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 BULLETIN 02

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

Version and amendments history

Version	Date	Created/Amended by	Changes
01	30/04/2022		

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

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

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FOREWORD

The development of CCU hubs is a major challenge in France and throughout Europe for the massive deployments of CCU projects. These hubs will be crucial for leveraging CCU projects, for reaching easier access to financing lines, for reducing project costs as well as creating jobs and attracting clean new industries.

The strategic intelligence bulletins support the CCU hubs development and has as one of its objectives to consolidate information about CCU in a single document to facilitate members of PYROCO2 consortium and companies interested in investing in CCU projects to have access to the latest and updated information.

We are delighted to present the second strategic intelligence bulletin. This second strategic bulletin aims to provide updated, clear and precise information about CCU projects in Europe focused on five main subjects:

- Carbon capture & utilization market
- European union policy and legislation
- Technology watch
- Funding and tender opportunities
- CCU ongoing projects

Additional information about the document:

The strategic intelligence bulletins will be published every 3 months. It aims to help the partners of the PYROCO2 consortium to make strategic decisions and to support the emergence of the CCU market also via broader dissemination, namely with the members of AXELERA cluster in order to engage them on the emergence of new CCU projects.

The content of this document refers to information from the previous three months, however, some older data with added value can be considered.

As CCU and CCS are strongly related for some projects, some publications about CCS which are relevant to the target audience are being included.

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

MARKET NEWS

Capturer et valoriser le CO2 (CCU) : des technologies pour lutter contre le réchauffement climatique

Infociments, Mars 2022

La baisse de l'empreinte carbone de l'industrie cimentière est un process continu puisque les émissions ont baissé de 40 % entre 1990 et aujourd'hui et la trajectoire fixée prévoit une baisse supplémentaire de 24 % d'ici 2030. L'ensemble de la profession travaille parallèlement sur les innovations de demain qui permettront d'aller plus loin et d'atteindre une réduction de 80 % des émissions en 2050. Ces innovations s'appuient sur les technologies de CCS (Captage et Stockage de CO2) et de CCU (Captage et Utilisation de CO2). For more information

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Six Carbon Capture and Utilisation technologies for a sustainable chemical and fuel production nominated for the Innovation Award "Best CO2 Utilisation 2022"

Conference on CO2-based Fuels and Chemicals 2022 – Cologne (Germany) 23-24 March 2022

Carbon Capture and Utilisation (CCU) Innovations of the Year 2022: A lot of technologies are in place and in development to face the challenges of a sustainable chemicals and fuels production based on the utilisation of captured CO2 from industrial off-gases or directly from the atmosphere. To honor these, nova-Institute grants its annual award, "Best CO2 Utilisation", within the framework of the "Conference on CO2-based Fuels and Chemicals" taking place in Cologne on 23-24 March 2022 (www.co2-chemistry.eu). Great submissions reached the nova-Institute and six nominees now get the chance to demonstrate their full potential to a wide audience in Cologne (Germany) and online. For more information

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TotalEnergies begins producing sustainable aviation fuel at its Normandy platform

Total Energies ,March 2022

TotalEnergies' Normandy platform has successfully started production of sustainable aviation fuel*1* (SAF). This new site complements the biojet fuel production capacities of La Mède biorefinery (Bouches-du-Rhône) and the Oudalle plant (Seine-Maritime). For more information

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Eni and Air Liquide to cooperate for the decarbonization of hard-to-abate industries in Europe

ENI company , March 2022

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

Eni and Air Liquide have entered into a collaboration agreement aimed at assessing decarbonization solutions in the Mediterranean region of Europe, focused on hard-to-abate industrial sectors. The two companies join forces combining their well-established expertise and know-how to enable CO2 capture, aggregation, transport and permanent storage. For more information

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Most schemes to capture and reuse carbon actually increase emissions

New scientist, Feb 2022

Carbon capture and utilisation technologies, which aim to pull carbon dioxide from the air and use it for emissions-lowering processes, emit more carbon than they remove. For more information

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Cemex to produce aviation fuel at Rüdersdorf cement plant

Written by Global Cement staff, March 2022

Mexico-based Cemex has joined a consortium with Sasol EcoFT and Enertrag that plans to use CO2 and hydrogen to produce aviation fuel. The project is part of Cemex's Future in Action program and is part of its plan to develop a carbon neutral operation at its Rüdersdorf cement plant by 2030. The consortium will source green hydrogen generated from wind and solar energy from Enertrag. The CO2 will come from the Rüdersdorf cement plant, which will provide 100t/day CO2 in the project's initial stages. Sasol will then contribute its technology to produce e-kerosene, which, once certified, can be blended to constitute up to 50% of jet fuel. For more information

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OGCI launches The CCUS Hub platform to share learnings and identify new hubs

