

CO₂-based Fuels and Chemicals Conference 2024

17–18 April • Cologne (Germany)

Conference Journal

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transkript.de



Table of Contents

Introduction	6
Conference Team, Venue & Accommodation, Entrance Fee	7
Address from the Minister	8
Floor Plan and Exhibition	9
Poster Sessions	10
CCU Networking and Streaming Platform	12
Program Day 1, 17 April 2024	14
Bright Future for CCU – Promising Future Policy Framework in the European Union	18
Conference Advisory Board	21
Nominees of the Innovation Award 2024	22
Winners of the Innovation Award 2023	26
Program Day 2, 18 April 2024	28
Valuable Quotes from the Speakers	32
Renewable Carbon Initiative	34
Save the Date: nova Conferences 2024 & 2025	36



Free WiFi

Network ID nova-Conference
Password #2024CCU



#2024CCU



#2024CCU

16 April 2024, 19:00 (CET)
On the Eve of the Conference

Proposed Meeting Point for a Social Evening Gathering

Kölsch Brewery
Schreckenskammer
Ursulagartenstraße 11–15, 50668 Köln (Cologne)
(10 minutes walk from Cologne Central Station)

Join at sli.do

for real time questions and comments



Main Sessions

Grand Hall

#2024CCU



Parallel Session

Room Adelheid

#2024CCU-2

Zoom Events

We sent you the link
to Zoom Events.

All details:
Please see page 12.



Program

The 12th edition of CO₂-based Fuels and Chemicals Conference will showcase again the newest and most important developments in the fast growing field of CO₂ capture and utilisation.

You can look forward to the following contents:

DAY 1

17 April 2024

9:30–18:15 (CET)

P. 14

Session 1:

Innovation, Strategy and Policy

Session 2:

Biogenic CO₂ Sources and Carbon Capture

Session 3:

Innovation Award “Best CO₂ Utilisation 2024”

DAY 2

18 April 2024

9:00–17:30 (CET)

P. 28

Session 1:

CO₂ to Chemicals and Fuels

Session 2:

CO₂ to Polymers and Materials

Session 3:

CO₂ Utilisation Technologies

Parallel Session:

Advanced Research in CCU



Welcome to the now 12th Edition of our “CO₂-based Fuels and Chemicals Conference” in Cologne

Dear Participants,

The story of CCU continues to unfold and there have been some interesting and significant steps in recent years. After the US and China have introduced stimulating policy frameworks, the European policy framework for CCU looks promising (see article on page 18).

Carbon capture and Utilisation (CCU) is much more than just a CO₂ removal technology, it is one of the three pillars to move forward to a sustainable and defossilized chemical industry for the future. 70% from the GHG emissions come from additional fossil carbon used for energy and material uses. For the energy sector there is a good strategy for decarbonisation with renewable energies, but this will not work for chemicals and materials, because most of them are based on carbon (just like humans) and there is a lasting and even increasing need for carbon for these chemicals and materials. The key challenge is to cover the demand for carbon by alternative carbon sources and those alternative carbon sources are biomass, CCU and recycling of carbon containing waste streams (bio and plastic waste) – we need them all together to replace fossil carbon as renewable carbon sources. So, the equivalent to decarbonisation in the energy sector is a transition to renewable carbon in the chemical and material industries, and both mean defossilisation.

The Intergovernmental Panel on Climate Change, in its 6th assessment report released in 2022 (IPCC 2022), recognizes CCU as one of the solutions to mitigate climate change. Several future scenarios for a net-zero chemical industry in 2050 show that between 10 and 30% of the demand for embedded carbon in chemicals and materials will come from the utilisation of CO₂. The potential of CCU has been acknowledged by several global brands which are already expanding their feedstock portfolio. Cooperation along the value chain is key to properly level the costs and benefits. Supportive regulations are implemented in the USA with the Inflation Reduction Act as well as in China. In the USA the use of CO₂ for fuels and chemicals from air capture and also from point sources is supported, including commercial plants. Such smart policies are needed to build the bridge between now and 2050 for companies to remain competitive in the sustainable transformation. Today, the EU is behind, but now that several support instruments for CCU are being discussed in Brussels, the future European policy framework for CCU looks more promising than ever (see article on page 18).

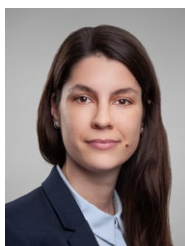
So how is the CCU landscape developing, and what else is happening in the world of CCU? The use of alternative carbon feedstock to replace fossil carbon remains still high on the agenda of many industry players and the production of e-kerosene as a sustainable aviation fuel (SAF) is being stimulated mainly by a forthcoming quota and supporting activities, as we see today in the US and the EU. The need of renewable energy and green hydrogen for CO₂ conversion is understood and a large number of international cross-sector projects for hydrogen production and logistics have been announced or are already under construction.

Over the next two days you will have the opportunity to discuss with new and leading players the developments in CCU and the need to create the right framework to promote it. Learn more about the latest technical and political developments and discuss future strategies in numerous panel discussions. It's all about communication and networking!

We wish all participants new insights, great ideas and lots of inspiration.

The future belongs to the use of CO₂ and we have the chance to actively shape this path together.

Yours sincerely,



Pia Skoczinski
Program



Achim Raschka
Program



Michael Carus
Managing Director



Your Conference Team



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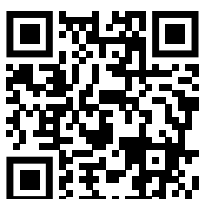
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Registration
co2-chemistry.eu/registration

Venue & Accommodation



Maternushaus
Kardinal-Frings-Str. 1–3
50668 Köln (Cologne)
Germany

Phone: +49 221 – 1631-0
frontoffice@maternushaus.de
www.maternushaus.de

Recommended Hotels
www.co2-chemistry.eu/venue

Entrance Fee

2 Days • 17–18 April 2024

Ticket for on site (and online) attendance
incl. dinner buffet on the first day
995 €

Day 1 • 17 April 2024

Ticket for on site (and online) attendance
incl. dinner buffet
670 €

Day 2 • 18 April 2024

Ticket for on site (and online) attendance
600 €

2 Days Online Ticket • 17–18 April 2024

Ticket for virtual attendance
690 €

2 Days Student Ticket • 17–18 April 2024

Ticket for on site (and online) attendance
incl. dinner buffet on the first day
350 €



Address from the Minister, Mona Neubaur, to the CO₂-based Fuels and Chemicals Conference 2024



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Minister Mona Neubaur,
Ministry of Economic Affairs, Industry,
Climate Action and Energy of the State of
North Rhine-Westphalia

As we are setting up our industrial region for net zero, a prominent role is set aside for the chemical industry. Some 98 per cent of industry value chains in North Rhine-Westphalia build on chemical products, with all sectors facing considerable challenges. The transition requires sizeable spending on new technologies and infrastructure. In a parallel effort, we need to put the consumption of energy and other resources on a more efficient footing whilst reducing the use of fossil feedstocks and energy sources. The chemical industry is made to stand out by its pivotal role in value creation and as an enabler of many transformation processes.

