ADVANCED RECYCLING Conference 2023

28–29 November • Cologne (Germany)

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Free WiFi

Network ID nova-Conference
Password #2023ARC

#2023ARC

27 November 2023, 19:00 (CET)
On the eve of the conference

Proposed Meeting Point for a Social Evening Gathering

Kölsch Brewery
Gaffel am Dom
Bahnhofsvorplatz 1, 50667 Cologne
(Right next to Cologne Central Station)

Join at sli.do
for real time questions and comments

Main Sessions
Grand Hall
#2023ARC

Parallel Sessions
Room Laurentius
#2023ARC-2

Zoom Events
We sent you the link to Zoom Events.

All details:
Please see page 10.

Program

The Advanced Recycling Conference is packed with a variety of relevant topics, which are grouped into nine sessions.

You can look forward to the following contents:

DAY 1

28 November 2023
10:00–17:40 (CET)

P. 18

Main Session 1:
Policy, Markets & Strategy
Understanding what political foundations have been laid for a meaningful transformation of the circular economy, and what are the challenges? Which markets show the most promising prospects for investment and what strategies can lead to success?

Main Session 2:
Pyrolysis & Other Thermochemical Approaches (Part 1)
Pyrolysis is a versatile tool that is able to complement mechanical recycling and to produce a wide range of different products that can be utilised in the chemical and plastics industry. The boundaries to other thermochemical processes are usually fluid, but can occur under similar reaction conditions. Depending on the reactor and reaction design, different products can be obtained from the process to realise open or closed recycling loops.

Main Session 3:
Dissolution
Polymer extraction from plastic (multilayer) packaging and other materials through dissolution and the selection of suitable solvents for the process.

Parallel Session:
Versatility of Extruders
(Pre-treatment and Reactive Extrusion)
& Advanced Mechanical Recycling
Extruders are not only known in the world of mechanical recycling; they can be utilised as reactor or pre- and post-treatment units in advanced recycling. Depending on the composition and type of polymer different processes may be necessary or more suitable for which a large toolbox of advanced and mechanical recycling technologies can be accessed.

DAY 2

29 November 2023
9:00–16:40 (CET)

P. 24

Main Session 1:
Depolymerisation
Assisted by heat, radiation, the use of catalysts or addition of chemicals and enzymes, the depolymerisation breaks plastic waste, and even textiles into its building units (e.g. monomers) that can be fed back into polymer production. Learn more about solvolysis, Enzymatic recycling and the detoxification of contaminated plastics.

Main Session 2:
Pre-/Post-treatment & Upgrading
Pre-processing, post-processing, and upgrading technologies are connecting elements (enablers) to all advanced recycling technologies. The here introduced processes realise higher yields and achieve higher product qualities while bringing recycling to another level.

Parallel Session:
Gasification
In contrast to incineration and energy recovery the gasification coupled with downstream processes opens new pathways for highly contaminated and very heterogenous waste streams. With the production of syngas and its processing in further downstream processes new paths are being taken for the production of chemicals and fuels.

Main Session 3:
LCA & Environmental Aspects
This session will elaborate Life Cycle Assessment (LCA) in the context of advanced recycling, how such assessments should and can be performed, and discuss the open questions and challenges of how to communicate their results as well as monitoring of environmental and health aspects.

Main Session 4:
Pyrolysis & Other Thermochemical Approaches (Part 2)
Pyrolysis is a versatile tool that is able to complement mechanical recycling and to produce a wide range of different products that can be utilised in the chemical and plastics industry. The boundaries to other thermochemical processes are usually fluid, but can occur under similar reaction conditions. Depending on the reactor and reaction design, different products can be obtained from the process to realise open or closed recycling loops.

