# 9th Conference on $CO_2$

$CO_2$-based Fuels & Chemicals

www.CO2-chemistry.eu

## $CO_2$ as chemical feedstock – a challenge for sustainable chemistry

**23–24 March 2021** / Online Event

# Conference Journal

- Policy & Innovation
- Green Hydrogen Production
- Power-to-Fuels
- Six Innovation Award Presentations
- Carbon Capture & Utilisation
- $CO_2$ for Chemicals, Cosmetics & Gas
- $CO_2$ for Chemicals and Food

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**In Cooperation with**

IASA International Association for Sustainable Aviation e.V.

www.iasaev.org

## 2nd European Summit on $CO_2$-based Aviation Fuels

**23 MARCH 2021 · ONLINE EVENT**

SPECIAL SESSION AT THE CONFERENCE

Policy & Strategy · CCU Fuels & Power-to-Liquid Technologies · Sustainable Aviation · Panel Discussion with Speakers of the Session

# 9th Conference on $CO_2$

## $CO_2$-based Fuels & Chemicals

## Conference Advisory Board

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


**Damien Dallemagne**
$CO_2$ Value Europe (EU)


**Bruce Dannenberg**
Phytonix Corporation (US)


**Heleen De Wever**
Flemish Institute for Technological Research (VITO) (BE)


**Rudolf Dörpinghaus**
IASA e.V. (DE)


**Christoph Gürtler**
Covestro (DE)


**Stefanie Kesting**
$CO_2$ Value Europe (EU)


**Frank Köster**
Energie.Agentur NRW (DE)


**Peter Lindblad**
Uppsala University / Phytonix Corporation (SE/US)


**Martin Lindmeyer**
YNCORIS GmbH & Co. KG (DE)


**Sarah Refai**
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**Christian Schweitzer**
bse Engineering Leipzig GmbH (DE)


**Peter Styring**
University of Sheffield (UK)


**Haralabos Zorbas**
Industrielle Biotechnologie Bayern Netzwerk GmbH (IBB) (DE)

## Ticket Fee CCU

Online Conference (23-24 March 2021) 450 €

**Twitter**
#2021aviation
#2021CCU

## Conference Team


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## nova-Institute for ecology and innovation


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- Critical Reviews

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- Target Price Analysis for Feedstock & Products
- Strategic Consulting for Industry, Policy & NGO's
- Political Framework, Measures & Instruments
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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 $CO_2$ 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. nova-Institute has 40 employees.

**nova-Institut GmbH**

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Industriestraße 300
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www.nova-institute.eu

# 9th Conference on $CO_2$ | $CO_2$-based Fuels & Chemicals

## Dear participants,

welcome to the "9th Conference on $CO_2$-based Fuels and Chemicals" – and for the second time to the "European Summit on $CO_2$-based Aviation Fuels" in cooperation with the International Association of Sustainable Aviation (IASA).

Following the news, it is striking that the use of $CO_2$ is becoming more and more visible even in the public. Especially in the fuels area, the synthetic ones based on $CO_2$ are becoming viable and are seen as one approach to reduce the carbon footprint especially in the aviation industry, paving the way into a more sustainable future. Even or particularly in times when the industry suffers from its lock-down due to the pandemic several airlines are discussing on the topic of future sustainability and alternative fuels. Additionally, numerous technologies are now available to produce not only fuels, but also chemicals from $CO_2$ and renewable energy. The expansion of the availability of renewable energy as well as a clear focus on green hydrogen production and grids is providing tailwind for Carbon Capture & Utilisation (CCU) and Power-to-X technologies. More players show their interest in getting involved in these fields and established pioneers are increasingly demanding political support. Although the use of $CO_2$ instead of fossil raw materials is climate-friendly and the future for the industry, $CO_2$-based products are still 2 to 3 times more expensive than those made from cheap fossil fuels. In order to realise the full potential of these technologies, supportive political framework conditions such as a fossil carbon tax or binding quotas for e.g. $CO_2$-based kerosene are needed.

The two-day online event is one of the oldest and most established conference worldwide and has developed into a unique meeting place for the entire CCU and Power-to-X industry and its customers. New and leading players will showcase novel and improved applications based on carbon capture, green hydrogen production and the use of $CO_2$ as a feedstock. Learn about the latest technical and political developments and discuss future strategies in numerous panel discussions. It is all about communication and networking!

We wish all participants new insights, ideas and inspiration. The future belongs to $CO_2$ use and we have the chance to shape the way together.

Your nova team

**Achim Raschka**
Program
Carbon Capture & Utilisation (CCU)
Chemicals, building blocks & polymers
Biotechnology

**Pia Skoczinski**
Program & Innovation Award
Carbon Capture & Utilisation (CCU)
Chemicals, building blocks & polymers
Biotechnology

**Michael Carus**
Managing Director

## Message from the Minister

Like few other regions, the heavily industrialised state of North Rhine-Westphalia is an integral part of worldwide value networks and defined by an innovative blend of specialised family-owned enterprises and major corporate players. The chemical industry is a mainstay of this and has been a trailblazer for overall economic success. Unlike most other sectors, the chemical industry's innovative prowess delivers knock-on effects throughout the entire economy.