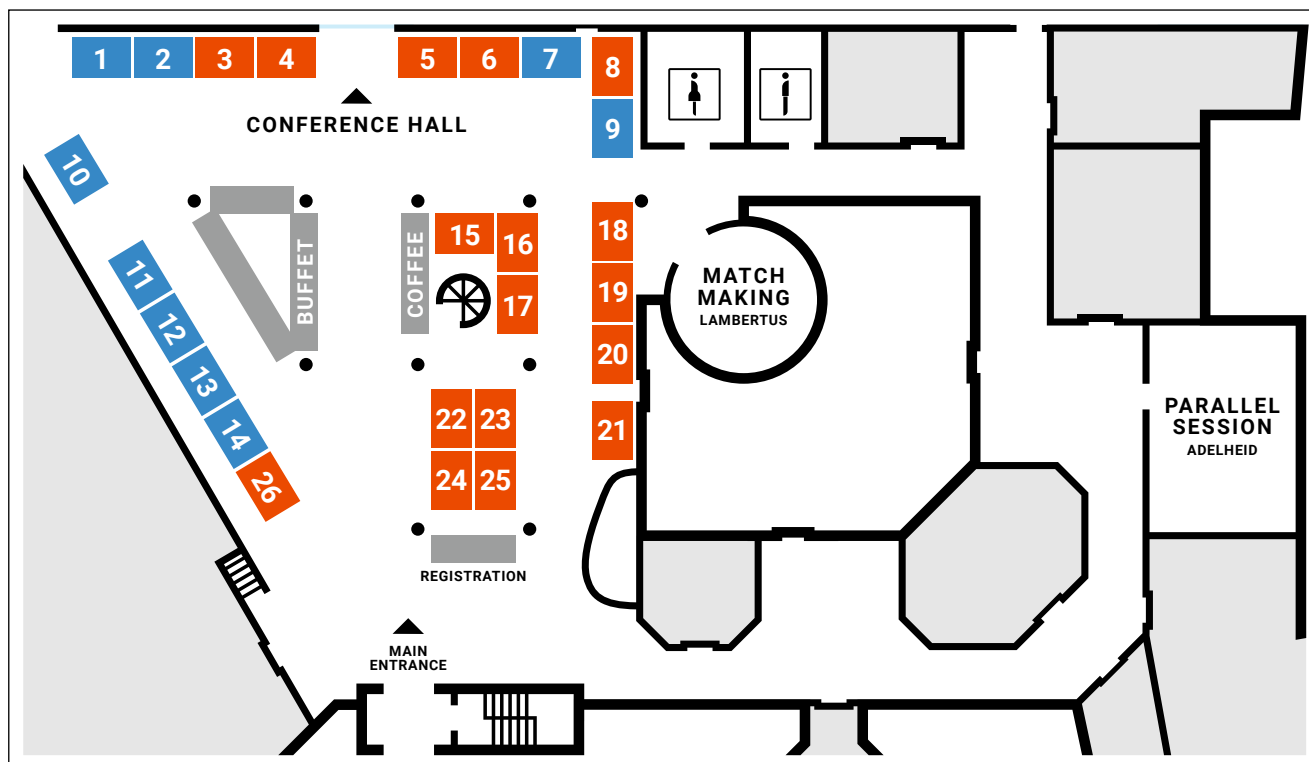
As an energy-hungry industry which occupies an early stage of the value chain, the chemical sector is a key trade in North Rhine-Westphalia, and one that we are keen to hold on to. The sector has been hit particularly hard during the past few years, in a period dominated by a multitude of crises. The challenges facing the chemical industry have been exacerbated by high energy prices, international competition, scarcity of raw materials and supply chain issues. It is therefore all the more important for us to create and maintain an overall business climate in North Rhine-Westphalia that fosters competitiveness of local industries.

We are encouraged by the advances in renewable energy expansion and the rapid development of the hydrogen sector. Another thing that is moving forward nicely is the creation of a sustainable circular economy, which is making great strides in several jurisdictions. Here, carbon capture and utilisation is providing the chemical industry in particular with the opportunity to dovetail climate action and resource security. At the same time, there are still some key political and technological questions to be addressed, such as those relating to carbon loop closure or the permanent storage of CO₂.

When it comes to dealing with these issues and unlocking the potential of CCU for the chemical industry, the 12th CO₂-based Fuels and Chemicals Conference makes a significant contribution. It is vitally important to have a sustainable and thus competitive industry if we want to retain our economic strength. The insight and perspectives delivered by and during the conference, along with the potential for exchange and cooperation, will be of huge benefit. On that note, I wish those taking part a very productive conference and much food for thought.

Exhibition

■ Free
 ■ Reserved for Sponsors
 ■ Booked



List of Exhibitors

- 03 Sulzer (CH)
- 04 GIG Karasek (AT)
- 05 Yncoris (DE)
- 06 nova-Institute (DE)
- 08 Media Table
- 15 Coatema Coating Machinery (DE)
- 16 Carbon Beyond Limits (DE)
- 17 PtX Lab Lausitz |
Zukunft – Umwelt – Gesellschaft (ZUG) (DE)
- 19 Brusche Process Technology (NL)
- 20–21 Innovation Award "Best CO₂ Utilisation 2024"
- 22 NANOGAP (ES)
- 23–25 Poster Session
- 26 Endress+Hauser (CH)



Book your booth:
co2-chemistry.eu/exhibition-booking

Status:
 3 April 2024
 More exhibitors expected: co2-chemistry.eu/exhibitors



Poster Sessions

The poster sessions will take place on 17th of April starting at 18:30 and during the lunch break (13:10–14:40) of the second day 18th of April with a few minutes presentation at a special poster area at booths number 23–25 on the exhibition space.

AIMPLAS (ES)

Deivi Oliveros

Paving the Asphalt Industry with Sustainable CO₂-Bitumen Mixtures

Institut für Katalyseforschung und -technologie (IKFT),
Karlsruher Institut für Technologie (KIT) (DE)

Henri Steinweg

The Interface of Biotechnology and Process Technology in Fermentative CCU Process Development

Ainia (ES)

Alejo Valles

In-situ Biogas Upgrading in Anaerobic Digestion by DIET Promotion Strategies

Institute of Geotechnics of the Slovak Academy of Sciences (SK)

Erika Tothova

Potential use of K-Feldspar for CO₂ Sequestration

Austrian centre of Industrial Biotechnology (acib) (AT)

Halima Aliyu Alhafiz

High Cell Density Gas Fermentation for a Carbon Neutral Bioplastic Production by a Knallgas Bacterium

International Iberian Nanotechnology Laboratory (INL) (PT)

Soraia Patrícia Silva Fernandes

Metal-Organic Framework Composites for CO₂ Capture and Storage

Delft University of Technology (NL)

Josephine Vos

Ex-ante Techno-economic Assessment of a first-of-a-kind co-electrolysis Plant for Syngas Production

KU Leuven (BE)

Julien Devos

Coupling ZnZrOx and SSZ-13 for CO₂ Hydrogenation to Olefins

Empa, Swiss Federal Laboratories for Materials Science and Technology (CH)

Carlos E. Gómez-Camacho

Synthetic Aviation Fuels: Current and Prospective Environmental Sustainability Insights

LUT University (FI)

Tero Tynjälä

How to Create Market for CO₂ CCUS Infrastructure for Carbon Neutral Finland

Future Fuels Institute (DLR) (DE)

Clarisse Lorreyte

Biomass Pyrolysis with Concentrated Solar Power: Development of Solar Receiver Particle Heat Carriers

National Atomic Research Institute (TW)

Hui-Jun Wang

Constructing and Optimizing a Platform of Cyanobacteria for Lactic Acid Production

Indian Institute of Technology Indore (IN)

Jayashree Parthiban

Ruthenium-Catalyzed Formic Acid/Formate Dehydrogenation and Carbon Dioxide/(bi) Carbonate Hydrogenation in Water

National Institute of Chemistry (SI)

Aleksa Kojčinović

The Effect of Various Preparation Procedures of Metal Phenoxides on Their Respective Carboxylation Efficiency and Development of a Microkinetic Model



Sekisui Chemical Co., Ltd. (JP)

Keisuke Iijima

**Innovative CO₂ to CO Conversion Technology Oriented
Toward both Carbon Neutrality and Circular Economy**

University of Bologna (IT)

Amiza

**Acetic Acid Production by Means of Carbon Capture and Fixation
(CCF) through Homoacetogenic Microbial Consortium Supported
on Biochar-based System**

Syed Babr Ali School of Science and Engineering, LUMS (IN)

Ifra Bashir

**Convergent Electrochemical Formate Synthesis by
Integrating Electrooxidation of PET-Derived Ethylene Glycol
with CO₂ Electroreduction**

University of Liège (BE)

Alejandro Morales

**Design of a Fischer-Tropsch Installation for Jet Fuel Production
Using Water-assisted Vinylene Mechanism for Cobalt Catalyst
Kinetics**

TU DELFT (NL)

Jai Singh

**CO₂ Adsorption on Pure and Ionic Liquid Immobilized
Na-Y zeolite and Al-MCM-41: Molecular Simulation Studies**

University of Munich (DE)

Marcel Dossow

**Biomass Gasification as a Valuable Carbon Source for
Power-to-Liquid Processes**

UCL, IMAP (BE)

Mar Garcia Alvarez

**CO₂ Revalorization as (Bi)carbonate Crystals using
Membrane Technology**

VITO (BE)

Ben Sutens

**3D Printed Hybrid Zeolite Structures Constructed
by a Phase Inversion Process**

Universidad de Valladolid (ES)

Maira Ivette Chinchilla Dueñas

**Hydrothermal Reduction of CO₂ in Semicontinuous Plant
with Biomass as Reducing Agent**

Universität Bielefeld (DE)

Max Rogowski

Biological Utilization of CO₂ and CO₂ Derived Substrates

Université Catholique de Louvain (FR)

Kamyll Cocon

**Polyionic Liquid Deposited Biocatalytic Membrane Contactor for
Intensified CO₂ Capture and Conversion into Bicarbonate**



co2-chemistry.eu/posters



Networking and Streaming Platform

Zoom Events offers all participants, speakers, exhibitors and sponsors the opportunity to network and chat.