OGCI Oil and Gas Climate Initiative , March 2022

OGCI has launched The CCUS Hub, a web-based platform designed to support regulators, emitters and potential hub developers interested in setting up CCUS hubs globally. For more information

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Global CCUS projects in development by region or country

IEA, Global CCUS projects in development by region or country, 2021/2022

Access here

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

World's first industrial CO2-neutral e-kerosene plant inaugurated in Germany

Clean Energy wire, October 2021

NGO atmosfair and its partners have launched the world's first production facility for CO2-neutral e-kerosene. The facility, located in the town of Werlte in northern Germany, uses CO2 captured from the air and from a biogas plant that uses food waste, and electricity from wind and solar installations to produce green hydrogen. For more information

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Most carbon capture & utilisation technologies may be counterproductive: Study

Down to earth February, 2022

Most carbon capture and utilisation (CCU) technologies, which suck carbon dioxide (CO2) from the atmosphere and convert it into fuel or other valuable products, might fail to help the world reach Net Zero emissions by 2050, according to a new study. A majority of these systems are energy intensive and the resultant product can also release CO2 into the atmosphere, the lead author Kiane de Kleijne, a climate researcher at Radboud University, told Down To Earth (DTE). For more information

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2022 trends to shape global CCUS and green hydrogen markets

Smart Energy International, Feb 2022

A new report released by research company Wood Mackenzie highlights developments within the global carbon capture, storage and utilisation and green hydrogen markets. For more information

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Vers une production d'acier sans CO2 en France (Towards CO2-free steel production, France)

Arcelor Mittal, February 2022

The Prime Minister announced the State's support for ArcelorMittal's decarbonization program, which represents investments of around €1.7 billion at the Fos-sur-Mer and Dunkirk sites. These investments will enable a profound transformation of steel production in France and a total reduction of nearly 40% of ArcelorMittal's CO2 emissions by 2030. For more information

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Will CCUS and hydrogen live up to the hype in 2022?

Wood Mckenzie, outlook 2022

There was huge momentum behind both hydrogen and carbon capture, utilisation and storage (CCUS) in 2021. Project pipelines ballooned, new policies and funding pots were announced and COP26 spurred net zero targets. Will that momentum gather pace in 2022? What could stand in the way? This article is an introduction to CCUS and hydrogen: 5 things to look for in 2022. For more information

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

Limits to Paris compatibility of CO2 capture and utilization

Kiane de Kleijne, Steef V. Hanssen, Lester van Dinteren, Mark A.J. Huijbregts, Rosalie van Zelm, Heleen de Coninck, March 2022

The Paris Agreement's temperature goals require global CO2 emissions to halve by 2030 and reach net zero by 2050. CO2 capture and utilization (CCU) technologies are considered promising to achieve the temperature goals. This paper investigates which CCU technologies—using atmospheric, biogenic, or fossil CO2—are Paris compatible, based on life cycle emissions and technological maturity criteria. We systematically gathered and harmonized CCU technology information for both criteria and found that CCU with technology readiness levels (TRLs) of 6 or higher can be Paris compatible in 2030 for construction materials, enhanced oil recovery, horticulture industry, and some chemicals. For 2050, considering all TRLs, we showed that only products storing CO2 permanently or produced from only zero-emissions energy can be Paris compatible. Our findings imply that research and policy should focus on accelerating development of CCU technologies that may achieve (close to) zero net emissions, avoiding lock-in by CCU technologies with limited net emission reductions. For more information

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MARKET – REPORTS

Hydrogen, electrofuels, CCU and CCS in a Nordic context

Nordic Energy research, 2022

The Nordic countries aim to maintain a leading role in the energy and climate transition towards a low-carbon society. All Nordic countries are in the process of developing or implementing their own national hydrogen strategies and road maps, while also exploring renewable hydrogen, electrofuels and associated carbon capture technology solutions. The international focus on hydrogen and its applications – as well as CCS and CCU – is growing steadily. Building on the identification of Nordic strengths and synergies in this report, the following recommendations and remarks can sum up the findings. For more information

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Direct Air Capture A key technology for net zero

International Energy Agency , March 2022

This report explores the growing momentum behind direct air capture, together with the opportunities and challenges for scaling up the deployment of direct air capture technologies consistent with net zero goals. It considers the current status of these technologies, their potential for cost reductions, their future energy needs, and the optimal locations for direct air capture facilities. Finally, the report identifies the key drivers for direct air capture investment and priorities for policy action. For more information

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Current and future cost of e-kerosene in the United States and Europe

Power-to-liquids (PtL), also known as e-fuels, are getting increased attention, especially in the aviation sector, due to their potential to decarbonize the sector without investments in new fueling infrastructure and engines. PtL are produced by combining carbon dioxide (CO2) and hydrogen derived from water electrolysis, through chemical reactions, such as Fischer-Tropsch (FT) synthesis. The product of FT synthesis is a mixture of