The impact of the Corona pandemic is currently presenting business and the wider community with enormous challenges – which then helps accelerate the structural changes. Faster than ever before, digital technologies are reshaping national and international markets, calling time-honoured business models and division-of-labour routines into question. On top of all this, we are faced with the need for change in the face of global warming, a fundamental challenge of our generation.

In order to retain the appeal and international competitiveness of industrialised North Rhine-Westphalia, we need to define unambiguous development perspectives as a way of reinforcing the business sector's innovation capabilities and pushing forward the necessary changes. As State Government, we are setting ourselves an ambitious goal, with an industrial policy vision designed to achieve this goal. We are aiming to turn North Rhine-Westphalia into Europe's most modern climate- and eco-friendly industry hub.

With the development of innovative technologies, processes and products, the chemical industry is already a problem-solver for a multitude of sustainability-related issues. Moving towards a climate-neutral industry sector, we need to boost this role.

It is not only the reduction of $CO_2$ which is important, but utilisation as well. Modifying and expanding the source of raw materials is the way forward when it comes to increasing the potential of the chemical industry. $CO_2$ is a carbon source – a valuable resource to be put to profitable use if we do it right.

As an enabling industry, the chemical sector is set to play a major part in reducing climate footprints along the full length of the value chain. On that note, the 9th Conference on $CO_2$-based Fuels and Chemicals can significantly boost the effort to increase the industry's eagerness for innovation and make it more visible.

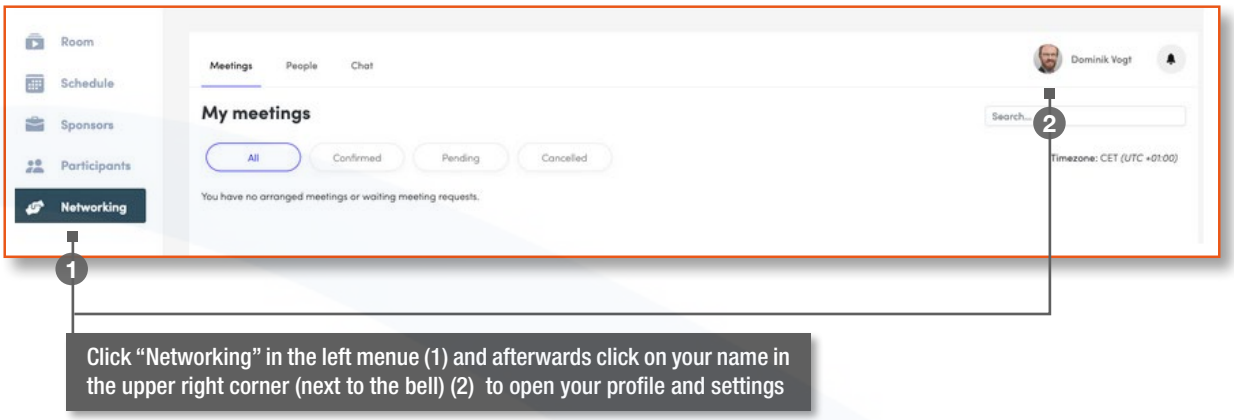
**Professor Dr Andreas Pinkwart**
Minister of Economic Affairs, Innovation, Digitalization and Energy of the State of North Rhine-Westphalia

9th Conference on $CO_2$ | $CO_2$-based Fuels & Chemicals

# Online networking opportunities

Arrange video chats with promising conference participants – during the networking time (8:00 - 10:00, lunchtime and late afternoon) or parallel to the presentations. Every registered participant has access to the networking tool. After you have been logged in successfully you can adjust your profile and your personal time slots and you can directly arrange meetings with other participants of your choice.

