates the current policies and framework based on a SWOT (Strength, Weakness, Opportunities, and Weakness) analysis, which includes a PEST (Political, Economic, Social, and Technological) macro-economic factor assessment with a case study in Portugal. The results show that the cheapest production costs continue to be dominated by grey hydrogen (1.33 €/kg.H2) and blue hydrogen (1.68 €/kg.H2) in comparison to green hydrogen (4.65 €/kg.H2 and 3.54 €/kg.H2) from grid electricity and solar power in the PEM - Polymer Electrolyte Membrane for the year 2020, respectively. The costs are expected to decrease to 4.03 €/kg.H2 (grid-electricity) and 2.49 €/kg.H2 (solar – electricity) in 2030. The LCOH of the green grid-electricity and solar/wind-powered Alkaline Electrolyzer (ALK) and Solid Oxide Electrolyzer Cell (SOEC) are also expected to decrease in the time-span from 2020 to 2050. A sensitivity analysis shows that investments costs, electricity price, the efficiency of electrolyzers, and carbon tax (for SMR) could play a key role in reducing LCOH, thereby making the economic competitiveness of hydrogen production. The key barriers are costs, amendments in rules/regulations, institutions and market creation, public perception, provisions of incentives, and constraints in creating market demand. For more information

---

Carbon dioxide removal as an integral building block of the European Green Deal

German Institute for international and security affairs, June 2022

The implementation of the new net emission targets for 2030 and 2050 as part of the European Green Deal is moving the deliberate removal of CO2 from the atmosphere up the agendas of political decision-makers. In its latest report, the Intergovernmental Panel on Climate Change (IPCC) also recently reiterated that net-zero targets can-not be achieved without the deployment of carbon dioxide removal (CDR) methods. The political debate in the European Union (EU) about CDR has changed rapidly in recent years, with almost all political actors now calling for a new regulatory frame-work for CDR to become an integral building block of EU climate policy. However, fundamental conflicts are brewing over the question as to which removal methods and policy instruments should be implemented and which priorities should be set. There are signs of emerging political alliances on the EU level that will shape the Fit-for-55 legislation in the short term and pre-structure the debate on the design of climate policy between 2030 and 2040. For more information

---

Experiences with the development of a policy framework for CCUS in the Netherlands

Netherlands Ministry of Economic Affairs and Climate Policy, June 2022

This presentation shows some steps that Netherlands has taken to advance CCUS. For more information

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

FUNDING & TENDER OPPORTUNITIES

FRANCE

Développement de briques technologiques et services par des PME pour la décarbonation de l'industrie (IBAC)
ADEME

Deadline date: **16/10/2023** (17/10/2022; 17/04/2023 ; 16/10/2023)

This Call aims to support projects led by SMEs developing innovative, competitive and sustainable methodologies, technologies, industrial solutions and services in the field of industrial decarbonisation. For more information

---

Soutien de l'offre de solutions de décarbonation des industriels (SOLInbac)
ADEME

Deadline date: **15/09/2022**

This call aims to support the best investment projects with the objective of massifying the production of decarbonisation solutions to enable future industrial buyers to reduce their CO_2 emissions. For more information

---

Investments for the decarbonization of production process ASP
(Agence de services et de paiement)

Deadline date: 31/12/2022

This topic is addressed to industrial companies of all sizes that wish to equip themselves to reduce their CO2 emissions or improve their energy efficiency. For more information

---

Appel à projets (DEMIBAC) Stratégie d'accélération décarbonation
ADEME

Deadline date: 16/10/2023 (**17/10/2022**; 17/04/2023 ; 16/10/2023)

This call aims to support innovation projects led by companies which accelerate in the market the implementation of sustainable technologies and/or solutions to decarbonize industry, from the industrial research phase to the demonstration phase. For more information

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

Favoriser le développement de Zones Industrielles Bas Carbone (ZIBAC)
ADEME

Deadline date: 15/02/2023 (**15/09/2022** - 15/02/2023)

This call aims to support industrial territories in their ecological and energy transformation in order to gain in competitiveness and attractiveness. For more information

Innovation Fund: EU invests €1.8 billion in clean tech projects
European Commission , July 2022