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hydrocarbons that can be used in transportation. Outputs include diesel (noted as FT-diesel), jet fuel (noted as e-kerosene), and other hydrocarbons such as propane and naphtha. For more information

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Carbon capture utilisation and storage: Barriers, Enabling frameworks and prospects for climate change mitigation

Oxford institute for energy studies, January 2022

This issue of the Oxford Energy Forum examines the recent trends in CCS and explores the regulatory and commercial barriers limiting the deployment of CCS at a large scale. The Forum opens with Samantha McCulloch's article which provides an overview of the recent trends in CCUS, highlighting the immense challenge required to scale-up CCUS under net-zero pathways. The International Energy Agency (IEA) report Net Zero by 2050. For more information

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'Décarboner l'industrie sans la saborder' (decarbonizing the industry without undermining it)

The shift project, January 2022

The Plan for Transforming the French Economy (PTEF) aims to propose pragmatic solutions to decarbonize the economy, sector by sector, while promoting resilience and employment.

For more information

Global CCU Infrastructure market assessment

SINTEF ER, Elvia Chavez, Octavian Partenie. December 2020

In this report, an approach to assessing the sustainability of CCU systems is presented. One of the key parameters considered is climate change mitigation, evaluating the net impact in terms of CO2 emissions based on the estimated CO2 uptake of a product and the time that the CO2 is expected to be stored. The potential of CCU options to mitigate CO2 emissions is generally low, relative to the scale of global emissions, but CCU can play a role for hard-to-abate sectors like aviation and steel production. Other aspects such as the energy required for the process and the economic benefits also need to be considered when evaluating the long-term potential of CCU options. For more information

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Assessing the Cost Reduction Potential of CCUS Cluster Projects in China: A Case Study

Muxin Liu (Guangzhou City Institute of Technology), Yueze Zhang Beijing (Institute of Geological Survey) Xi Liang (University College London), 2022

Abstract: Carbon capture, utilisation, and storage (CCUS) have garnered extensive attention as a target of carbon neutrality in China. The development trend of international CCUS projects indicates that the cluster

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construction of CCUS projects is the main direction of future development. The cost reduction potential of CCUS cluster projects has become a significant issue for CCUS stakeholders. The Pearl River Mouth Basin, adjacent to Guangdong province, is a suitable region for CCUS cluster project construction. To assess the cost reduction potential of CCUS cluster projects, we selected three coal-fired power plants in the coastal area of Guangdong as research targets. We initially assessed the costs of building individual CCUS projects for each plant and subsequently designed a CCUS cluster project for these plants. By comparing individual costs and CCUS cluster project costs, we assessed the cost reduction potential of CCUS cluster projects. The results show that CCUS cluster projects can significantly reduce costs by sharing pipelines and storage facilities. Furthermore, we conducted a simulation for the scenario of a larger designed capture capacity for each plant. We found that as the capture scale increases, the cost reduction potential is higher in the future, considering large-scale CCUS cluster projects. For more information

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CC(U)S initiatives: Prospects and economic efficiency in a circular economy

Alina Ilinova, Ekaterina Kuznetsova , 2022 , Science Direct

Abstract: The transition to a circular economy model requires the creation of new zero-waste industries. One of the largest industrial wastes, technogenic CO2, now worries the whole world. One of the promising technologies able to turn CO2 into valuable products is carbon capture and utilization. CO2 utilization technologies could contribute to the creation of circular production cycles, but it remains unclear today whether they will become widespread. Thus, the aim of the research is to analyze the current state and prospects of CC(U)S initiatives in the light of a circular economy, as well as to present a case study on a CO2-based methanol production project in Iceland to assess the economic performance of existing CO2 utilization options. For this purpose, the possible contribution of CC(U)S initiatives to emission reduction was evaluated, the specifics of the production of the most mature CO2-based products were identified, and the economic efficiency of CO2 utilization was assessed using data on a methanol plant in Iceland. For more information

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A techno-economic review on CCUS for achieving a net-zero CO2 emissions future

Wan YunHong, March 2022

Abstract: Carbon capture and storage (CCS)/carbon capture, utilisation and storage (CCUS) systems are widely recognised to have the potential in reducing CO2 emissions. However, current their global deployment is still not sufficient to reach the anticipated net-zero CO2 emissions target by 2050. This article aims to provide a general techno-economic review of CCUS systems. The technology readiness, technical performance, energy requirement and cost associated with CO2 capture, separation, transport, utilisation and storage technologies were discussed and compared. The CO2 capture technological pathways include industrial separation, post-combustion, pre-combustion, oxy-fuel combustion, chemical looping combustion and direct air capture. CO2 separation technologies such as absorption, adsorption, membrane, cryogenic and biological were also covered. Then, a review on CO2 transportation by pipeline, ship, truck and rail was presented, followed by a review on CO2 utilisation pathways for direct usage and through conversion into other products. Lastly, different CO2 storage options were reviewed, which include storage through CO2-enhanced oil recovery, in depleted oil and gas fields, in saline formations, in basalt and ultramafic rocks, in coal seams through enhanced coal bed methane recovery and in the deep ocean. This article concluded that the challenges with current CCUS technologies can possibly be overcome by developing a commercially viable hybrid system comprising more than one technology. However, this approach needs to be further investigated for industrial applications. For more information