# Manage availabilities and interests



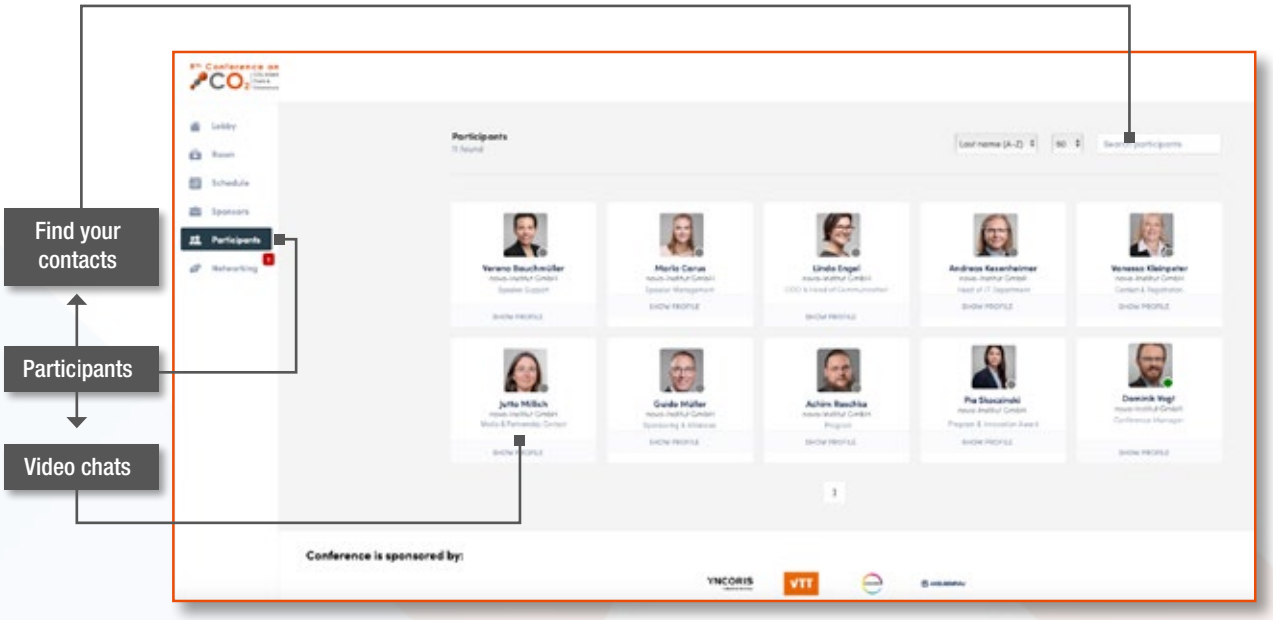

Click “Networking” in the left menue (1) and afterwards click on your name in the upper right corner (next to the bell) (2) to open your profile and settings


Fill out your profile and set up your availabilities and interests

Turns into grey by clicking and shows your **non-availability**

# 9th Conference on $CO_2$ | $CO_2$-based Fuels & Chemicals

## Get in contact




### All advantages at a glance

- Video chat tool - meet decision makers of the industry – 1-on-1
- Find new networking and business opportunities via direct contact or topic search
- Arrange meeting time with ease based on available time slots
- Manage all your meetings in one simple user-friendly environment
- Get alerts for meeting requests

You are not yet registered or you have questions about the networking tool? Dominik Vogt will help you.

**Dominik Vogt**
dominik.vogt@nova-institut.de

# 2nd European Summit on $CO_2$-based Aviation Fuels

**23 MARCH 2021 · ONLINE EVENT**

## SPECIAL SESSION AT THE CONFERENCE

### 1ST DAY OF CONFERENCE / 23 MARCH 2021

**Networking**

08:00 - 10:00 Schedule Video Chats with the Participants!

**Conference Opening**

10:00 **Michael Carus**
**nova-Institute (DE)**
Conference Opening

10:10 **Minister Andreas Pinkwart**
**Ministry of Economic Affairs, Innovation, Digitalization and Energy of the State of North Rhine-Westphalia (DE)**
Industrial Transformation – GameChanger for NRW

## 1ST DAY OF CONFERENCE / 23 MARCH 2021

### 2nd European Summit on $CO_2$-based Aviation Fuels

**Chairperson**
Ralf Nolting
**IASA (DE)**

10:15 Klaus-Peter Willsch
**Aviation and Space Group, Deutscher Bundestag (DE)**
Welcome Message from Berlin: Climate-Friendly Air Traffic – The Role of Politics

10:25 Roland Dittmeyer
**Institute for Micro Process Engineering (DE)**
Synthetic Fuels via Power-to-X – Status and Potential of Decentralized Plants

10:55 Rudolf Dörpinghaus
**IASA (DE)**
Serosin Now! Why Production of Sustainable Aviation Fuels must be pushed forward more intensively

11:15 Frithjof Kublik
**Shell (NL/DE)**
Development of a Bio-PTL Plant using Synergies with an Existing Large Refinery

11:45 Gunnar Holen
**Nordic Blue Crude (NO)**
Producing Fischer-Tropsch-based Kerosene and Naphtha on Commercial Scale in Norway

12:15 Henrik von Storch
**Deutsche Post DHL Group (DE)**
The Role of Sustainable Aviation Fuels for Deutsche Post DHL Group's Path to Zero Emission

12:45 Bruce Parry
**European Business Aviation Association (EBAA) (BE)**
The Need for Sustainable Fuels in Business and Corporate Aviation

13:15 Stefan Gsänger
**World Wind Energy Association (WWEA) (DE)**
The Power of Wind for Sustainable Aviation Fuels

13:45 Discussion with all Speakers of the Session

14:00 Closing Remarks by Ralf Nolting and Rudolf Dörpinghaus

14:15 Networking

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Investments in new technologies are investments for the future. Our purpose is to bring together people, business, science and technology, to solve the world's biggest challenges, and thus create sustainable growth, jobs and well-being.

VTT is one of Europe's leading applied research institutions. To lead a path of exponential hope with science-based innovation we have identified systemic and technological challenges where we can make the biggest possible impact together with our customers. They are:

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- Productivity leap
- Societal resilience
- Quantum leap
- Super-performing materials
- Superior digital systems
- Synthetic biology

Carbon capture and utilization (CCU) is one of the key tools needed for climate change mitigation. We have extensive knowledge and capability for critical analysis of CCU and clean hydrogen value chains as well as active research collaboration in related industry.

Join us in creating the business of the future and be part of cutting-edge innovation networks!