The EU is investing over €1.8 billion in 17 large-scale innovative clean-tech projects with a third round of awards under the Innovation Fund. Grants will be disbursed from the Innovation Fund to help bring breakthrough technologies to the market in energy-intensive industries, hydrogen, renewable energy, carbon capture and storage infrastructure, and manufacturing of key components for energy storage and renewables. The selected projects are located in Bulgaria, Finland, France, Germany, Iceland, the Netherlands, Norway, Poland and Sweden. For more information

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

FUNDING & TENDER OPPORTUNITIES

EUROPE

Breakthrough Energy Catalyst

Deadline date : Submissions received after 15 June 2022 will be evaluated on a rolling basis, but no less frequently than semi-annually

Commission President Ursula von der Leyen and Bill Gates have announced a pioneering partnership between the European Commission and Breakthrough Energy Catalyst to boost investments in the critical climate technologies that will enable the net-zero economy. Presented on the occasion of the sixth Mission Innovation Ministerial meeting, the new partnership aims to mobilize new investments of up to €820 million/$1 billion between 2022-26 to build large-scale, commercial demonstration projects for clean technologies – lowering their costs, accelerating their deployment, and delivering significant reductions in CO2 emissions in line with the Paris Agreement. This new partnership intends to invest in a portfolio of high-impact EU-based projects initially in four sectors with a high potential to help deliver on the economic and climate ambitions of the European Green Deal: Green hydrogen, Sustainable aviation fuels, Direct air capture and Long-duration energy storage. For more information

---

Biogenic carbon capture and use (CCU) for circular bio-based products

Deadline date: **22/09/2022**

Successful proposals will support researchers and innovators to upgrade technological solutions for biogenic gaseous carbon capture and use (CCU) and the production of sustainable circular non-fossil-based products, in line with the objectives of the European Climate Law and with the initiatives outlined in the 'Sustainable Carbon Cycles' Communication from the European Commission. The successful proposals will contribute to mitigating climate change along the bio-based industrial systems. For more information

---

Demonstration of complete value chains for advanced biofuel and non-biological renewable fuel production

Deadline date: **27/10/2022**

Proposals should demonstrate innovative and cost effective sustainable value chains for advanced biofuels or synthetic renewable fuels of non-biological origin (other than for hydrogen as a final product), over the entire cycle from feedstock to end use. Any sustainable biomass feedstock

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

including residues and wastes, or biogenic CO2 or industrial CO2 and renewable hydrogen, as well as input energy to the conversion should be addressed. Pathways which are biochemical, thermochemical, biological, chemical, electrochemical or combinations of them should be considered. Proposals should aim at improved performance in terms of increasing the efficiency and sustainability and reducing the cost, while evidencing the value creation along the value chain steps. Complete value chains may address any relevant end use. For more information

---

Development of algal and renewable fuels of non biological origin (RIA)

Deadline date: 10/01/2023

Proposals will develop and improve algal and/or non-biological renewable fuel technologies (other than for hydrogen as a final product), through developing synthetic pathways including biological, biochemical, thermochemical, electrochemical processes or combinations of them. Improving the performance of the conversion process by increasing the efficiency, reducing the cost and decreasing the GHG emissions from the production should be addressed beyond the current state of the art. Implementing and improving circularity for energy and material use should be considered, also as means to enhance sustainability and economic feasibility of the proposed concepts. Proposals should also address systemic constraints and opportunities for scaling-up algal and non-biological renewable fuel technologies. For more information

---

Demonstration of complete value chains for advanced biofuel and non-biological renewable fuel production

Deadline date: 27/10/2022

Proposals should demonstrate innovative and cost effective sustainable value chains for advanced biofuels or synthetic renewable fuels of non-biological origin (other than for hydrogen as a final product), over the entire cycle from feedstock to end use. Any sustainable biomass feedstock including residues and wastes, or biogenic CO2 or industrial CO2 and renewable hydrogen, as well as input energy to the conversion should be addressed. Pathways which are biochemical, thermochemical, biological, chemical, electrochemical or combinations of them should be considered. Proposals should aim at improved performance in terms of increasing the efficiency and sustainability and reducing the cost, while evidencing the value creation along the value chain steps. Complete value chains may address any relevant end use. For more information