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

TECHNOLOGY WATCH

Biochemical conversion of CO2 in fuels and chemicals: status, innovation, and industrial aspects

Gupta, R., Mishra, A., Thirupathaiah, March 2022

Abstract: Carbon dioxide levels in the earth atmosphere have been rising to alarming levels over the past few decades by human activity and thus caused global climate change due to the “greenhouse effect,” which in turn brought about adverse effects on the planet. Major sources of carbon dioxide (CO2) emissions include fossil fuel combustion, land-use change, industrial processing, respiration of various life forms, and decomposition of biomass. However, over the past 20 years, there has been a continuous research effort on the reducing carbon dioxide levels, by converting into the syngas, methanol, dimethyl carbonate, epoxides, polymers, and fine chemicals through chemical catalytic or biotransformation routes. Biological conversion including microbial and/or enzymatic conversion holds high potential as an alternative to the energy-intensive chemical conversion of CO2. Besides being the low energy process, bio-conversion of CO2 offers several unique advantages such as an easy and improved production at a high scale with a better conversion rate, the possibility of a diverse product range, and hyper-production by genetic modifications with zero competition for land with food crops. To this end, products that use CO2 biotransformation by the global biotech and chemical industry are only about 11.5 million tons annually, and it is a very small fraction of the approximately 24 billion tons of annual CO2 emission. Hence, there is an enormous scope for generation of high end biorefineries through CO2 bioconversion systems. Here, we review the various production sources of CO2, the metabolic and enzymatic CO2 conversion pathways, and the commercialization potentiality of various green chemicals from CO2. For more information

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Coupling carbon capture and utilization with the construction industry: Opportunities in Western Germany

Ali Abdelshafy, Grit Walther, March 2022

Abstract: Carbon capture and utilization (CCU) is an essential method to sequester unavoidable CO2 emissions in regions with insufficient geological storage capacities. Nonetheless, there are several uncertainties and knowledge gaps in terms of the future value chains of some CCU technologies (e.g. carbonation). This paper analyzes the potentials of coupling CCU with the supply chains of the construction industry by means of carbonating the concrete products and waste concrete in the German federal state of North Rhine–Westphalia. Based on extensive data and statistical analyses, the locations and outputs of the concrete and recycling plants have been determined in order to quantify their CO2 sequestration capacities. Location-allocation models have been applied to allocate the carbon sources to the potential carbon sinks and calculate the minimum transportation costs. The analysis shows that the total annual sequestration capacity is up to 1 Mt CO2 with an average transportation distance of 37.4 km (8.3 EUR/ton). Nonetheless, some emission sources have a clear comparative advantage in terms of their proximity to the carbon sinks as the distance ranges between 0.7 km and 99.7 km. Also, some carbon sinks have a comparative advantage in terms of capacities and technology readiness levels. Therefore, the paper also presents models for the different products in order to display the potentials of each category separately and offer more flexibility to the stakeholders. For more information

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Decarbonizing the iron and steel industry: A systematic review of sociotechnical systems, technological innovations, and policy options

Jinsoo Kim, Benjamin K. Sovacool, Morgan Bazilian, Steve Griffiths, Junghwan Lee, Minyoung Yang, Jordy Lee. March 2022

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

Abstract: The iron and steel industry is the largest coal consumer and the most greenhouse gas intensive industry. It consumes about 7% of global energy supply, and conservative estimates report that it is responsible for 7–9% of global greenhouse gas emissions. Decarbonization of the iron and steel industry is thus vital to meet climate change mitigation targets and achieve a sustainable future for the industry. This paper presents a comprehensive and systematic review that considered more than 1.6 million pieces of literature and analyzes in depth a shortlist of 271 studies on the iron and steel industry's decarbonization. Applying a sociotechnical lens that investigates raw materials, iron and steel making processes, steel products making and usage, and waste and recycling, the review identifies the climate footprint of the iron and steel industry. The review also assesses current and emerging practices for decarbonization, identifying 86 potentially transformative technologies. The benefits of decarbonizing the iron and steel industry are considered through energy and carbon savings, financial savings, and other environmental and public health benefits. Barriers to decarbonization are considered across financial, organizational, and behavioral aspects. The review also discusses various financial tools and policy instruments that can help overcome the barriers. Lastly, research gaps are outlined. For more information