How to enter

- 1 The use does not require a Zoom account. Register either with your Zoom account or with your email address.

Use the link in your participation confirmation email to register to the Zoom Events platform. There, you can get in contact with other participants, speakers, exhibitors and sponsors.

- 2 If you have a Zoom account, please use it to login. Otherwise please login with your email account, a verification code will be sent to you via email.

- 3 After registration, you will then receive a second email which contains a "Join" button.

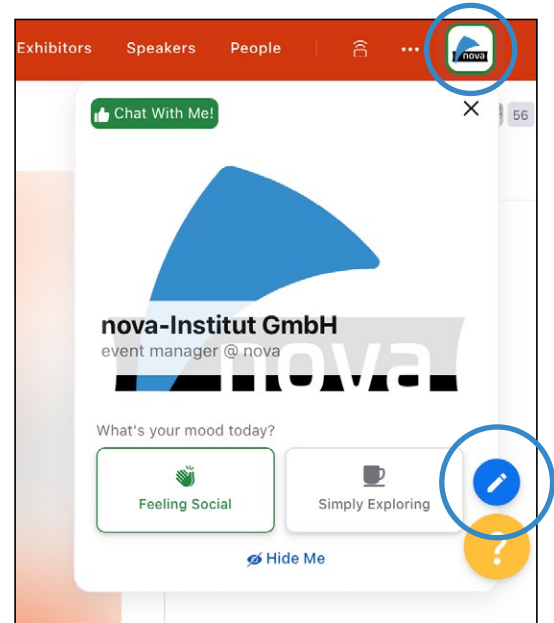
Please use this path to (re)enter throughout all conference days.



Your profile

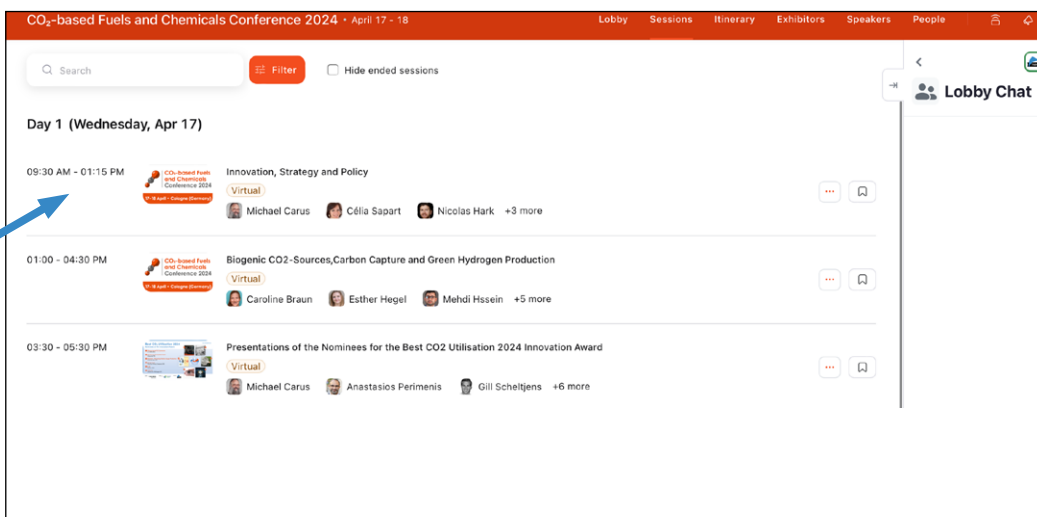
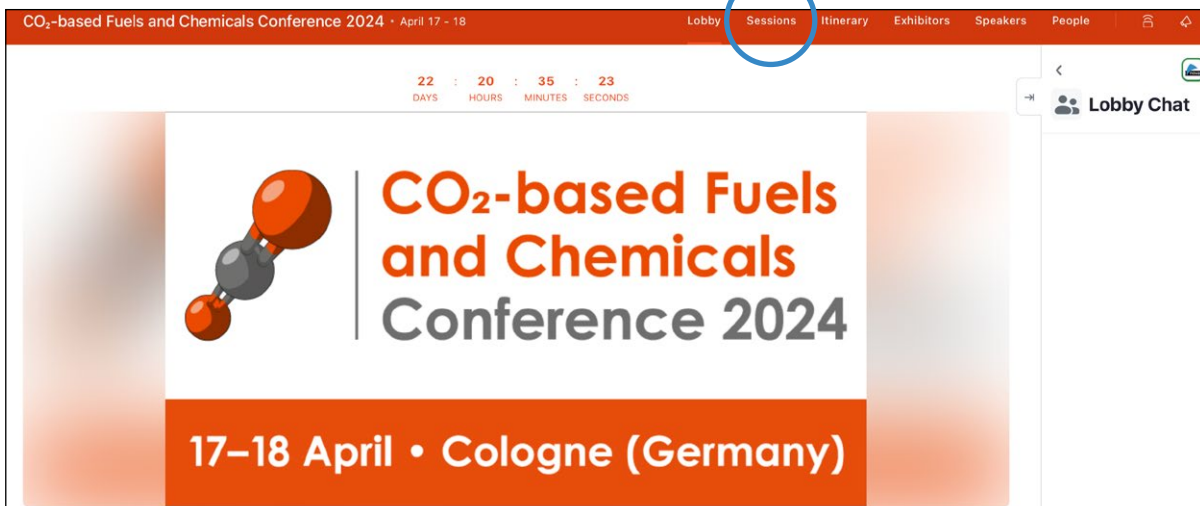
Adding more information allows others to find and contact you, by entering for example key words.

To edit your profile, click on the icon in the upper right corner.



How to follow the livestream

Sessions in the main event hall will be streamed in the lobby, but you can have a larger screen by clicking on "sessions" and entering the individual session.





DAY 1

17 April 2024, 9:30–18:15 (CET)

9:30 **Michael Carus**
nova-Institute (DE)
Conference Opening

9:40 – 11:45

Innovation, Strategy and Policy

Grand Hall

Chairpersons: Lara Dammer & Christopher vom Berg, nova-Institute

9:40



Michael Carus
nova-Institute (DE)
The Importance of CCU in a Renewable Carbon
Economy – Making the Case for CCU

10:00



Anastasios Perimenis
CO₂Value Europe (BE)
The Contribution of CCU towards Net-Zero in EU

10:20



Nicolas Hark & Matthias Stratmann
nova-Institute (DE)
Policy and Sustainability in CCU – A Status Quo

10:50



Volker Sick
Global CO₂ Initiative (US)
Policy Support for CO₂ Capture and Conversion
in the USA

11:10



Lena Friedmann
CM Fluids (DE)
Renewable CO₂ – Biogas Sector's Perspective

11:30

Panel Discussion with all Session Speakers

11:45

Lunch Break & Networking



13:15 – 16:35

Biogenic CO₂ Sources and Carbon Capture

Grand Hall

Chairpersons: Achim Raschka, Pia Skoczinski & Pauline Ruiz, nova-Institute

13:15



Caroline Braun

Landwärme (DE)

A Value Chain for Biogenic CO₂

13:35



Esther Hegel

DECHEMA (DE)

CO₂ from Biogas Plants:
A Future Feedstock for
Biotechnology?