---

Development of algal and renewable fuels of non-biological origin (RIA)

Deadline date: 10/01/2023

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

Proposals will develop and improve algal and/or non-biological renewable fuel technologies (other than for hydrogen as a final product), through developing synthetic pathways including biological, biochemical, thermochemical, electrochemical processes or combinations of them. Improving the performance of the conversion process by increasing the efficiency, reducing the cost and decreasing the GHG emissions from the production should be addressed beyond the current state of the art. Implementing and improving circularity for energy and material use should be considered, also as means to enhance sustainability and economic feasibility of the proposed concepts. Proposals should also address systemic constraints and opportunities for scaling-up algal and non-biological renewable fuel technologies. For more information

---

Innovation fund - Small-scale projects

European Commission

Deadline date: 31/08/2022

The second call for small-scale projects was launched on 31 March 2022 with a budget of EUR 100 million. The call text and application process remained largely similar to those of the first call and applicants have five months to prepare their application (until 31 August 2022). For more information

---

Innovation fund - large-scale projects

European Commission

Deadline date: Next round 2023

With a budget of EUR 1.5 billion, which is increased by 50% compared to the previous call, it will finance breakthrough technologies for renewable energy, energy-intensive industries, energy storage, and carbon capture, use and storage. For more information

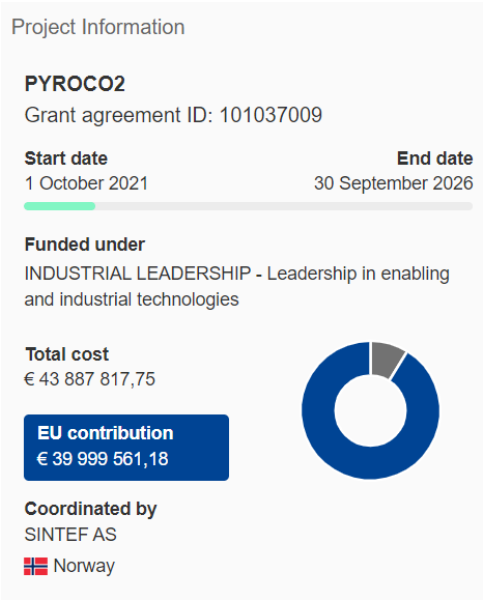
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

CCU ONGOING PROJECTS

EUROPE

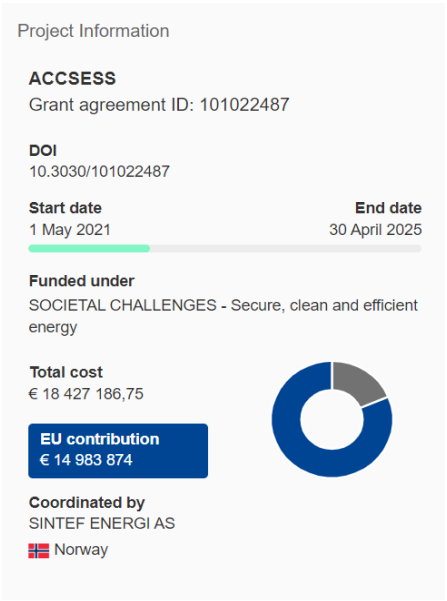
Horizon 2020 - Demonstrating sustainable value creation from industrial CO2 by its thermophilic microbial conversion into acetone

Twenty leading industrial and research partners from 11 countries have teamed up to prove that large-scale conversion of industrial carbon emissions into value-added chemicals and materials is possible. As a game changer for European carbon-intensive industries, the EU- funded PYROCO2 project will pave the way for the sustainability of Europe's chemical industry. It will demonstrate the scalability and economic viability of carbon capture and utilisation to generate climate- positive acetone from industrial CO2 and renewable electricity-derived hydrogen. The project will demonstrate that the acetone produced is an ideal platform for the catalytic synthesis of a range of chemicals, synthetic fuels and recyclable polymer materials from CO2 for viable business cases and pre-developed processes for replication and commercialization For more information