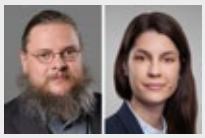
**vttresearch.com**


beyond the obvious

# 9th Conference on $CO_2$ | $CO_2$-based Fuels & Chemicals

## 1ST DAY OF CONFERENCE / 23 MARCH 2021

### Green Hydrogen Production and Power-to-Fuels



**Chairpersons**
**Achim Raschka and Pia Skoczinski**
**nova-Institute (DE)**

14:45 **Volker Goeke**
**ITM Linde Electrolysis (DE)**
PEM-Electrolyzer Integration into CleanFuelsProduction Schemes

15:45 **Nicholas M. Musyoka**
**Council for Scientific and Industrial Research (CSIR) (ZA)**
Power-to-Methanol (PtMeOH) in South Africa: Opportunities and Challenges

15:15 **Stef Denayer**
**North-CCU-hub (BE)**
The North-CCU-Hub Roadmap

16:15 **Marcos Oliviera**
**Gesellschaft für Internationale Zusammenarbeit (GIZ) (BR)**
Sustainable Aviation Fuels produced in a Decentralized Way – The Brazilian Case

16:45 **Discussion with all Speakers of the Session**

## 1ST DAY OF CONFERENCE / 23 MARCH 2021

### Presentations of the nominees for the "Best $CO_2$ Utilisation 2021"

**Chairpersons**
Michael Carus and Asta Partanen
**nova-Institute (DE)**

**17:00** Michael Carus
**nova-Institute (DE)**
Innovation Award Introduction

**17:50** Marina Sebastian and Christoph Gürtler
**Covestro (DE)**
Washing with $CO_2$-Technology – Surfactants based on $CO_2$

**17:10** Célia Sapart
**$CO_2$ Value Europe (EU)**
CCU, for a New Industry Good for the Climate, the Economy and the People

**18:05** Brad Brennan
**Dimensional Energy (US)**
HI-Light Reactor Platform

**17:20** Johann Kirchner
**bse Methanol (DE)**
FlexMethanol

**18:20** Babette Pettersen
**LanzaTech (US)**
CarbonSmart Ethanol

**17:35** Benedikt Stefánsson
**Carbon Recycling International (IS)**
Liquid Fuel from Hydrogen with CCU at Commercial Scale

**18:35** Gerard Campeau
**UR One (CA)**
Dissociation of GHG Oxides using Plaron Technology

**18:50** Online Voting

**19:00** Martin Lindmeyer
**Yncoris (DE)**
Innovation Award Ceremony

**19:10 - open end** Networking

# 9th Conference on $CO_2$ | $CO_2$-based Fuels & Chemicals

## 2ND DAY OF CONFERENCE / 24 MARCH 2021

### Networking

08:00 - 10:00 Schedule Video Chats with the Participants!

### Conference Opening

10:00 **Michael Carus**
**nova-Institute (DE)**
Conference Opening

### Carbon Capture & Utilisation

**Chairpersons**
**Achim Raschka and Pia Skoczinski**
**nova-Institute (DE)**

10:10 **Michael Carus**
**nova-Institute (DE)**
The Renewable Carbon Initiative (RCI) and CCU

10:40 **Dinah Dux**
**Uniper (DE)**
**Gkiokchan Moumin**
**German Aerospace Center (DLR), Institute of Future Fuels (DE)**
Feasibility Study on CCU opportunities for North Rhine-Westphalia

11:10 **Anastasios Perimenis**
**$CO_2$ Value Europe (EU)**
Progress of CCU in the European Context

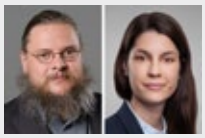
11:40 **Volker Sick**
**University of Michigan/Global $CO_2$ Initiative (US)**
Developing Carbon Dioxide as a Versatile Raw Material for Chemicals and Fuels

12:10 Discussion with all Speakers of the Session

12:25 Networking

## 2ND DAY OF CONFERENCE / 24 MARCH 2021

### Power-to-X – $CO_2$ for Chemicals, Cosmetics and Gas



**Chairpersons**
Achim Raschka and Pia Skoczinski
**nova-Institute (DE)**

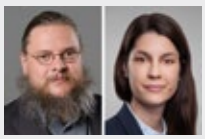
**13:00** Hiroyuki Kamata
**IHI Corporation (JP)**
Catalytic $CO_2$ Hydrogenation to Produce Monomers for Greener Resin Production

**14:00** Doris Hafenbradl
**Electrochaea (DE)**
Generation of Renewable Methane – an Immediate Application for Large-scale Hydrogen Production

**13:30** Liv Reinecke
**Evonik (DE)**
Artificial Photosynthesis – Production of Valuable Raw Materials using Carbon Dioxide

**14:30** Discussion with all Speakers of the Session

### Power-to-X – $CO_2$ for Chemicals and Food



**Chairpersons**
Achim Raschka and Pia Skoczinski
**nova-Institute (DE)**

**14:45** Jean-Luc Dubois
**Arkema (FR)**
$CO_2$ Gas Fermentation: Opportunities and Technical Challenges

**16:15** Tore Sylvester Jeppesen
**Haldor Topsøe (DK)**
Electrochemical Production of Fuels and Chemicals – Utilising High Temperature Electrolysis

**15:15** Juha Lehtonen
**VTT (FI)**
Polycarbonate Polyols from Biogenic $CO_2$ – Feasibility Assessment

**16:45** Reza Ranjbar
**Centre for Process Innovation (UK)**
Efficient Conversion of $CO_2$ to Protein at Semi-industrial Scale