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Design of an Integrated Power-to-Liquid Plant at a Cement Factory and Comparison of Process Structures and Reactor Technologies

Christoph Markowitsch, Markus Lehner, Markus Maly, March 2022

Abstract: This paper describes a carbon capture and utilization (CCU) system in which, in a first step, process related carbon dioxide is captured in a cement plant. With the reaction partner green hydrogen produced on site in an electrolysis, the captured CO2 is converted to syngas in a reverse water-gas shift reactor and further to paraffinic liquids in a Fischer Tropsch synthesis. The final steps for receiving marketable products are carried out in a nearby refinery by processing the Fischer Tropsch product in a steam cracker to lower olefins, and in a subsequent polymerization step to the final products polypropylene and polyethylene. This CCU process chain, starting with carbon capture up to the Fischer Tropsch product separation, is simulated in ASPEN Plus V12.1® with the aim to compare different available technologies for the main equipment. Key performance indicators, product volumes, as well as investment and operational costs are determined and compiled for a comparison. The power-to-liquid (PtL) plant consisting of an amine scrubber, high temperature electrolysis (SOEC), electrified reverse water-gas shift reactor with downstream Fischer Tropsch synthesis represents with a PtL efficiency of 54% and a carbon conversion of 85% the best process compared to the other investigated scenarios. For more information

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Paradigm shift in algal biomass refinery and its challenges

Won-Kun Park, Kyoungseon Min, Jin-Ho Yun, Minsik Kim, Min-Sik Kim, Gwon Woo Park, Soo Youn Lee, Sangmin Lee, Jiye Lee, Joon-Pyo Lee, Myoung, February 2022

Abstract: Microalgae have been studied and tested for over 70 years. However, biodiesel, the prime target of the algal industry, has suffered from low competitiveness and current steps toward banning the internal combustion engine all over the world. Meanwhile, interest in reducing CO2 emissions has grown as the world has witnessed disasters caused by global warming. In this situation, in order to maximize the benefits of the microalgal industry and surmount current limitations, new breakthroughs are being sought. First, drop-in fuel, mandatory for the aviation and maritime industries, has been discussed as a new product. Second, methods to secure stable and feasible outdoor cultivation focusing on CO2 sequestration were investigated. Lastly, the need for an integrated refinery process to simultaneously produce multiple products has been discussed. While

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the merits of microalgae industry remain valid, further investigations into these new frontiers would put algal industry at the core of future bio-based economy. For more information

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Advances in systems metabolic engineering of autotrophic carbon oxide-fixing biocatalysts towards a circular economy

Marilene Pavan, Kristina Reinmets, Shivani Garg, Alexander P. Mueller, Esteban Marcellin, Michael Köpke, Kaspar Valgepea, January 2022

Abstract: High levels of anthropogenic CO2 emissions are driving the warming of global climate. If this pattern of increasing emissions does not change, it will cause further climate change with severe consequences for the human population. On top of this, the increasing accumulation of solid waste within the linear economy model is threatening global bio sustainability. The magnitude of these challenges requires several approaches to capture and utilize waste carbon and establish a circular economy. Microbial gas fermentation presents an exciting opportunity to capture carbon oxides from gaseous and solid waste streams with high feedstock flexibility and selectivity. Here we discuss available microbial systems and review in detail the metabolism of both anaerobic acetogens and aerobic hydrogenotrophs and their ability to utilize C1 waste feedstocks. More specifically, we provide an overview of the systems-level understanding of metabolism, key metabolic pathways, scale-up opportunities and commercial successes, and the most recent technological advances in strain and process engineering. Finally, we also discuss in detail the gaps and opportunities to advance the understanding of these autotrophic biocatalysts for the efficient and economically viable production of bioproducts from recycled carbon. For more information

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EU POLICIES & LEGISLATION

The role of CCUS on the EU road to climate neutrality

JONES, Christopher, PIEBALGS, Andris, April 2022

The EU has decided to achieve carbon neutrality by 2050. While energy efficiency and renewable energy must and will remain the foundation of the EU's future energy priorities, carbon capture, utilisation and storage (CCUS) will be necessary to achieve this 2050 objective, notably during the transition. In some sectors with hard-to-abate greenhouse gas (GHG) emissions, such as cement, this is the only option for decarbonisation, and in other energy-intensive areas it will be needed for affordable GHG reductions during the energy transition period. CCUS using biomethane could also deliver negative emissions and be an important carbon sink. Finally, the use of carbon capture and storage (CCS) for producing low-carbon hydrogen could provide significant cost savings, again during the energy transition. Despite the implementation of Directive 2009/31/EC 'On the geological storage of carbon dioxide,' the use of CCUS has been slow. Strong leadership by the European Commission is needed. The adoption of a European Strategy for CCUS and a European Commission initiative to catalyse CO2 infrastructure could provide this necessary step change. For more information