Horizon 2020 - Providing access to cost-efficient, replicable, safe and flexible CCUS

The ACCSESS concept is centered around the project vision to Develop replicable CCUS pathways towards a Climate Neutral Europe in 2050. ACCSESS will improve CO2 capture integration in industrial installations (20-30% cost cuts) as a key element to accelerate CCUS implementation, address the full CCUS chain and the societal integration of CCUS. ACCSESS has the ambition unleash the ability of CCUS to contribute to the ambitious EU Green Deal transformation strategy. The project is dedicated to developing viable industrial CCUS business models. ACCSESS will engage with citizens and citizens, explaining how CCUS can contribute to the production of climate neutral or climate positive end-products in a sustainable cities' context. For more information



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

Horizon 2020 - Demonstrating a Refinery-Adapted Cluster-Integrated Strategy to Enable Full-Chain CCUS Implementation

Almost everyone now agrees that we should decrease the amount of atmospheric carbon dioxide (CO2) to mitigate climate change. Reducing CO2 production is not the only way to reduce emissions. Carbon capture, use and storage (CCUS) refers to an integrated set of technologies to prevent the CO2 produced during the combustion of fossil fuels from entering the atmosphere. Currently, these technologies focus on the greatest sources of CO2 in a process, ignoring smaller ones. The EU-funded REALISE project is developing a way to capture up to 90 % of CO2 from multiple sources in operating refineries at a cost that is 30 % lower than existing capture methods. For more information

Project Information

REALISE
Grant agreement ID: 884266

DOI
10.3030/884266

Start date 1 May 2020 — **End date** 31 October 2023

Funded under
SOCIETAL CHALLENGES - Secure, clean and efficient energy

Total cost
€ 7 131 752,50

EU contribution
€ 6 444 163,75

Coordinated by
SINTEF AS
Norway

Horizon 2020 -Advanced Carbon Capture for steel industries integrated in CCUS Clusters

The Paris Agreement sets out a global framework to avoid dangerous climate change by limiting global warming to well below 2 °C and pursuing efforts to limit it to 1.5 °C. Without carbon capture, utilisation and storage (CCUS), it is difficult to realise the temperature levels indicated in the Paris Agreement. In the context of the European Energy Union, CCUS is a vital research and development priority to achieve 2050 climate objectives in a cost-effec tive way. With the focus on the iron and steel industry as part of the CCUS chain, the EU-funded C4U project will work with eight European countries and Mission Innovation countries (Canada, China and the United States) to address all the essential elements required for optimal integration of CO2 capture into the North Sea Port CCUS cluster. For more information

Project Information

C4U
Grant agreement ID: 884418

DOI
10.3030/884418

Start date 1 April 2020 — **End date** 31 March 2024

Funded under
SOCIETAL CHALLENGES - Secure, clean and efficient energy

Total cost
€ 13 845 496,89

EU contribution
€ 12 499 083,27

Coordinated by
UNIVERSITY COLLEGE LONDON
United Kingdom

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

Horizon 2020 - Creating added-value chemicals from bio-industrial CO2 emissions using integrated catalytic technologies

The European Green Deal sets the blueprint for making Europe the first climate neutral continent in the world. The goal is to reduce greenhouse gas emissions (GHGs) to at least 55 % below 1990 levels by 2030. The EU-funded CATCO2NVERS project will develop and optimize technologies that convert waste CO2 into useful bio-origin chemicals to produce plastics, methanol, cosmetics, and renewable feedstocks for industrial processes. The project's overall vision will be to use waste CO2 energy- and resource-efficiently in bio-based industries to produce zero GHGs and reduce the quantity of CO2 released into the atmosphere. For more information

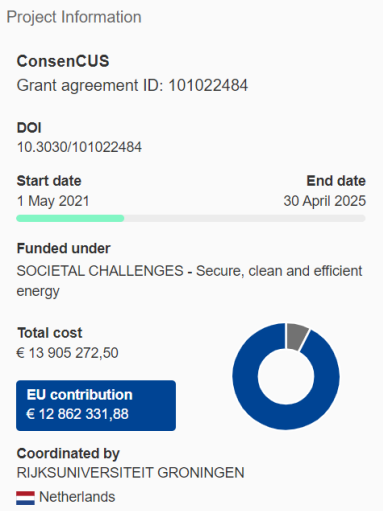
Horizon 2020 - Production of synthetic renewable aviation fuel from CO2 and H2