13:55



Mehdi Hssein

GIZ Morocco (MA)

Carbon Sources and Capture in Morocco:
Challenges and Opportunities

14:15

Panel Discussion with all Session Speakers

14:30

Coffee Break & Networking

15:00



Oliver Ziegler

PtX Lab Lausitz (ZUG) (DE)

Study Review: Scalable Stand Alone Direct Air
Capture System Using Zeolites

15:20



Ulrich Dietz & Ralf Gesthuisen

CBL-Carbon Beyond Limits (DE)

Amino-acid Based Carbon Capture – A Novel, Efficient
and Wide Range Applicable Carbon Capture Process
Technology

15:40



Marleen Rombouts & Ben Sutens

Flemish Institute for Technological Research – VITO (BE)

CO₂ Capture Using Porous Structured Absorbents

16:00

Panel Discussion with all Session Speakers

16:15

Short Pitch Presentations of Poster Presenters

**16:35 – 18:00**

Innovation Award “Best CO₂ Utilisation 2024”

Grand Hall

Chairpersons: Michael Carus & Asta Partanen, nova-Institute

16:35



Michael Carus
nova-Institute (DE)
Innovation Award Introduction

16:45



Anastasios Perimenis
CO₂ Value Europe (BE)
Innovation Award Introduction

16:55



Gill Scheltjens
D-CRBN (BE)
Plasma-based CO₂ Conversion

17:05



Sarah Lamaison
Dioxycle (FR)
Ethylene Producing Electrolyser

17:15



Mohammed Rezaei
GIG Karasek (AT)
ECO₂ Cell – Pioneering Modular
Syngas Production

17:25



Kevin Emery
The Sky Mining Company (UK)
Skydiamond

17:35



Nicholas Flanders
Twelve (US)
E-Jet



17:45



Cristian Torri
University of Bologna (IT)
RAPCOR

17:55

Online Voting

18:05



Martin Lindmeyer
Yncoris (DE)
Innovation Award Ceremony

18:10

Networking with Local Beer**18:30****Poster Session****20:00****Gala Dinner****22:00****Bowling – Get Together in the Party Room
beneath Maternushaus**



Bright Future for CCU – Promising Future Policy Framework in the European Union

Authors:

Michael Carus and Christopher vom Berg,
nova-Institute and RCI

For a long time, the political and economic conditions for CCU in Europe have been (and still are) unfavourable, and people looked enviously at the US, where the Biden administration massively promoted the storage (CCS) and use (CCU) of CO₂ with tax credits. In the future, however, the situation in the EU is going to change significantly.

On the one hand, this is due to the massive information work of stakeholders like CO₂ Value Europe (CVE) and the Renewable Carbon Initiative (RCI), which have comprehensively highlighted the importance of CCU as a key technology for a sustainable net-zero future.

On the other hand, the European Commission (EC) has started to acknowledge that CCU will be required for the defossilisation of fuels, chemicals and materials – and for sustainable carbon cycles.

In addition, the Commission has also increasingly recognised that CCU is needed to reduce demand for overall limited sustainable biomass. Below is a brief overview of current policies and regulations from Brussels that now include CCU in targets and strategies for the first time.

EU 2040 Climate Target

In February 2024, the EC presented its assessment for a 2040 climate target for the EU. Overall, the Commission recommends a 90% GHG emission reduction target by 2040 to put Europe on course for climate neutrality by 2050. Carbon Capture and Utilisation (CCU) is recognised as part of the low carbon energy solutions needed to decarbonise the energy system by 2040, as is the development of CCU to increase the uptake of non-fossil feedstocks to replace fossil fuels in carbon-based products.

Find out more at: https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2040-climate-target_en.

Industrial Carbon

Management Communication

Published together with the 2040 climate target recommendation, the Industrial Carbon Management Communication assigns a critical role to CCU as an essential and innovative aspect of an industrial carbon management value chain. The document clearly stresses the importance of CCU to produce advanced synthetic fuels, chemicals, polymers or minerals (“Capturing CO₂ and recycling it to produce advanced synthetic fuels, chemicals, polymers or minerals is another important and innovative aspect of an industrial carbon management value chain”). As a result of modelling, it is highlighted that up to a third of captured CO₂ could be used in 2040 – and up to 45% in 2050 (equivalent to up to 200 Mt CO₂).

Find out more at: https://ec.europa.eu/commission/presscorner/detail/en/IP_24_585.

Boosting Biotechnology and Biomanufacturing in the EU

Mid of March 2024, the EC published a series of targeted actions to boost biotechnology and biomanufacturing in the EU. While the Communication naturally focuses on bio-based, it also paints a more comprehensive picture for non-fossil feedstock supply and stresses that alternative feedstocks such as sustainable biomass, recycled waste and CO₂ captured from biogenic sources could be used to produce polymers, plastics, solvents, paints, detergents, cosmetics and pharmaceuticals. Critically highlighted is that, while demand for biomass is growing, the supply of sustainable biomass is estimated to be 40–70% below projected demand by 2050. This will require the use of additional renewable carbon sources such as recycled waste or captured carbon.

Find out more at: https://ec.europa.eu/commission/presscorner/detail/en/ip_24_1570.

Net-Zero Industry Act

In February, the European parliament and the Council of the European Union agreed to include CCU as an eligible strategic net zero technology in the Net-Zero Industry Act (NZIA). Proposed by the Commission in 2023, this act aims to strengthen the European manufacturing capacity of net-zero technologies and overcome barriers to scaling up these capacities in Europe. Within the NZIA, CCU is defined as a net zero technology and as an eligible strategic



technology under the recently agreed Net Zero Industry Act (NZIA). The role of CCU in meeting the EU's climate change targets is recognised, where CO₂ use can now be referred to as net zero in national clean technology policies and as strategic by national governments.

Find out more at: https://single-market-economy.ec.europa.eu/industry/sustainability/net-zero-industry-act_en.

Carbon Removal Certification

End of February 2024, EU legislators reached a political agreement on a world's first carbon removal certification scheme. The EU carbon removal certification framework aims to scale up carbon removal activities and fight greenwashing by empowering. Businesses to show their action in this field. CCU can obtain a certificate for carbon removal in long-term applications (> 35 years), which is defined and explained as "Binding carbon in long-lasting products and materials, such as wood-based construction materials or biochar." It is expected that other long-term applications such as CO₂- and bio-based plastics in construction may be accepted in the future too.

Find out more at: https://climate.ec.europa.eu/eu-action/sustainable-carbon-cycles/carbon-removal-certification_en.

ReFuelEU Aviation

Adopted in October 2023, the ReFuelEU Aviation initiative has the aim to increase demand for and supply of sustainable aviation fuels (SAF). This includes binding quotas, both for SAFs in general, which shall be at 70% in 2050, and for synthetic aviation fuels, which shall be at least 35% of all aviation fuels in the EU by 2050. Some experts expect a much higher share of up to 60% for the synthetic aviation fuels in reality – and that for a total of 50 million ton oil equivalent (Mtoe) of kerosene. Additional demand for CCU will also come from road and marine fuels. At the same time, by-products of synthetic fuel production, such as naphtha, could be used in the chemical industry.

Find out more at: <https://www.consilium.europa.eu/en/press/press-releases/2023/10/09/refueeu-aviation-initiative-council-adopts-new-law-to-decarbonise-the-aviation-sector/>.

EU ETS Delegated Act on Long Time Storage of CO₂ (not published yet)

The EU Emission Trading System is a cornerstone of the EU's policy to combat climate change and a key tool for reducing greenhouse emissions. Currently, the Commission is working on a delegated act to update rules that enable deduction of emissions if these have been permanently stored via CCU, and are considering the inclusion of products from chemical and plastics industries for the upcoming 2026 review – with potential exemptions for products derived from CO₂ emissions.

Transition Pathway Chemical Industry

In 2023, the EC published the transition pathway for the chemical industry, an actionable plan co-developed by the Commission with EU countries, chemical industry stakeholders, NGOs and other interested parties. Key target of the transition pathway is achieving a green

and digital transition of the chemical industry that also improves resilience. The co-implementation of the pathway is ongoing, and the action items include a separate topic with targets for the development of CO₂ as an alternative feedstock for the chemical industry.

Find out more at: https://single-market-economy.ec.europa.eu/sectors/chemicals/transition-pathway_en.

Sustainable Carbon Cycles

The Sustainable Carbon Cycles Communication was published at the end of 2021 based on the understanding that for achieving climate neutrality, Europe will have to develop sustainable carbon cycles. The communication includes an aspirational 20% non-fossil carbon target for chemicals and plastics that also directly refers to CCU: "We need to recycle carbon from waste streams, from sustainable sources of biomass or directly from the atmosphere, to use it in place of fossil carbon in the sectors of the economy that will inevitably remain carbon dependent. The circular economy and the sustainable bioeconomy sectors can address this objective and should promote technological solutions for carbon capture and use (CCU) and the production of sustainable synthetic fuels or other non-fossil based carbon products."

Find out more at: https://climate.ec.europa.eu/eu-action/sustainable-carbon-cycles/overview_en.

The above regulatory items show that Europe has picked up pace when it comes to carbon capture and utilisation, and has started to consider the technology as a critical pillar to achieve net-zero targets and sustainable carbon cycles. How quickly and comprehensively these promising policy approaches for integrating and supporting CCU will be implemented, depends largely on the next European Commission – which will take office after the summer break. It is expected that industrial policy might play a stronger role again, based on the increasing recognition that the Green Deal can only be implemented with a strong European industry and investments in innovative technologies. This would certainly benefit the implementation of the CCU.