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The use of ships within a CCUS system: Regulation and liability

M. Tsimplis, K. Noussia, January 2022

Abstract: The transport of CO2 by ships for storage or utilisation is a component of CCS/CCUS systems which has been considered based on existing ship designs and on the assumption that the internationally agreed

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standards are always applicable and always constrain the ship and storage designs that can be used. This paper demonstrates that, for systems developed to be used within one or two jurisdictions, novel ship and storage designs can be considered irrespective of the international regulatory system. Significant discretion also exists within the international regulatory system for novel designs. Thus, the consideration of cost and efficiency of CCUS systems need not be constrained to existing ship designs. In addition, the established limitation of liability regime, which protects shipowners, charterers, managers, and operators of ships, provides an upper limit for the financial exposure for losses during transport by ships, an aspect which is not well defined when pipelines or other modes of transport are considered. For more information

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Policy guidance calls for faster deployment of carbon capture for Europe's industry - Enhancing CCUS in Europe in support of the Paris Agreement

Martina Fantini Laboratorio Energia e Ambiente Piacenza (CLEANKER) Richard Porter Department of Chemical Engineering, University College London (C4U), November 2021.

Greater support and better regulation are needed to accelerate deployment in Europe of carbon capture, utilisation and storage (CCUS), a set of technologies widely seen as essential for decarbonising industry and helping limit dangerous global heating A new policy brief, prepared by a group of leading CCUS researchers and practitioners, argues that the technology should be prioritised, alongside renewable energy and other decarbonisation options, in national regulatory frameworks. For more information

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European Commission builds on "Fit for 55" energy and climate package with new measures

EY – Ernest Y, January 2022

In December 2021, the European Commission (the Commission) released a series of legislative proposals as a continuation to the "Fit for 55" package announced in July 2021. The proposals aim to pave the way towards renewable and low carbon fuels and create a market for hydrogen. The package also contains provisions related to methane emissions, providing for obligatory tracking and reduction of methane released into the atmosphere from the energy sector. Furthermore, the Commission set forth the principles around sustainable carbon cycles and for efficient and green mobility and introduced another proposal aiming to foster the decarbonization of the building sector. The new measures are viewed as another milestone in delivering the goals of the European Green Deal. Ahead of implementation, the measures are expected to significantly accelerate business transformation toward sustainability in gas, agriculture and transportation sectors. For more information

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Questions & Answers on Sustainable Carbon Cycles

European Commission, December 2021

The Green Deal is the EU's growth strategy. While we need to drastically reduce the use of fossil carbon, our economy will still need carbon to function. However, the "one-way" approach of extracting carbon from fossil reserves, using it, and releasing it as waste to the atmosphere is not compatible with the EU's objective of

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climate neutrality. We need to slow down, stop and reverse the accumulation of CO2 in the atmosphere that is in large part responsible for global warming, through three key-actions: For more information

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Yara's position on Fit for 55 - Supporting Europe's low-carbon solutions

Yara, January 2022

Yara sees opportunities to improve the legislative proposals in some specific areas, which would accelerate the transition, enhance the competitiveness for European low carbon solutions on the global market and make the legislative package more coherent For more information

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Council agrees on the Carbon Border Adjustment Mechanism (CBAM)

DG Trésor , March 2022

On Tuesday 15 March, the Council reached agreement (general approach) on the Carbon Border Adjustment Mechanism (CBAM) regulation, which is one of the key elements of the European Union's 'Fit for 55' package. The main objective of this environmental measure is to avoid carbon leakage. It will also encourage partner countries to establish carbon pricing policies to fight climate change. For more information

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European Parliament provides recommendations on EU Carbon Border Adjustment Mechanism

EY Ernest Yang, March 2022

Last summer, the European Commission (the Commission) presented a set of proposals ("Fit for 55" legislative package). This package aims to align the European Union (EU) climate, energy, land use, transport and taxation policies with the goal of reducing net greenhouse gas (GHG) emissions by at least 55% from 1990 levels by 2030 with the overarching goal to achieve climate neutrality in Europe by 2050. One of the proposals is the Carbon Border Adjustment Mechanism (CBAM), which will introduce a carbon price on certain products imported into the EU. The CBAM proposal will be enacted by the European Parliament (EP) and the Council of the EU. The ordinary legislative procedure sets out that the responsibility committee for CBAM is the EP's Committee on the Environment, Public Health and Food Safety (ENVI). In December 2021, the ENVI completed the first reading of the proposal and submitted their recommendations to the EP. The recommendations are seen as a substantial transformation of the initial draft, aimed at rapid deployment with wider coverage. For more information