Aviation fuels derived from non-fossil resources are the only way to diminish the hefty carbon footprint of air transport. The EU-funded TAKE-OFF project will bring together leading industrial players and prominent research institutes to develop an innovative process for producing sustainable aviation fuels with higher efficiency and lower costs compared to other power-to-liquid alternatives. State-of-the-art successful attempts to turn carbon dioxide into jet fuel involve complex processes such as the Fischer-Tropsch process. The unique TAKE-OFF technology will be based on converting carbon dioxide and green hydrogen into fuel via ethylene as an intermediate. In this process, carbon dioxide is captured from industrial flue gases and reacts with hydrogen produced by renewable electricity to create light olefins. For more information

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

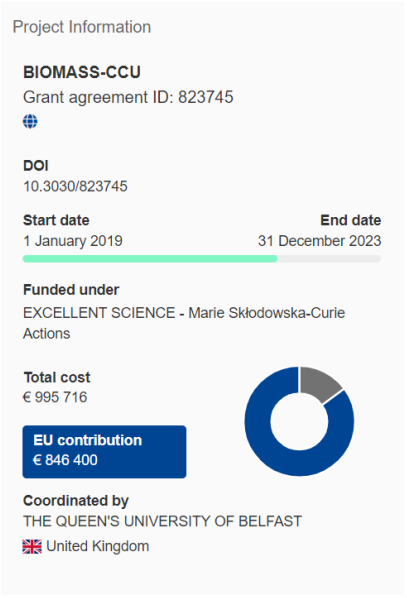
Horizon 2020 - CO2 capture, utilisation and storage for a net-zero carbon future

With climate change putting people worldwide in danger and nations taking steps to decrease its effects, new innovations regarding green solutions are more welcome than ever. The EU-funded ConsenCUS project aims to assist in this goal by providing an industrial plan for a net- zero carbon reality. To this aim it will utilise 3 electricity-based innovations: carbon capture based on alkali absorption, methods for conversion of CO2 to formate and formic acids for market uses and finally a safe cyclic loading system of CO2 into salt formations and aquifers for storage purposes. These innovations should greatly benefit the EU in reaching its net-zero carbon goal. [For more information]



Horizon 2020 - Biomass gasification with negative carbon emission through innovative CO2 capture and utilisation and integration with energy storage

This Research and Innovation Staff Exchange project aims to develop and maintain long term collaborations between universities in the EU with China and Australia. This collaboration will build a truly world-leading group through a total of 254 person months of structured international and intersectoral staff exchanges involving 77 individual researchers to innovate next generation low carbon fuel production. Extensive training and knowledge transfer activities will be carried out to enhance career development of the project participants. The research and innovation unites researchers with a common goal to advance biomass gasification technology by integrating CO2 capture and utilisation with multifunctional catalyst materials. [For more information]



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

Horizon 2020 - 3D-printed catalytic reactors could boost CO2 capture and conversion into valuable products

Catalytic reactors that can capture CO2 and transform it into valuable products are a promising technology for reducing harmful emissions. While there are many barriers to scaling up the technology, 3D-printed reactors could significantly improve throughput and efficiency. Besides the reactor architecture, the proper catalytic materials are crucial for efficient CO2 capture and utilisation. Funded by the Marie Skłodowska-Curie Actions programme, the 3DPILcat project will develop a highly efficient, configurable and scalable protocol for preparing tailored and structured catalytic reactors for CO2 capture and utilisation. Poly(ionic liquid)-based block copolymers with CO2-philic moieties will be employed to capture CO2 at near atmospheric pressure and catalyze its conversion into cyclic carbonates from epoxides and olefins. For more information