UNDERSTAND. SOLVE. DELIVER.

Our mission is to engineer defossilisation for the chemical & bio-based industry:

- Engineering of production processes from pilot- over demo- to industrial-scale
- Accompanying engineering projects from early stage to full-scale commissioning including technology assessment, feasibility studies, etc.
- Process optimization due to experiences in plant operation
- Engineering solutions for the integration of sustainable technologies



Innovation Award

“Best CO₂ Utilisation 2024”



Conference Advisory Board

We would like to thank the experts of the conference advisory board for their great help in selecting the best submitted papers and innovations.



Heleen De Wever
VITO (BE)



Martin Lindmeyer
Yncoris (DE)



Volker Sick
University
of Michigan (US)



Christoph Gürtler
Covestro (DE)



Sarah Refai
CLIB (DE)



Harry Lehmann
PTX Lausitz (DE)



Célia Sapart
CO₂ Value Europe (BE)



Nominees of the Innovation Award



1



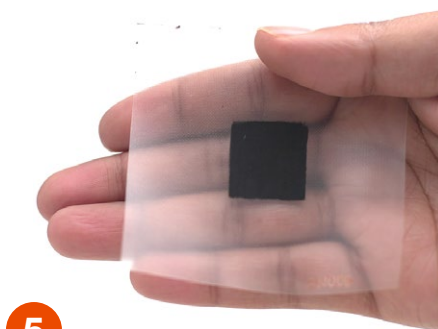
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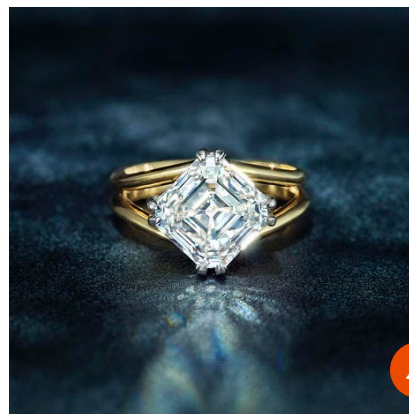
6



3



5



4



Organiser



Award Sponsor



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1

D-CRBN (BE) Plasma-based CO₂ Conversion

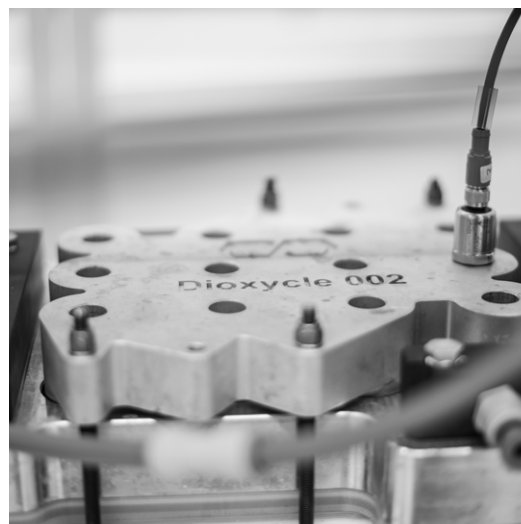


D-CRBN is a three-year-old CCU spin-off from the University of Antwerp. The company has established a proprietary modular and scalable plasma technology capable of splitting the CO₂ molecule into CO, all in a fully electrified, gaseous phase, without solvents or catalysts. The CO is then turned into added value chemicals, such as e-fuels, organic acids, polymers, etc. that are used as feedstocks for the chemical, petrochemical, maritime and metallurgical industries among others. The aim of D-CRBN is not only to defossilise industries by eliminating their point source emissions but also to replace fossil feedstocks with CO₂ recycled added value chemicals. This technology can provide strategic and decentralised resource independence to territories and industries which currently depend in oil and natural gas.

More information: www.d-crbn.com

2

Dioxycle (FR) Ethylene Producing Electrolyser



Dioxycle is pioneering a breakthrough carbon electrolysis technology that converts industrial emissions into sustainable ethylene using just renewable electricity and water. Ethylene is the world's most used organic chemical, finding application in key everyday products such as textile fibres, plastics and construction materials. Combining innovations at the catalyst, stack design, and system integration levels, Dioxycle's proprietary process works at unprecedented efficiencies. This efficiency lowers the cost of the recycling process and consequently, the cost of the ethylene generated. As a result, Dioxycle can produce carbon-neutral ethylene cost competitively with the fossil pathway, providing an economically attractive pathway to defossilise many industrial and commercial sectors.

More information: www.dioxycle.com



3

GIG Karasek (AT) ECO₂Cell - Pioneering Modular Syngas Production

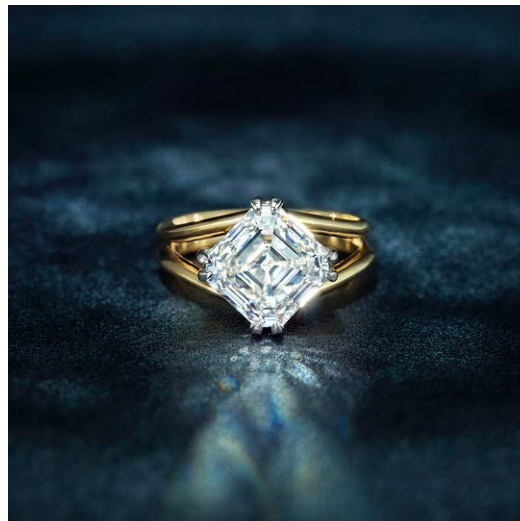


ECO₂Cell is a cutting-edge, modular plant for producing syngas through low-temperature electrochemical conversion of CO₂. This innovative technology platform efficiently converts CO₂ into valuable chemicals and fuels, promoting a circular economy. Its modular design ensures scalability and adaptability to various industrial applications, offering a sustainable and cost-effective solution for CO₂ emission challenges. ECO₂Cell exemplifies our commitment to environmental stewardship and technological innovation in addressing climate change.

More information: www.gigkarasek.com

4

The Sky Mining Company (UK) Skydiamond

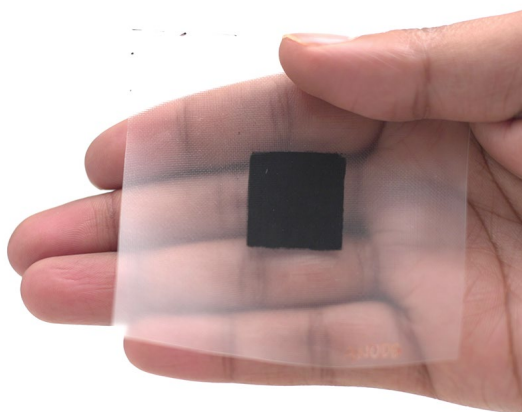


Skydiamond, the world's first carbon-negative diamond, mined from sky. The Sky Mining Company created an alternative to the destructive act of land mining, by returning to nature for the answers: alchemising the air that is breathed into light-splintering diamonds. Skydiamonds are planet-positive, certified, and chemically identical to the timeless diamonds that know and love; plus, more traceable, and eco-friendlier than standard lab-grown diamonds. It has taken five years of research and development by a band of pioneering British engineers and relentless efforts, culminating in an independently proven carbon-negative diamond, as verified by The Imperial College London. This carbon-capture innovation is a patented and bespoke biological process operating out of the English countryside using only four ingredients; Rain Water, Solar and Wind Power and of course, atmospheric carbon which we have too much of, making these the most sustainable diamonds in the world.

More information: www.skydiamond.com

5

Twelve (US) E-Jet

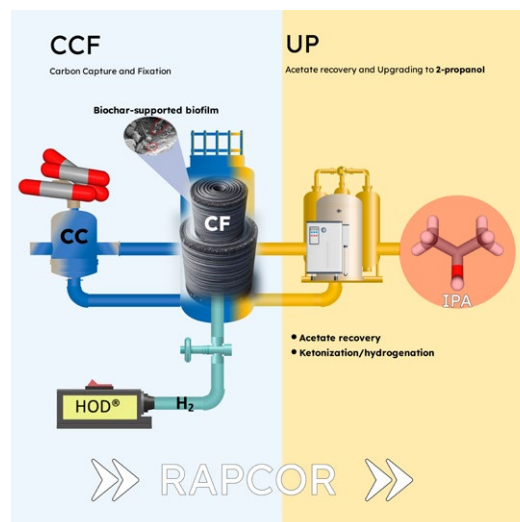


E-Jet® fuel, Twelve's sustainable aviation fuel (SAF) made from CO₂, has the potential to create a circular system in which aviation is powered by its own emissions. E-Jet® fuel, like other products made using Twelve's carbon transformation technology, is produced with only three inputs – water, renewable electricity, and CO₂. E-Jet® fuel was tested and certified by the U.S. Air Force in 2021, is drop-in ready for use in existing aircraft, and is made to ASTM D7566 specifications, the same performance standard as fossil-based jet fuel. All with up to 90% lower lifecycle emissions and fewer sulphur dioxide (SO₂), nitrogen oxides (NO_x), and other particulate emissions. Alaska Airlines is among Twelve's commercial partners and will use its E-Jet® fuel to power flights among its network.