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FUNDING & TENDER OPPORTUNITIES

FRANCE

Appel à projets i-Démo
BPI France

Deadline date :**03/05/2022**

The "i-Demo" action of the Future Investment Program (PIA) aims to develop industrial and service companies in promising markets, creating value and competitiveness for the economy and contributing to energy, ecological and digital transitions. For more information

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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

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

Deadline date: 16/10/2023 (15/04/22; 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

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

Deadline date: 15/02/2023 (**16/05/2022** - 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

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

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

Deadline date: 15/09/2022 (**16/05/2022**)

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

FUNDING & TENDER OPPORTUNITIES

EUROPE

Breakthrough Energy Catalyst

Deadline date :**13/05/2022** - 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

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HORIZON-CL5-2022-D3-02-08 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

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Research Fund for Coal & Steel (RFCS) - RFCS-2022-CSP-Big Tickets for Steel

Deadline date: **03 May 2022**

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

Within the European Green Deal objectives, applicants to the RFCS Calls should consider the following elements when preparing their proposals: Energy-intensive industries, such as steel are indispensable to Europe's economy, as they supply several key value chains. The decarbonisation and modernization of this sector is essential. The Commission will support clean steel breakthrough technologies leading to a zero-carbon steel making process by 2030. For more information

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HORIZON-CL5-2022-D3-03-07: 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

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Innovation fund - Small-scale projects

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

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Innovation fund - large-scale projects

Deadline date: March 2022. 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

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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 – Strategic Planning of Regions and Territories in Europe for Low-Carbon Energy and Industry Through CCUS

Carbon capture, utilization and storage (CCUS) is expected to play a key role in the decarbonizing of Europe's industry and energy supply. The EU-funded STRATEGY CCUS project will design economic evaluations at regional and national scales for CCUS deployment in seven southern and eastern EU Member States. The aim is to elaborate scenarios taking into account the needs and concerns of key regional and national stakeholders, as well as the positive environmental impact of CCUS in the lifecycle of carbon. Currently, advanced CCUS clusters are mainly concentrated in western Europe around the North Sea. The project will consider transport corridors between local CCUS clusters and the North Sea infrastructure. For more information

Project Information

STRATEGY CCUS

Grant agreement ID: 837754

Start date 1 May 2019

End date 31 July 2022

Funded under
H2020-EU.3.3.
H2020-EU.3.3.2.

Overall budget
€ 3 069 473,75

EU contribution
€ 2 959 533,75

Coordinated by
BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES

France

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

Project Information

ACCSESS

Grant agreement ID: 101022487

Start date 1 May 2021

End date 30 April 2025

Funded under
H2020-EU.3.3.
H2020-EU.3.3.2.

Overall budget
€ 18 427 186,75

EU contribution
€ 14 983 874

Coordinated by
SINTEF ENERGI AS

Norway

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

Horizon 2020 - IMplementation Plan for Actions on CCUS Technologies in the SET Plan Support

Carbon capture, utilisation and storage (CCUS) can be applied across the energy system. While CCUS technologies will no doubt play a big role in decarbonization of the European energy and industrial sectors, they have not been developed in Europe to the extent required. The EU-funded IMPACTS9 project will support the EU's implementation of the Strategic Energy Technology (SET) Plan – a major tool to contribute to cost reduction and improve performance of low-carbon energy technologies through impactful synergetic innovation actions. The project consortium is composed of organizations highly representative of the related stakeholders and will engage with them for their active contribution in implementation of the SET Plan. For more information

Project Information

IMPACTS9

Grant agreement ID: 842214

Start date 1 May 2019

End date 30 April 2022

Funded under H2020-EU.3.3.

Overall budget € 1 100 298,75

EU contribution € 1 100 298,75

Coordinated by THE CARBON CAPTURE AND STORAGE ASSOCIATION

United Kingdom

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

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. The project will include the evaluation of the entire CCUS chain from emitter to storage as well as socio-political aspects and social readiness assessments based on three business cases in the EU and China. For more information

Project Information

REALISE

Grant agreement ID: 884266

Start date 1 May 2020

End date 30 April 2023

Funded under H2020-EU.3.3.2.

Overall budget € 7 131 752,50

EU contribution € 6 444 163,75

Coordinated by SINTEF AS

Norway

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

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-effective 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

Start date 1 April 2020

End date 31 March 2024

Funded under
H2020-EU.3.3.
H2020-EU.3.3.2.

Overall budget
€ 13 845 496,89

EU contribution
€ 12 499 083,27

Coordinated by
UNIVERSITY COLLEGE LONDON
United Kingdom

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

Project Information

CATCO2NVERS

Grant agreement ID: 101000580

Start date 1 May 2021

End date 30 April 2025

Funded under
H2020-EU.3.2.4.2.
H2020-EU.3.2.