Project Information

3DPILcat

Grant agreement ID: 101026335

Start date 1 November 2021

End date 31 October 2023

Funded under

EXCELLENT SCIENCE - Marie Skłodowska-Curie Actions

Total cost

€ 172 932,48

EU contribution

€ 172 932,48

Coordinated by

UNIVERSITAT JAUME I DE CASTELLON

Spain

Horizon 2020 - Very-low-cost carbon capture option

Concrete is a highly durable material and, when used effectively, it helps buildings to be extremely energy efficient. Due to global population growth and increasing urbanisation, demand is set to increase. However, cement production is CO2-intensive (8 % of global CO2 emissions). The majority of these CO2 emissions are released directly and unavoidably from the processing of the raw materials – not from the combustion of fossil fuels. The EU-funded LEILAC2 project is piloting new technology that re-engineers the existing process flows by indirectly heating the limestone. Building on the success of the first LEILAC Horizon 2020 project (capturing around 5 % of a typical cement plant's process CO2 emissions), this project seeks to scale up to around 20 % of a typical cement plant's process CO2 emissions in a deployable and scalable module. For more information

Project Information

LEILAC2

Grant agreement ID: 884170

DOI

10.3030/884170

Start date 1 April 2020

End date 31 March 2025

Funded under

SOCIETAL CHALLENGES - Secure, clean and efficient energy

Total cost

€ 34 675 725

EU contribution

€ 15 994 730

Coordinated by

CALIX - EUROPE

France

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

Horizon 2020 - Jet fuel from CO2 using sustainable and affordable processing technologies

Carbon capture and utilisation (CCU) technologies can play a significant role in easing the transition to renewable forms of energy while producing useful products like fuels or chemicals. They help economies reduce their emissions into the atmosphere without requiring an immediate change in energy source and related technologies to meet emission reductions goals and requirements. CCU technologies that use low-carbon energy sources keep the overall carbon footprint small. Current CCU technologies that use renewable electricity to produce fuels are relatively expensive and inefficient. The EU-funded eCOCO2 project will develop an intensified process to directly produce synthetic jet fuels from CO2 using renewable electricity and water steam. Benefits abound for the aerospace industry, the EU's leadership position on climate change and for the environment. For more information

Project Information

eCOCO2
Grant agreement ID: 838077

DOI
10.3030/838077

Start date 1 May 2019 — **End date** 31 October 2023

Funded under
SOCIETAL CHALLENGES - Secure, clean and efficient energy

Total cost
€ 4 447 978,75

EU contribution
€ 3 949 978,75

Coordinated by
AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS
Spain

Horizon 2020 - Photonics technology to turn carbon dioxide into fuels

The EU-funded SPOTLIGHT project will work on a new photonic device to convert carbon dioxide and hydrogen into methane and carbon monoxide which is the starting material for producing methanol. Both methane and methanol fuels could find use in cars and energy storage applications. SPOTLIGHT's photonic device will comprise a transparent flow reactor optimized for light incoupling in the catalyst bed, secondary solar optics to concentrate sunlight and project it onto the reactor, and an energy-efficient light-emitting diode to work towards continuous round-the-clock operation. The new device and process concept are well suited for CO2 sources up to 1 Mt per year, which makes them complementary to existing large-scale carbon capture and utilisation processes. For more information

Project Information

SPOTLIGHT
Grant agreement ID: 101015960

DOI
10.3030/101015960

Start date 1 January 2021 — **End date** 31 December 2023

Funded under
INDUSTRIAL LEADERSHIP - Leadership in enabling and industrial technologies - Information and Communication Technologies (ICT)

Total cost
€ 5 604 958,75

EU contribution
€ 5 604 958,75

Coordinated by
NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO
Netherlands

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

FRANCE

CO2 capture by accelerated carbonation of recycled concrete aggregates – Co2ncrete – ANR

The CO2NCRETE project focuses on CO2 sequestration through accelerated carbonation of recycled aggregates with industrial gases. Recent literature reviews show that this approach is the most promising of the strategies being considered to reduce the carbon footprint of concrete construction. Most studies also show that carbonation improves the properties of crushed aggregates and thus their recyclability. Carbonation of crushed aggregates is therefore a step towards the circular and carbon-neutral economy that Europe has been calling for. For more information