More information: www.twelve.co

6

University of Bologna (IT) RAPCOR



Energy transition demands for a reduction in CO₂ emission that should be almost total, effective and extremely sharp. The RAPCOR concept aims to convert flue gas carbon into renewable isopropyl alcohol (IPA), serving as a versatile fuel, energy carrier, hydrogen carrier, or commodity chemical. RAPCOR approach uses microbial mixed culture (MMC, consisting of anaerobic homoacetogens) supported on a peculiar char-based sparger reactor to reduce bicarbonate with renewable hydrogen, thus obtaining high concentration (>60 g/L) acetate, which is ketonised and hydrogenated to IPA. This process works at mild pressure and temperature and allows to overcome most of the limitations of existing Power-To-Fuel pathways.

More information: www.site.unibo.it/pyrolysis/en



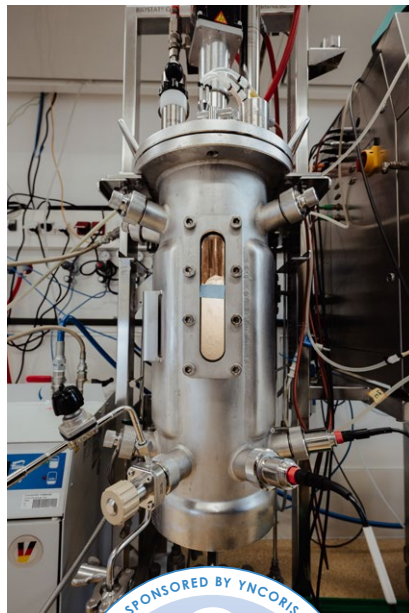
Winners of the Innovation Award

“Best CO₂ Utilisation 2023”

DITF Denkendorf (DE)
CellCO₂



Arkeon (AT)
Arkeon



CarbonBuilt (US)
CarbonBuilt:
Ultra-low Carbon
Concrete



BRONZE
SPONSOR



Concentrating the Essentials

CO₂ Valorization for Diverse Industries



Together, let's build a sustainable future and transform CO₂ from a problem into an opportunity!

GIG Karasek – expert in industrial equipment and plant construction – offers the ECO2CELL electro-chemical utilization unit for transforming captured CO₂ into valuable chemicals and fuels.

ECO2CELL is perfectly suited for numerous applications and offers several advantages:

- ◆ **Patented technology**
- ◆ **Versatile product spectrum**
- ◆ **Zero-emission technology**
- ◆ **Easy scale-up**
- ◆ **Mild process conditions**
- ◆ **No hydrogen needed for the process**

Interested to learn more?

Visit our website or read our technical blog!





DAY 2

18 April 2024, 9:00–17:30 (CET)

9:00 Achim Raschka & Pia Skoczinski
nova-Institute (DE)
Conference Opening

9:10 – 10:55

CO₂ to Chemicals and Fuels

Grand Hall

Chairpersons: Achim Raschka & Pia Skoczinski, nova-Institute

9:10



Mark Sassenburg

TNO (NL)

Towards Industrial Ethylene Electrosynthesis:
Upscaling Hurdles and Perspectives

9:30



Florian Haakmann

thyssenkrupp Steel Europe (DE)

Carbon2Chem® – CO₂ Emissions
from Point Sources

9:50



Lorenzo Cremonese

PtX Lab Lausitz (ZUG) (DE)

Resource Demand of a GHG-neutral Aviation Sector
in Europe: A Study on e-Kerosene

10:10

Panel Discussion with all Session Speakers

10:30

Coffee Break & Networking

**11:00 – 13:10****CO₂ to Polymers and Materials****Grand Hall**

Chairpersons: Achim Raschka & Michael Carus, nova-Institute

11:00

**Christian Holzleitner**European Commission DG CLIMA (EU)
European Perspectives on Sustainable Carbon
Cycles in Industry

11:20

**Pauline Ruiz & Pia Skoczinski**
nova-Institute (DE)Status and Outlook for CO₂-based Products

11:40

**Alexander Sandahl**Danish Technology Institute (DK)
From CO₂ to Polymers

12:00

**Athanasia Tsoukalou**Sulzer Management (CH)
CO₂-based Inorganic and Organic
Carbonates to Green Up Construction
and Transport Sectors

12:20

**Thomas Mairegger**Net Zero Emission Labs (DE)
CO₂ Capture and Utilization
Pave the Way Towards a Climate Neutral
Cement Production

12:50

Panel Discussion with all Session Speakers

13:10**Lunch Break & Networking**

A Poster Session will take Place at the Beginning of the Lunch Break



14:40 – 17:30

CO₂ Utilisation Technologies

Grand Hall

Chairpersons: Michael Carus & Pauline Ruiz, nova-Institute

14:40



Rob Marrow

Econic Technologies (UK)
Effective Life Cycle Assessments in Emerging CO₂-Utilisation Technologies

15:00



Charalambos Panagopoulos

Helleniq Energy (GR)
The Prospects of CCUS for EU Refineries and Related Processes

15:20



Koen Quataert

Bio Base Europe Pilot Plant (BE)
The Importance of Open-Access Piloting for Microbial CCU Technologies using Real Industrial C1-Gases

15:40

Coffee Break & Networking

16:10



Ida Kongsgaard

Again (LuaBio ApS) (DK)
Again – We Ferment Emissions to Unpickle the Planet

16:30



Mike Schultz

PTI Global Solutions (US)
Gas Fermentation – An Emerging Technology for CO₂-based Fuels and Chemicals

16:50

Panel Discussion with all Session Speakers

17:10

Final Words

17:25

Networking and End of Conference

14:40 – 17:30

Parallel Session

Advanced Research in CCU

Room Adelheid, No Online Transmission

Chairpersons: Achim Raschka & Pia Skoczinski, nova-Institute

14:40



Francesca Di Bartolomeo

SINTEF (NO)
The PYROCO₂ Project. Advancing Carbon Capture and Utilisation for Climate-Positive Acetone Production in Europe

15:00



Douglas Khoo

A*Star (SG)
Research in Singapore on Low-Carbon Technologies and Alternative Feedstocks for Sustainability

15:20



Pegah Shakeri

Coatema Coating Machinery (DE)
Innovative Approaches for Industrial Electrode Production: A WaterProof EU Horizon Initiative

15:40

Coffee Break & Networking

16:10



Kai junge Puring

Fraunhofer UMSICHT (DE)
Putting Pressure on CO₂ Electrolysis – Enabling a Sustainable Chemical Industry by Pushing Sector-Coupling to Higher Levels

16:30



Verena Süß

Fraunhofer ICT (DE)
Further Developments in Heterogeneous Catalyzed Ethanol Synthesis

16:50

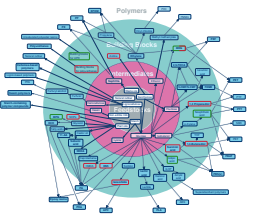
Panel Discussion with all Session Speakers

nova Market and Trend Reports on Renewable Carbon

The Best Available on Bio- and CO₂-based Polymers & Building Blocks and Chemical Recycling

NEW

Bio-based Building Blocks and Polymers
Global Capacities, Production and Trends 2023–2028



Authors: Pia Skoczinski, Michael Carus, Gillian Tweedie, Pauline Ruiz, Nicolas Hark, Am Zhang, Doris de Guzman, Jan Ravenstijn, Harald Kib and Achim Raschka
March 2024
This and other reports on renewable carbon are available at www.renewable-carbon.eu/publications

NEW

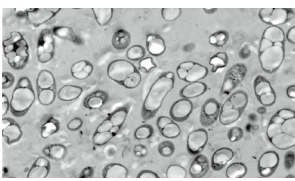
Carbon Dioxide (CO₂) as Feedstock for Chemicals, Advanced Fuels, Polymers, Proteins and Minerals
Technologies and Market, Status and Outlook, Company Profiles