**17:15** Discussion with all Speakers of the Session

**15:45** Steffen Lindner-Mehlich
**Max Planck Institute of Molecular Plant Physiology (MPIMP) (DE)**
Frank Kensy
**b.fab (DE)**
The Formate Bio-Economy: Synthetic Formatotrophy for Assimilation of Formate Synthesized from Electricity and $CO_2$

# 9th Conference on $CO_2$ | $CO_2$-based Fuels & Chemicals

## 2ND DAY OF CONFERENCE / 24 MARCH 2021

### Power-to-Fuels II


**Chairpersons**
Achim Raschka and Pia Skoczinski
**nova-Institute (DE)**


**17:30** Heino von Meyer and Giulia Varaschin
**International PtX Hub Berlin (DE)**
Dimensions of Sustainability ref. $CO_2$-based Fuels and Chemicals


**18:00** Steffen Schemme
**Mitsubishi Power Europe (DE)**
René Stahlschmidt
**Chemieanlagenbau Chemnitz (DE)**
Synthetic Gasoline derived from $CO_2$ and $H_2$ as important Part of Power-to-Fuel Concepts to achieve Sustainability in the Transport Sector

**18:40** Discussion with all Speakers of the Session

**19:00 - open end** Networking

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- Engineering of production processes from pilot- over demo- to industrial scale
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- Design, support & assessment of trials
- Technic-economic analysis (TEA)

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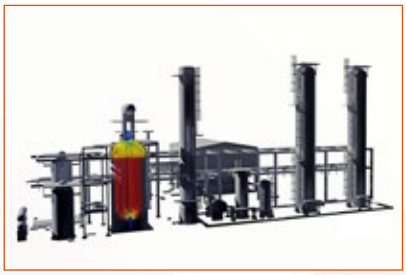
# 9th Conference on $CO_2$

$CO_2$-based Fuels & Chemicals

## Nominees of the Innovation Award “Best $CO_2$ Utilisation 2021”



**bse Methanol (DE)**
FlexMethanol

**Carbon Recycling International (IS)**
Emissions-to-Liquids Technology


**Covestro (DE)**
Washing with $CO_2$-Technology – Surfactants based on $CO_2$

**Dimensional Energy (US)**
HI-Light Reactor Platform

**LanzaTech (US)**
CarbonSmart Ethanol


**UR One (CA)**
Dissociation of GHG Oxides using Plaron Technology


Organiser | Innovation Award Sponsor | Innovation Award Co-Organiser

nova Institute for Ecology and Innovation — nova-institute.eu

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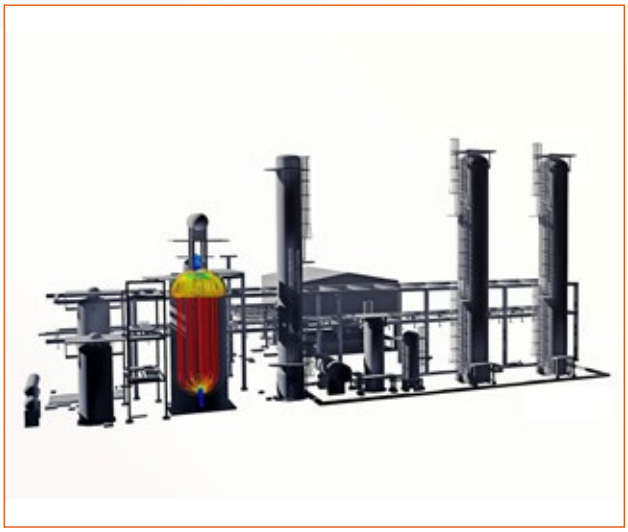
$CO_2$ VALUE EUROPE — co2value.eu

## bse Methanol (DE)
FlexMethanol



FlexMethanol will enable economically viable transformation of excess electrical power and off-gas $CO_2$ into methanol as chemical energy storage and feedstock within small-scale and delocalised production units. Using a tailor-made catalyst, the direct conversion of $CO_2$ is ensured without a cost-intensive water-gas-shift reactor. FlexMethanol consists of four industrially available process steps (electrolysis, $CO_2$ scrubbing, methanol synthesis and distillation) as 10 and 20 MW modules scalable up to 100 MW. FlexMethanol significantly stabilises the revenues by dynamic operation according to the power market and price conditions, e.g., switching from feed into the grid and producing methanol from hydrogen. As a result, no feed storage tanks are necessary.

More information: www.bse-engineering.eu

## Carbon Recycling International (IS)
Emissions-to-Liquids Technology

Carbon Recycling International (CRI) has been developing its Emissions-to-Liquids (ETL) technology since 2006. CRI's first industrial demonstration plant was commissioned in Iceland in 2012. It has a capacity of 4,000 tonnes methanol per year. ETL converts $CO_2$ and hydrogen into methanol in a one-step reaction. In 2020 the company moved from industrial demonstration scale to full commercial scale with a project in Anyang, Henan province, China. A plant, which will have a capacity of 110,000 tonnes methanol per year, will be commissioned in 2021. This represents an important step for $CO_2$ hydrogenation projects worldwide. The $CO_2$-based methanol is used for gasoline blending, biodiesel esterification, fuel cell operation, waste-water denitrification and chemicals production.