---

CaTaLyst foR TrAnsItion to ReNewable Energy FutuRe

The TRAINER research activity of the third project year has continued in line to the scheduled plan, with a particular attention to the development of catalytic processes and reactor setup suitable to ensure more sustainable and environmentally friendly transformations at the heart of renewable energy technology. Accordingly processes and reactors devoted to a greener and cost-effective CO2 conversion/valorization (CCU) have been realized with the involvement of alternative and more sustainable routes to the heat management required for the process to occur. In particular, we demonstrated the superior performance of highly nickel-loaded gamma-Al2O3 composites as catalysts and susceptors for the radiofrequency heated CO2 methanation reaction. For more information

---

Catalytic Valorization of Industrial Carbon – CatVIC

A common aim of CEA and MPI-CEA is to strengthen the European leadership in clean energy technologies, and to support the emerging European hydrogen industry. Both organizations see Power-to-X as a very promising solution to convert large amount of intermittent renewable energy into hydrocarbon molecules, and to close the carbon loop For more information

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

UPCOMING EVENTS

Déploiement des Technologies CCU à L'échelle du Territoire
September 8, 2022 Villeurbanne, France
https://www.axelera.org/fr/evenement/deploiement-des-technologies-ccu-a-l-echelle-du-territoire/programme-48

The AXELERA chemical-environmental cluster, in partnership with Club CO2, invites you to participate on Thursday, September 8, in a day dedicated to the deployment of CCU technologies on a regional scale.

Séminaire régional CCUS, Auvergne-Rhône-Alpes
03 October 2022 Lyon, France

https://my.weezevent.com/seminaire-regional-cscv-auvergne-rhone-alpes

This seminar will discuss the potential of the CCUS sector to help decarbonize the Auvergne-Rhône-Alpes region, according to its specificities and needs, and the role of its actors to enable the development of this sector in France.

The Carbon Capture Technology Conference & Expo
19-20 October 2022, Messe Bremen, Germany

https://www.carboncapture-expo.com/

The two-day event will bring together leading engineering firms, technology manufacturers and suppliers, energy firms, the oil and gas sector, heavy industry, chemical companies, various manufacturing organizations, research groups and NGOs, consultants, and government bodies to explore how we can rapidly accelerate the deployment and commercialization of carbon-removal technologies as a key solution on the pathway to net-zero carbon emissions.

16th Greenhouse Gas control technologies
23-27 October 2022 Lyon , France

https://ghgt.info/

As this conference will be the first time ever held in France, it will truly showcase France's (and more broadly Europe's) expertise in CCUS and support the future CCUS developments across Europe, especially regarding applications in the industry sector. The Conference host Club CO2, with a French consortium composed of: ADEME, BRGM, IFP Energies nouvelles and Total Energies, is committed to support the organization of GHGT-16 in Lyon, the 2nd largest metropolitan area (after Paris) in France and the 1st European capital of smart tourism (voted in 2019). The planning is now in place to hold an in person event (subject to Covid 19 restrictions) in Lyon at the extensive Lyon Convention Center (Cité Internationale). The location offers affordable and accessible travel and

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.

accommodation to all delegates now eager to connect in a safe face to face conference environment, and enjoy the heritage and gastronomy of this fabulous city.

COP 27
6 - 18 November , 2022, Egypt
https://www.cop27.eg/

Science has established beyond doubt that the window for action is closing rapidly. In November 2022, Egypt will host the 27th Conference of the Parties of the UNFCCC (COP27) in Sharm El-Sheikh, with a view to building on previous successes and paving the way for future ambition.

A golden opportunity for all stakeholders to rise to the occasion and tackle effectively the global challenge of climate change facilitated by Egypt on the African continent.

INTERESTING SITES

PYROCO2 Project - https://www.pyroco2.eu/

CO2 Value Europe - https://www.co2value.eu/

CO2 Value Europe database - https://database.co2value.eu/

Club CO2 - https://www.club-co2.fr/fr

International Energy Agency - https://www.iea.org/

Zero Emission Platform - https://zeroemissionsplatform.eu/

Strategy CCUS - https://www.strategyccus.eu/

Global CCS Institute - https://www.globalccsinstitute.com

France Hydrogen - https://www.france-hydrogene.org/

GreenH2Atlantic Project **(New)** - https://www.greenh2atlantic.com/

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101037009.