Authors: Pauline Ruiz, Pia Skoczinski, Achim Raschka, Nicolas Hark, Michael Carus
With the support of: Ajlin Orger, Jasper Kern, Nico Flum
April 2023
This and other reports on renewable carbon are available at www.renewable-carbon.eu/publications

GOIPHA | **nova institute**

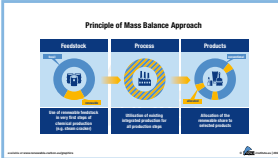
Mimicking Nature – The PHA Industry Landscape
Latest trends and 28 producer profiles



Author: Jan Ravenstijn
March 2022
This and other reports on renewable carbon are available at www.renewable-carbon.eu/publications

nova institute

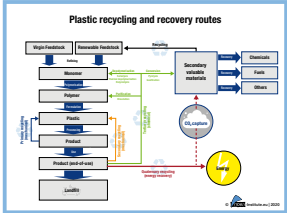
Bio-based Naphtha and Mass Balance Approach
Status & Outlook, Standards & Certification Schemes



Authors: Michael Carus, Doris de Guzman and Harald Kib
March 2021
This and other reports on renewable carbon are available at www.renewable-carbon.eu/publications

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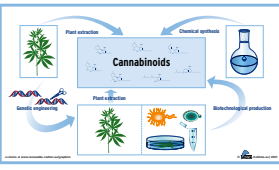
Chemical recycling – Status, Trends and Challenges
Technologies, Sustainability, Policy and Key Players



Author: Lars Krause, Florian Dietrich, Pia Skoczinski, Michael Carus, Pauline Ruiz, Lars Giermer, Achim Raschka, nova-Institut GmbH, Germany
November 2020
This and other reports on the bio- and CO₂-based economy are available at www.renewable-carbon.eu/publications

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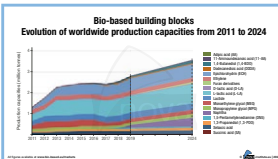
Production of Cannabinoids via Extraction, Chemical Synthesis and Especially Biotechnology
Current Technologies, Potential & Drawbacks and Future Development



Authors: Pia Skoczinski, Franjo Grotenhermen, Bernhard Beitzke, Michael Carus and Achim Raschka
January 2021
This and other reports on renewable carbon are available at www.renewable-carbon.eu/publications

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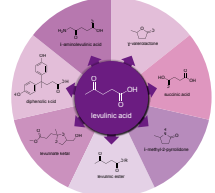
Commercialisation updates on bio-based building blocks



Author: Doris de Guzman, Tecnon OROChem, United Kingdom
Updated Executive Summary and Market Review May 2020 – Originally published February 2020
This and other reports on the bio- and CO₂-based economy are available at www.bio-based.eu/reports

nova institute

Levulinic acid – A versatile platform chemical for a variety of market applications
Global market dynamics, demand/supply, trends and market potential



Authors: Achim Raschka, Pia Skoczinski, Raj Chinnappa, Angel Puentes and Michael Carus, nova-Institut GmbH, Germany
October 2019
This and other reports on the bio-based economy are available at www.bio-based.eu/reports



renewable-carbon.eu/publications



Valuable Quotes

Ida Kongsgaard

Again (DK)

"The CO₂-based Fuels and Chemicals Conference presents a great opportunity for stakeholders across the full CCU and PtX value chain to get together and share learnings, experiences and meet potential project partners."

Lena Friedmann

CM Fluids (DE)

"The process step from CO₂ to usable products is the core element of a future circular economy. I am therefore very excited about the conference on this completely underestimated topic."

Pegah Shakeri

Coatema (DE)

"An excellent opportunity to explore innovations in CO₂-based fuels and chemicals, bridging sustainability with industrial progress at the forefront of environmental solutions."

Rob Marrow

Econic Technologies (UK)

"It is clear CO₂ based fuels and chemicals are critical to meeting climate goals, and this conference is an important opportunity to accelerate progress."

Kai junge Puring

Fraunhofer UMSICHT (DE)

"The CO₂-based Fuels and Chemicals Conference serves as a vital platform for advancing CCU technologies and driving meaningful progress towards a greener future."

Charalampos Panagopoulos

Helleniq Petroleum (GR)

"Today we stand on the edge of a new Frontier – the old era is ending and the old ways will not do."

Ulrich Dietz

INEOS (DE)

"We are pleased to have the opportunity to give a contribute to this excellent international platform of new developments in the wide field from carbon capture and to carbon usage."

Ralf Gesthuisen

INEOS (DE)

"This conference provides an excellent international platform to present and discuss new developments in the wide field from carbon capture and to carbon usage."

Caroline Braun

Landwärme (DE)

"Biogenic CO₂ separated at biogas upgrading plants is a valuable resource for fuels and chemicals, defossilizing these industries in the process."

Thomas Mairegger

Net Zero Emmission Labs (DE)

"The shift from regarding CO₂ as a pollutant to recognizing its value as a chemical is an unavoidable progression in our carbon-centric lifestyle, and this conference serves to expedite this transformation."

Lorenzo Cremonese

PtX Lausitz (DE)

"The CO₂-based Fuels and Chemical Conference is an insightful arena to learn about the latest developments in the carbon cycle world."

**Mike Schultz****PTI Global Solutions (US)**

"I'm looking forward to learning about the latest developments in CO₂-based fuels and chemicals, and networking with leaders in this field."

Francesca Di Bartolomeo**SINTEF (NO)**

"The CO₂-based Fuels and Chemicals Conference in Cologne stands as a pivotal hub for progress and networking in the CCU research and industry. As a researcher deeply engaged in CO₂ utilization, I am consistently impressed by the conference's role in catalysing sustainable, CO₂-based technological advancements. It's a great convergence point where scientific exploration aligns with strategic vision driving essential developments in carbon capture and utilization for our sustainable future."

Cecilia Mondelli**Sulzer (CH)**

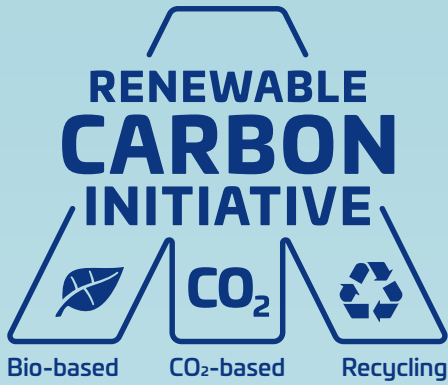
"A great forum to hear and discuss about new technologies in the CCUS field."

Florian Haakmann**thyssenkrupp (DE)**

"Industrial CO₂-point sources are good starting point for circularity, let's talk about it."

Volker Sick**University of Michigan/Global CO₂ Initiative (US)**

"This nova-Institute conference has become the must-go-to meeting for CO₂ conversion to chemicals and fuels."



Circular Economy

Shape the Future of the Chemical and Material Industry

WHY JOIN RCI?

RCI is an organization for all companies working in and on renewable chemicals and materials – plastics, composites, fibres and other products can be produced either from biomass, directly via CO₂ utilisation, or recycling. RCI members profit from a unique network of pioneers in the sustainable chemical industry, creating a common voice for the renewable carbon economy.

To officially represent the RCI in Brussels, the RCI is registered in the EU's transparency register under the number 683033243622-34.