More information: www.carbonrecycling.is

## Covestro (DE)

Washing with $CO_2$-Technology – Surfactants based on $CO_2$


$CO_2$ instead of petroleum – Covestro is pursuing new avenues for turning the waste gas into a useful raw material. The goal is to use $CO_2$ as resource in as many applications as possible. And the next scope is here to come: Surfactants based on $CO_2$! First application tests have shown that these $CO_2$-based surfactants can be used in a standard detergent formulation. The product development process is still in progress and the boundary conditions are already set: less fossil-based, less global warming potential, readily biodegradable and comparable washing performance – a new class of more sustainable surfactants for the everyday businesses.

More information: www.covestro.de

## Dimensional Energy (US)

HI-Light Reactor Platform

Dimensional Energy (DE) has developed a concentrated solar fuels platform technology for converting $CO_2$ to syngas (CO + $H_2$ mixtures) with remarkable efficiency of > 50 % $CO_2$ conversion (3rd party verified by 350Solutions during the XPrize competition in Gillette, Wyoming, USA). The robust platform technology utilises DE catalysts, reactor designs, and software in an integrated unit, and was tested on-sun during the Carbon XPrize Finals. The 5 tonnes/year demonstration plant was shown to work during variable weather and with no catalyst degradation. The reactor is scalable to parabolic dish size, and the modular system can be easily expanded by additional units. Continued development of the platform will yield > 70 % conversion in 2021, and will integrate a Fischer-Tropsch reactor for kerosene production from the syngas.

More information: www.dimensionalenergy.com

## LanzaTech (US)
CarbonSmart Ethanol

The CarbonSmart Ethanol technology relates to capturing carbon and creating value from waste; effectively turning pollution into products. LanzaTech uses microorganisms to make ethanol from the carbon emissions of industrial processes like steel, syngas from municipal solid waste, waste wood or waste plastics. Ethanol is a chemical building block that can be used to produce a broad range of everyday products from household cleaning products, plastic shampoo bottles, furniture and toys, to fine fragrances and sporting goods. With a commercial plant in China that has produced over 20,000 tonnes of ethanol and mitigated over 100,000 tonnes of $CO_2$ since 2018 and the first EU plant in Belgium in 2021, the technology is rapidly gaining traction in the market.

More information: www.lanzatech.com

## UR One (CA)
Dissociation of GHG Oxides using Plaron Technology


Commercially ready carbon capture with 80 % lower operating and capital costs and dissociation of greenhouse gases including $CO_2$, CO, $NO_x$, $SO_2$, SO. Carbon is captured as high value allotropes Buckminster Fullerenes with > 90 % capture rate. No consumables except electricity, and a small amount of water. All greenhouse gases from a 300 MW coal plant can be treated using only 3 MW of power and no back pressure. Only small amounts of electricity are required to separate molecules into their elemental components. Carbon is collected in water in the form of Buckminster Fullerenes (C60, C70, C80 and nano tubes) and other high value carbons.

More information: www.urone-inc.com

# Valuable Quotes: 9th Conference on $CO_2$-based Fuels and Chemicals

**ARKEMA**
## Jean-Luc Dubois (FR)
*"To fight global warming, it will not be sufficient to use more biomass or recycle more plastics. $CO_2$ conversion, in an energy efficient way will be necessary. It's time to identify which process for which product."*

**b.fab**
## Steffen Lindner-Mehlich and Frank Kensy (DE)
*"The Formate Bioeconomy – from pathway design to industrial implementation."*

**Centre for Process Innovation (CPI)**
## Reza Ranjbar (GB)
*"For the first time large volumes of protein is produced without using photosynthesis process with significantly higher efficiency and lower footprints."*

**$CO_2$ Value Europe**
## Anastasios Perimenis (EU)
*"The CCU industry is ready to provide scalable solutions and help reach EU's ambitious 2030 and 2050 climate goals."*

**Council for Scientific and Industrial Research (CSIR)**
## Nicholas Musyoka (ZA)
*"My talk will highlight the potential opportunities and challenges for renewable methanol production in South Africa and also draw attention to the technical progress currently being implemented at the CSIR."*

**DHL**
## Henrik von Storch (DE)
*"The role of sustainable aviation fuels for Deutsche Post DHL Group's path to zero emission."*

**Electrochaea**
## Doris Hafenbradl (DE)
*"Generation of renewable Methane – an immediate application for large-scale hydrogen production."*

**Evonik**
## Liv Reinecke (DE)
*"The Project Mimics the Natural Photosynthesis as an Artificial Photosynthesis, not to Synthesise Glucose, but other Valuable Raw Materials for the Care Market."*

**IHI-Corporation**
## Hiroyuki Kamata (JP)
*"Synthesis of green olefins for low carbon plastics."*

International PtX Hub

## Giulia Varaschin and Heino von Meyer (DE)

*"To fully exploit the decarbonization potential of $CO_2$-based fuels and chemicals, multi-level sustainability dimensions need to be included in the framework."*