Overall budget
€ 6 641 111,25

EU contribution
€ 6 641 110,75

Coordinated by
FUNDACION PARA EL DESARROLLO Y LA INNOVACION TECNOLOGICA
Spain

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

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

Project Information

TAKE-OFF

Grant agreement ID: 101006799

Start date 1 January 2021

End date 31 December 2024

Funded under
H2020-EU.3.3.3.

Overall budget
€ 5 340 538,75

EU contribution
€ 4 998 788,25

Coordinated by
NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO

Netherlands

Creating value from industrial CO2 sources

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

Project Information

PYROCO2

Grant agreement ID: 101037009

Start date 1 October 2021

End date 30 September 2026

Funded under
INDUSTRIAL LEADERSHIP - Leadership in enabling and industrial technologies

Total cost
€ 43 887 817,75

EU contribution
€ 39 999 561,18

Coordinated by
SINTEF AS

Norway

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

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.

Project Information

ConsenCUS
Grant agreement ID: 101022484

Start date 1 May 2021
End date 30 April 2025

Funded under
SOCIETAL CHALLENGES - Secure, clean and efficient energy

Total cost
€ 13 905 272,50

EU contribution
€ 12 862 331,88

Coordinated by
RIJKSUNIVERSITEIT GRONINGEN
Netherlands

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

Développement de matériaux catalytiques à double fonction pour le captage et la conversion intégrés du CO2 – DuCaCO2 (ANR)

Carbon capture and storage (CCS) or utilization (CCU) technologies have the potential to mitigate the anthropogenic CO2 emissions, largely responsible for climate change. In this project we aim an integrated CO2 capture and utilization (ICCU) process, by which CO2 is first captured and then converted to a chemical commodity or fuel in a single fixed bed reactor under isothermal conditions. For this reason a dual functional material will be developed, which exhibit at the same time considerable CO2 capture capacity and favorable catalytic properties for CO2 conversion. The objective is to combine clay mineral as CO2 sorbent with metal-doped ceria nanoparticles (NPs) as effective catalysts for CO2 hydrogenation to CH4. The consortium will bring together their competences with a purpose to formulate a new class of dual functional solids and demonstrate their feasibility for CO2 capture and conversion in medium-term application in the energy 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.

UPCOMING EVENTS

Europe Conference CO2 Capture, Storage & Reuse, 17-18 May 2022, Copenhagen, Denmark
https://fortesmedia.com/co2-capture-storage-reuse,4,en,2,1,19.html

During this 2-day event rich in presentations from industry end-users and running projects case studies you will gain a comprehensive overview of the carbon capture technology. You can hear experts focusing on new regulations, changing market situation and more. Get an opportunity to network and exchange views with industry leaders.

CO2 Carbon Capture technology North America EXPO
14-16 June 2022, Houston, Texas, USA
https://www.ccus-expo.com/

Carbon Capture Technology Expo North America will unveil the very latest current and emerging technologies from some of the sector's leading experts and energy leaders while providing a showcase for innovative models that can capture carbon's potential by turning CO2 by-products into profitable applications for concrete, carbon fiber, polymers, food, fertilizers, liquid fuels, chemicals, graphene and more.

2nd International Conference on Negative CO2 Emissions
14-17 June, 2022 Gothenburg, Sweden
https://negativeco2emissions2020.com/

The purpose of this conference series is to bring together a wide range of scientists, experts and stakeholders, in order to engage in various aspects of research relating to negative CO2 emissions. This will include various negative emission technologies, climate modelling, climate policies and incentives

World Conference on Climate Change & Sustainability
01-03 September, Frankfurt Germany
https://climateweek.thepeopleevents.com/

The World Conference on Climate Change & Sustainability (Climate Week 2022) with theme of Advancing the Global efforts on Climate Transparency, offers an interdisciplinary forum for the discussion of the impact of climate change and global warming in the global context. This conference is the foremost global forum for m ultilateral discussion of climate change matters, and has an incredibly busy schedule. Climate Week 2022 will be bringing together a range of key actors from institutions, governments, cities and communities, the private sector, and civil society, including young minds, from all over the world, to make the world more climate-resilient.

Carbon Capture Technology Expo
19-20 October 2022, Messe Bremen, Germany
https://www.carboncapture-expo.com

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

Carbon Capture Technology Expo Europe is dedicated to discussing the increasing role that Carbon Capture, Utilization & Storage (CCUS) will play in transition to a net-zero carbon economy. Leading experts from around the world will discuss the latest advances in new technology for carbon capture, storage and transport, as well as unique ways of utilizing CO2 to produce net-zero fuels and for other manufacturing processes.

16th Greenhouse Gas control technologies conference,
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).

INTERESTING SITES

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

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

CO2 Value Europe database ***(New)*** - 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/

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