



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

Project type: IA – Innovation Action
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MARKET STUDIES



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FOREWORD

In the face of escalating global concerns regarding climate change and the imperative to transition to a low-carbon economy, the exploration and implementation of innovative carbon management solutions have become paramount. Carbon Capture and Utilization (CCU) and Carbon Capture, Utilization, and Storage (CCUS) projects represent promising avenues in our quest to mitigate carbon dioxide emissions and foster sustainable development.

This part of the Toolbox encapsulates a comprehensive examination of market studies surrounding CCU and CCUS initiatives. It delves into the intricate landscape of carbon capture technologies, utilization methods, storage mechanisms, and their commercial viability. Through meticulous analysis and synthesis of industry data, this report aims to provide stakeholders with invaluable insights into the current state and future prospects of CCU and CCUS endeavors.

As we navigate the complexities of climate change mitigation, collaboration between industry, policymakers, academia, and communities is essential. This report serves as a catalyst for informed decision-making, fostering dialogue, and inspiring action towards a more sustainable future.

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The world needs to capture, use, and store gigatons of CO₂: Where and how?

McKinsey & Company, April 2023

Countries and companies around the globe are committing to net zero by 2050. One suite of technologies—collectively called carbon capture, utilization, and storage (CCUS)—offers solutions for many hard-to-abate sectors such as aviation, cement, and hydrogen production from fossil fuels. However, global CCUS uptake needs to expand 120 times from current levels by 2050, rising to at least 4.2 gigatons per annum (GTPA) of CO₂ captured, for countries to achieve their net-zero commitments. This article explores potential CCUS hubs, five emerging hub archetypes, and three key steps to accelerate the development of CCUS hubs. [For more information](#)

Carbon capture and utilization: More than hiding CO₂ for some time

Mertens, Jan, Breyer, Christian, Arning, Katrin, Bardow, André, Belmans, Ronnie, Dibenedetto, Angela, Erkman, Suren, Gripekoven, Jim, Léonard, Grégoire, Nizou, Sylvain, Pant, Deepak, Reis-Machado, Ana S., Styring, Peter, Vente, Jaap, Webber, Michael, Sapart, Célia J. February 2023

This paper, led by Jan Merten, Chief Science Officer with the contribution of Jim Gripekoven clarifies some of the myths related to CO₂ utilisation and highlights some important facts about CCU technologies with a focus on synthetic fuels which refers to creating fuels from renewable energy, water and carbon dioxide. These myths also exist at the level of public opinion and influence the general socio-political acceptance of CCU technologies. [For more information](#)

Best CO₂ Utilisation 2023” Innovation Award – Three winning CCU solutions open the road to transition away from fossil resources

Nova-Institut GmbH, April 2023

More than 245 participants from 30 countries across the world attended the Innovation Award ceremony at the Conference on CO₂-based Fuels and Chemicals 2023 in Cologne, Germany and online. The conference is one of the most established worldwide events on CCU for the entire Power-to-X industry and its customers. This year’s 11 th edition showcases the latest and most important developments in the fast-growing field of CO₂ capture and utilisation. During the ceremony, six nominees had the opportunity to present their innovative CCU solutions to a broad audience of international experts, while nearly 200 people selected the three winners of the innovation award in an audience live voting. From materials that improve carbon capture to the production of proteins and CO₂-based building materials, the three winning CCU innovations open the road to transition away from fossil resources. [For more information](#)



How new business models are boosting momentum on CCUS

IEA , March 2023

2022 was a strong year for carbon capture, utilisation, and storage (CCUS). More than 140 new projects were announced, increasing planned storage capacity by 80%, and capture capacity by 30%. CCUS projects were announced in seven additional countries, in central and southern Europe, the Middle East, and Southeast Asia, bringing the total number of countries with plans to develop CCUS to 45.

Around 15 final investment decisions were taken across applications in industry, power, fuel transformation and direct air capture since the beginning of 2022, up from eight in 2021. This signals an increasing confidence in the industry, driven in part by CCUS-specific policy incentives in the United States, Canada, and the United Kingdom; by strengthened climate pledges; and by rising carbon prices in compliance and voluntary carbon markets. [For more information](#)

Has the time come to scale-up Carbon Capture, Utilisation and Storage?

DWF energy group, 2023

CCUS has had a checkered history. Despite being available for decades, there are still fewer than 30 commercial operational projects worldwide. Progress has been held back by a combination of high costs, technology issues and critically a lack of supportive regulatory frameworks. So what has changed? In this report, DWF's energy team explain why a wide range of interested parties from oil and gas companies to infrastructure investors, asset managers, and pension funds should move now to invest :

- ✓ How deep, large-scale storage will overtake enhanced oil recovery (EOR) as the primary destination for captured CO2 by 2030;
- ✓ What is behind the growth of the cluster model of large combined projects, bringing together multiple emitters and storage sites using shared infrastructure;
- ✓ How regulation and incentives are being used to address key hurdles to investment and potential barriers to entry;
- ✓ How cross-border partnerships and agreements can pave the way for international CO2 transport and storage as a service;
- ✓ The role of statutes (law, fiscal regimes, and regulation) and regulator responsibility (liabilities, co-funding) will become the most effective way to address and mitigate challenges across the CCUS project value chain.

[For more information](#)



Global Energy and Climate Model

IEA, October 2023

Since 1993, the IEA has provided medium- to long-term energy projections using a continually evolving set of detailed, world-leading modelling tools. First, the World Energy Model (WEM) – a large-scale simulation model designed to replicate how energy markets function – was developed. A decade later, the Energy Technology Perspectives (ETP) model – a technology-rich bottom-up model – was developed, for use in parallel to the WEM.

In 2021, the IEA adopted for the first time a new hybrid modelling approach relying on the strengths of both models to develop the world's first comprehensive study of how to transition to an energy system at net zero CO₂ emissions by 2050. The integrated framework of the IEA's Global Energy and Climate Model (GEC Model) is now the principal tool used to generate detailed sector-by-sector and region-by-region long-term scenarios across IEA publications, including the 2023 update of the Net Zero Roadmap, the World Energy Outlook series and Energy Technology Perspectives series.

Download the GEC Model Methodology document for an in-depth description of the overall approach and features of the model, and download the GEC Model Key Input dataset for selected key input data. [For more information](#)

Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach

IEA, September 2023.

In May 2021, the IEA published its landmark report Net Zero Emissions by 2050: A Roadmap for the Global Energy Sector. The report set out a narrow but feasible pathway for the global energy sector to contribute to the Paris Agreement's goal of limiting the rise in global temperatures to 1.5 °C above pre-industrial levels. The Net Zero Roadmap quickly became an important benchmark for policy makers, industry, the financial sector and civil society.

Since the report was released, many changes have taken place, notably amid the global energy crisis triggered by Russia's invasion of Ukraine in February 2022. And energy sector carbon dioxide emissions have continued to rise, reaching a new record in 2022. Yet there are also increasing grounds for optimism: the last two years have also seen remarkable progress in developing and deploying some key clean energy technologies.

This 2023 update to our Net Zero Roadmap surveys this complex and dynamic landscape and sets out an updated pathway to net zero by 2050, taking account of the key developments that have occurred since 2021. [For more information](#)