Mitsubishi Power Europe

## Florian Möllenbruck (DE)

*"Synthetic fuels will have an important role to play because they are short-term enablers of decarbonization in different sectors."*

North-CCU-hub

## Stef Denayer (BE)

*"Ambitious to make our sustainable industrial ingredients ourselves henceforth."*

Uniper

## Dinah Dux (DE)

*"Identifying $CO_2$ utilization pathways for North Rhine-Westphalia as part of the structural change and climate targets."*

University of Michigan

## Volker Sick (US)

*"The time is now to change our carbon source!"*

VTT

## Juha Lehtonen (FI)

*"By VTT process, polyols with carbon content over 90 % from carbon dioxide can be produced from biogenic $CO_2$ and renewable hydrogen."*


#CleanerProduction #PushingBoundaries

Covestro approaches sustainability with tireless ingenuity. As a leading global polymer company, we push boundaries with innovations like using $CO_2$ as a new raw material for plastics. Our commitment is strong and our goal is clear: to deliver products and technologies that help society while reducing impact on the planet. Learn more about how we're helping to make the world a brighter place at **covestro.com**.

# 9th Conference on $CO_2$ | $CO_2$-based Fuels & Chemicals

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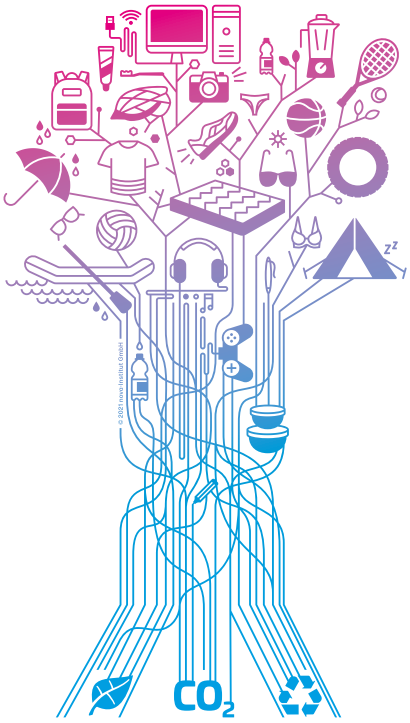


renewable-materials.eu

# RENEWABLE MATERIALS CONFERENCE 2021

## 18-20 May - Online Event

**All renewable material solutions at one event: bio-based, $CO_2$-based and recycled**

**The Renewable Materials Conference will provide new advantages and synergies by establishing a meeting point for numerous cross-sectoral networking opportunities.**

**Day 1:**
- Renewable Chemicals and Building Blocks from Biorefineries, CCU and Chemical Recycling

**Day 2:**
- Renewable Polymers and Plastics from Biomass, $CO_2$ and Recycling
- Innovation Award

**Day 3:**
- Renewable Plastics and Composites
- Packaging and Biodegradation

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RENEWABLE MATERIAL OF THE YEAR 2021 · 1 · INNOVATION AWARD

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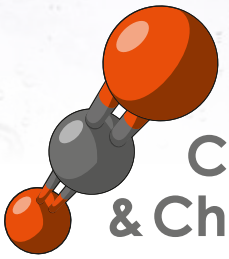
**Cellulose Fibres Conference, 2 - 3 February 2022**

International Conference on CELLULOSE FIBRES
2–3 February 2022
Cologne (Germany)

Third International Conference on Cellulose Fibres, the fastest growing fibre group in textiles, the largest investment sector in the bio-based economy and the solution for avoiding microplastics.

**www.cellulose-fibres.eu**



# Conference on $CO_2$-based Fuels & Chemicals 2022

**23 – 24 March • Cologne (Germany)**

SAVE THE DATE

**23 – 24 March 2022**

Hybrid Event

**www.co2-chemistry.eu**

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# THE RENEWABLE CARBON INITIATIVE

## Shape the future of the chemical and material industry


Renewable Carbon Initiative (RCI) was founded in September 2020. RCI members are committed to create a sustainable, fossil-free future for the chemical and material industry.

### WHY JOIN RCI?

RCI is an organization for all companies working in and on sustainable chemicals and materials – renewable chemicals, plastics, composites, fibres and other products can be produced either from biomass, directly via $CO_2$ utilisation, or recycling.

RCI members profit from a unique network of pioneers in the sustainable chemical industry.

### RCI OFFERS ITS MEMBERS

- A common voice for the renewable carbon economy.
- Increased visibility of their individual renewable carbon solutions.
- Collective advocacy work to create a supportive regulatory and economic framework.
- Support in finding solutions for your specific problems on the way to your renewable carbon goals.