LinkedIn: www.linkedin.com/showcase/renewable-carbon-initiative
#RenewableCarbon

Executive Managers:
Christopher vom Berg & Michael Carus
Contact: Verena Roberts
verena.roberts@nova-institut.de

JOIN NOW

Become a part of the Renewable Carbon Initiative (RCI) and shape the future of the chemical and material industry
www.renewable-carbon-initiative.com

Find all current RCI members at:
www.renewable-carbon-initiative.com/members



MEMBERS OF THE INITIATIVE

LARGE SUPPLIERS



SME



BRANDS



START-UPS



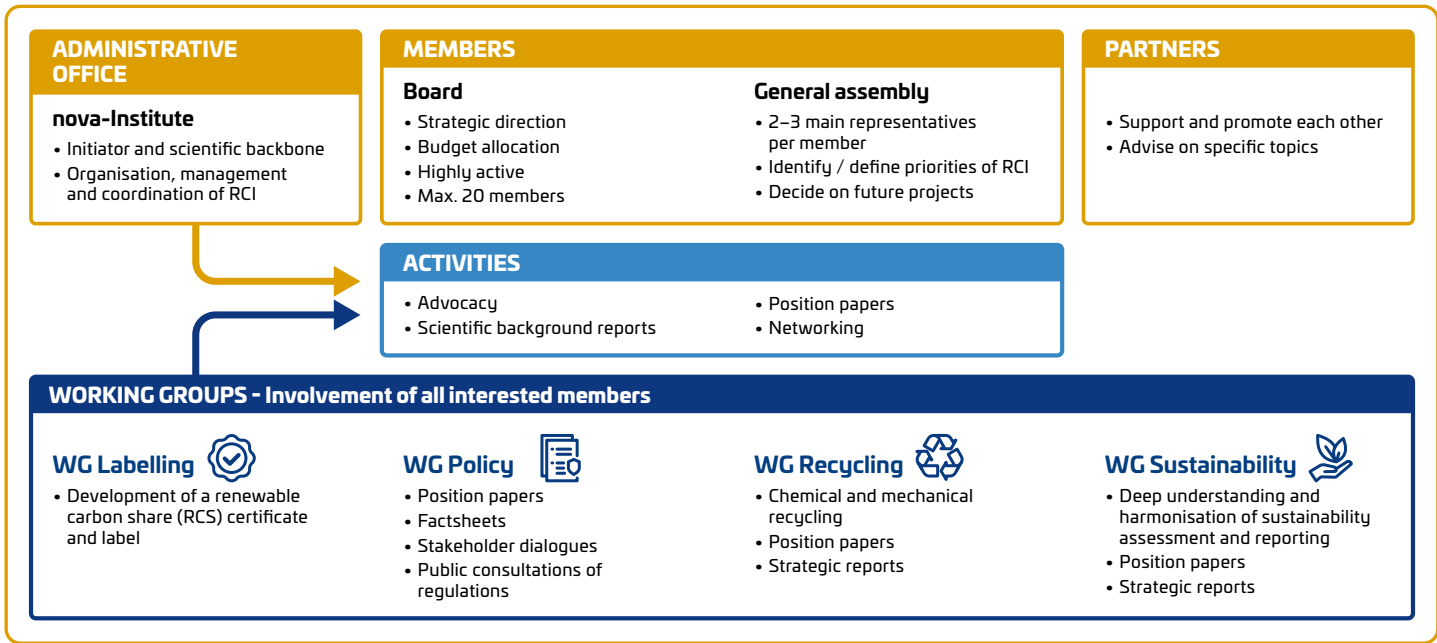
RESEARCH INSTITUTES



* Board Member

PARTNERS





RCI OFFERS ITS MEMBERS



ADVOCACY

RCI drives the message of renewable carbon, prepares position papers on relevant aspects and represents its stakeholders to the public and political decision-makers.



REPORTS AND PAPERS

Science-based reports and papers on the concept of renewable carbon and specific aspects to create solid argumentation in favor of the transformation.



NETWORKING

Nobody can do it alone! Together with other RCI members you will create an eco-system for renewable carbon solutions – the renewable carbon community. All RCI members meet twice a year, once in person, once online.



SHAPING THE INITIATIVE

Members actively shape the direction of the initiative and the renewable carbon strategy.



WORKING GROUPS

Members are actively involved in RCI activities via different working groups. Currently, these are “Policy”, “Labeling”, “Recycling” and “Sustainability”.



VISIBILITY

Members are part of the RCI communication activities and therefore highly visible and convey credibility. Get recognised as a pioneer in the transition to renewable carbon.

THE AIM

The aim of the Renewable Carbon Initiative (RCI) is to support and speed up the transition from fossil carbon to renewable carbon for all organic chemicals and materials.

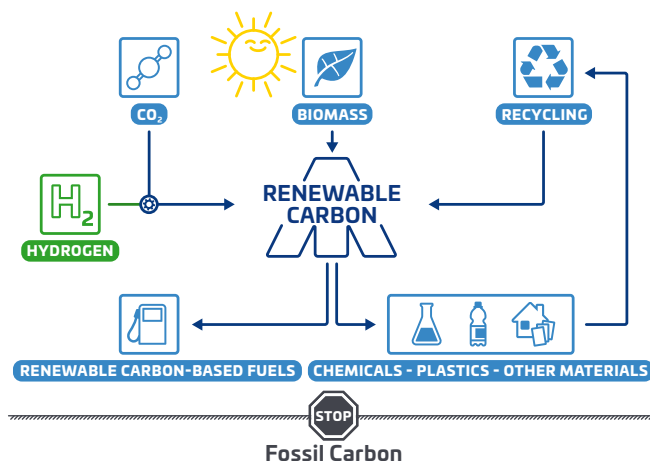
RCI addresses the core problem of climate change, which is extracting and using additional fossil carbon from the ground that will eventually end up in the atmosphere. Companies are encouraged to focus on phasing out fossil resources and to use renewable carbon instead.

The initiative wants to drive this message, initiating further actions by bringing stakeholders together, providing information and shaping policy to strive for a climate-neutral circular economy.

THE VISION

Fossil carbon shall be completely substituted by renewable carbon, which is carbon from alternative sources: biomass, CO₂ and recycling.

RENEWABLE CARBON



**Save
the Date**



**11–13 June
2024**

renewable-materials.eu



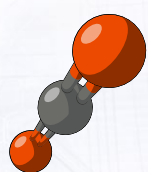
**20–21 Nov
2024**

advanced-recycling.eu



**12–13 March
2025**

cellulose-fibres.eu



**CO₂-based Fuels
and Chemicals
Conference**

**29–30 April
2025**

co2-chemistry.eu



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A series of horizontal dotted lines for writing notes.



The Who's Who of Renewable Carbon

Find Sustainable Alternatives for Fossil Based Chemicals and Materials

The business directory "Renewable Carbon Companies (ReCaCo)" has established itself as the primary source of information on renewable and sustainable material solutions. Innovative companies in the field of renewable carbon present their products, intermediates and services. ReCaCo began as a directory for bio-based businesses in 2009, the service provided by nova-Institute has evolved to include CO₂-based and recycling enterprises as well. Today, more than 20,000 company profiles are downloaded every year. They represent large and small corporations, trade associations, agencies, engineering and research institutions as well as certification bodies.

Submit your 2-page company profile free of charge at:
renewable-carbon.eu/companies/join/registration



renewable-carbon.eu/companies

Technology & Markets

Achim Raschka (achim.raschka@nova-institut.de)

- Market Research
- Market & Trend Reports
- Innovation & Technology Scouting
- Trend & Competitive Analysis
- Supply & Demand Analysis
- Feasibility & Potential Studies
- Customised Expert Workshops

Communications

Stefanie Fulda (stefanie.fulda@nova-institut.de)

- Comprehensive Communication & Dissemination in Research Projects
- Communication & Marketing Support
- Network of 60,000 Contacts to Companies, Associations & Institutes
- Targeted Newsletters for 19 Specialty Areas of the Industry
- Conferences, Workshops & nova Sessions
- In-depth B2C & Social Acceptance Research

Sustainability

Matthias Stratmann (matthias.stratmann@nova-institut.de)

- Life Cycle Assessments (ISO 14040/44, PEF Conform)
- Carbon Footprint Studies & Customised Tools
- Initial Sustainability Screenings & Strategy Consultation
- Holistic Sustainability Assessment (incl. Social & Economic Impacts)
- GHG Accounting Following Recognised Accounting Standards
- Critical Reviews for LCA or Carbon Footprint Reports
- Sustainability Reporting & Claims

Economy & Policy

Lara Dammer (lara.dammer@nova-institut.de)

- Strategic Consulting for Industry, Policy & NGOs
- Political Framework, Measures & Instruments
- Standards, Certification & Labelling
- Micro- & Macroeconomics
- Techno-Economic Evaluation (TEE) for Low & High TRL
- Target Price Analysis for Feedstock & Products



nova-Institute is a private and independent research institute, founded in 1994.

nova offers research and consultancy with a focus on the transition of the chemical and material industry to renewable carbon.

What are future challenges, environmental benefits and successful strategies to substitute fossil carbon with biomass, direct CO₂ utilisation and recycling? What are the most promising concepts and applications? We offer our unique understanding to support the transition of your business into a climate neutral future.

Our subjects include feedstock, technologies and markets, economy and policy, sustainability, communication and strategy development. Multidisciplinary and international team of 45 scientists.

nova-Institut GmbH

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50354 Hürth, Germany
T +49 2233 – 460 14 00
contact@nova-institut.de

www.nova-institute.eu
www.renewable-carbon.eu
F +49 2233 – 460 14 01

CEO: Michael Carus | COO: Linda Engel