### MEMBERS

Beiersdorf, BioBTX, Cosun Beet Company, covestro, Firmenich, Givaudan, Henkel, IBB Netzwerk GmbH, iff, LanzaTech, Lenzing, NESTE, nova, SHV ENERGY, Stahl, TripleW, Unilever, uniper, UPM BIOFORE BEYOND FOSSILS

### PARTNERS

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**JOIN NOW**

Become a part of the Renewable Carbon Community (RCC) and shape the future of the chemical and material industry
**www.renewable-carbon-initiative.com/membership/application**

More members, partners and information
**www.renewable-carbon-initiative.com**
Contact: **dominik.vogt@nova-institut.de**
**#renewablecarbon**

# Market and Trend Reports

nova Institute for Ecology and Innovation

NEW

## Bio-based Naphtha and Mass Balance Approach

Status & Outlook, Standards & Certification Schemes


*Authors: Michael Carus, Doris de Guzman and Harald Käb*

*March 2021*

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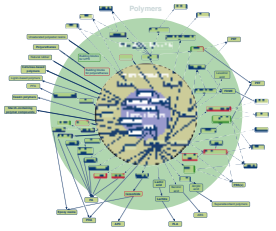
DATA FOR 2020

## Bio-based Building Blocks and Polymers – Global Capacities, Production and Trends 2020 – 2025



*Authors: Pia Skoczinski, Michael Carus, Doris de Guzman, Harald Käb, Raj Chinthapalli, Jan Ravenstijn, Wolfgang Baltus and Achim Raschka*

*January 2021*

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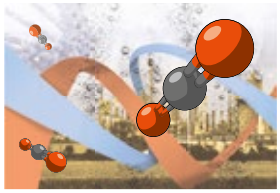
REVISED AND EXTENDED 2021

## Carbon Dioxide ($CO_2$) as Chemical Feedstock for Polymers

Technologies, Polymers, Developers and Producers



*Authors: Pauline Ruiz, Achim Raschka, Pia Skoczinski, Jan Ravenstijn and Michael Carus, nova-Institut GmbH, Germany*

*January 2021*

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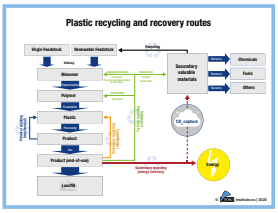
## Chemical recycling – Status, Trends and Challenges

Technologies, Sustainability, Policy and Key Players




*Author: Lara Krause, Florian Dietrich, Pia Skoczinski, Michael Carus, Pauline Ruiz, Lara Dammer, Achim Raschka, nova-Institut GmbH, Germany*

*November 2020*

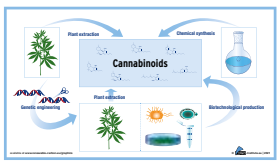
This and other reports on the bio- and $CO_2$-based economy are available at **www.renewable-carbon.eu/publications**

# THE BEST MARKET REPORTS AVAILABLE

## Bio- and $CO_2$-based Polymers & Building Blocks

## 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*

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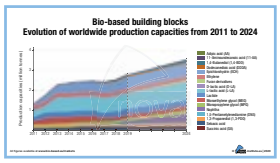
## Commercialisation updates on bio-based building blocks




*Author: Doris de Guzman, Tecnon OrbiChem, United Kingdom*

*Updated Executive Summary and Market Review May 2020 – Originally published February 2020*

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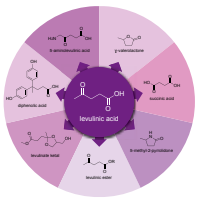
## Levulinic acid – A versatile platform chemical for a variety of market applications

Global market dynamics, demand/supply, trends and market potential




*Authors: Achim Raschka, Pia Skoczinski, Raj Chinthapalli, Angel Puente and Michael Carus, nova-Institut GmbH, Germany*

*October 2019*

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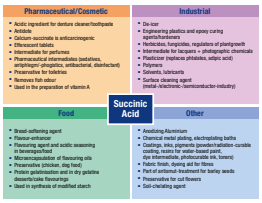
## Succinic acid – From a promising building block to a slow seller

What will a realistic future market look like?




*Authors: Raj Chinthapalli, Ángel Puente, Pia Skoczinski, Achim Raschka, Michael Carus, nova-Institut GmbH, Germany*

*October 2019*

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## Standards and labels for bio-based products

*Authors: Lara Dammer, Michael Carus and Dr. Asta Partanen nova-Institut GmbH, Germany*

*May 2017*

This and other reports on the bio-based economy are available at **www.bio-based.eu/reports**

## Bio-based polymers, a revolutionary change

Comprehensive trend report on PHA, PLA, PUR/TPU, PA and polymers based on FDCA and SA: Latest developments, producers, drivers and lessons learnt


E-mail: j.ravenstijn@kpnmail.nl
Mobile: +31.6.2247.8593

*Author: Jan Ravenstijn, Jan Ravenstijn Consulting, the Netherlands*

*April 2017*

This and other reports on the bio-based economy are available at **www.bio-based.eu/reports**

narocon

## Market study on the consumption of biodegradable and compostable plastic products in Europe 2015 and 2020

A comprehensive market research report including consumption figures by polymer and application types as well as by geography, plus analyses of key players, relevant policies and legislation and a special feature on biodegradation and composting standards and labels

Bestsellers


*Authors: Harald Kaeb (narocon, lead), Florence Aeschelmann, Lara Dammer, Michael Carus (nova-Institute)*

*April 2016*

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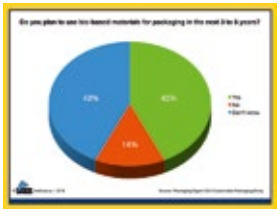
## Brand Views and Adoption of Bio-based Polymers



*Author: Dr. Harald Kaeb, narocon Innovation Consulting, Germany*

*January 2016*

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