Welcome to the Second Edition of the “Advanced Recycling Conference” (ARC)

We continue our journey after a successful conference debut last year

The event reaches far beyond chemical recycling and further presents various new and innovative solutions, that collectively complement and enable each other and thus advance recycling. All participants can be sure that this year we will again hear more about new technological success stories and discuss future opportunities. We are strongly convinced that a successful evolution of the circular economy can continue to be driven only by collaborative thinking of stakeholders as well as complementary approaches. The perfect solution is not to be found in one recycling technology, rather we have to ask ourselves how we can integrate the strengths and weaknesses of all technologies into a working and environmentally sustainable concept. In such a concept, solutions further upstream and downstream of the actual recycling process are also of elementary importance when it comes to increasing yields and qualities as well as establishing new pathways.

A pillar for renewable carbon

The major driver of the anthropogenic climate change is CO_2 from fossil carbon that is extracted from the ground. In order to mitigate climate change via greenhouse gas emissions the inflow of further fossil carbon from the ground must be reduced and eventually eliminated. The chemical and plastics sector cannot be decarbonised, because its products are mainly based on carbon. So, another approach is required, in which the carbon is kept (or cycled) as renewable carbon preventing its loss from the system – creating sustainable carbon cycles. In doing so less virgin fossil carbon is used. There are three pillars of renewable carbon which are bio-based, CO_2-based, and recycling-based. In contrast to partially established definitions from the plastic packaging sector, the term “recycling” is understood differently in the context of renewable carbon, as it is not exclusively about plastic-to-plastic or polymer-to-polymer recycling, but also about recycling carbon from different wastes into valuable feedstock for the production of any carbon containing products that has functional use (e.g. for the chemical industry). The production of energy and fuels from wastes would not fall under the term of recycling since the carbon would be lost from the system into the atmosphere.

The attitude we need

A look into the past makes us confident about the future and motivates us to provide a framework to critically exchange new ideas, concerns, and improvements. Looking back to the last recent years it is impressive to see that despite all the crises and headwinds, new start-ups, spin-offs, and SMEs continue to enter the recycling market or upscale their processes and start to change the recycling sector constructively. This is not out of sheer naivety or malicious intentions, but because they are aware of the challenges. Of course, not all approaches will turn out to be economically and ecologically sound solutions, but at least each experience will make us richer and sharpen our view of the whole. It is precisely this energetic Zeitgeist that we need to do justice to a sustainable circular economy and to escape the culture of complainers. The pioneers of tomorrow have already started to collaborate as well as to establish new value chains and to improve existing ones. Nevertheless, this alone is not enough. In Europe, there is already an enormous potential of know-how and providers for advanced recycling technologies, which are currently not fully exploited and in danger of falling behind. To counteract this situation additional political measures are needed, such as the revision of relevant directives or the establishment of incentives and investment programs. We are already looking forward to the discussions and opinions on what enablers need to develop from this.

A program tailored to gain well-balanced insights into the world of advanced recycling

This year many more abstracts for presentations and posters were submitted than before which makes us highly confident, that we have created a purposeful format keeping ARC on its successful track. It was a challenge to create a program out of the sheer amount and variety of submitted abstracts. For this reason, for the first time, we have assembled an advisory board for ARC with experts from various sectors, including industrial chemistry, waste disposal, brand manufacturing, industrial association, and academia. From the feedback of the experts, a two-day program has grown that provides a well-balanced insight into the versatile world of advanced recycling. So, let's get a clearer picture of where we stand and where our joint journey can take us. Now we are looking forward to a lively exchange, critical discussions, and extensive networking with all participants, online as well as offline.

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Lars Krause
Senior Expert

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Registration

advanced-recycling.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.advanced-recycling.eu/venue

Entrance Fee

2 Days • 28–29 November 2023
Ticket for on site (and online) attendance
incl. dinner buffet on the first day
945 €

Day 1 • 28 November 2023
Ticket for on site (and online) attendance
incl. dinner buffet
640 €

Day 2 • 29 November 2023
Ticket for on site (and online) attendance
580 €

2 Days Online Ticket • 28–29 November 2023
Ticket for virtual attendance
450 €

2 Days Student Ticket • 28–29 November 2023
Ticket for on site attendance
incl. dinner buffet on the first day
350 €

Exhibition

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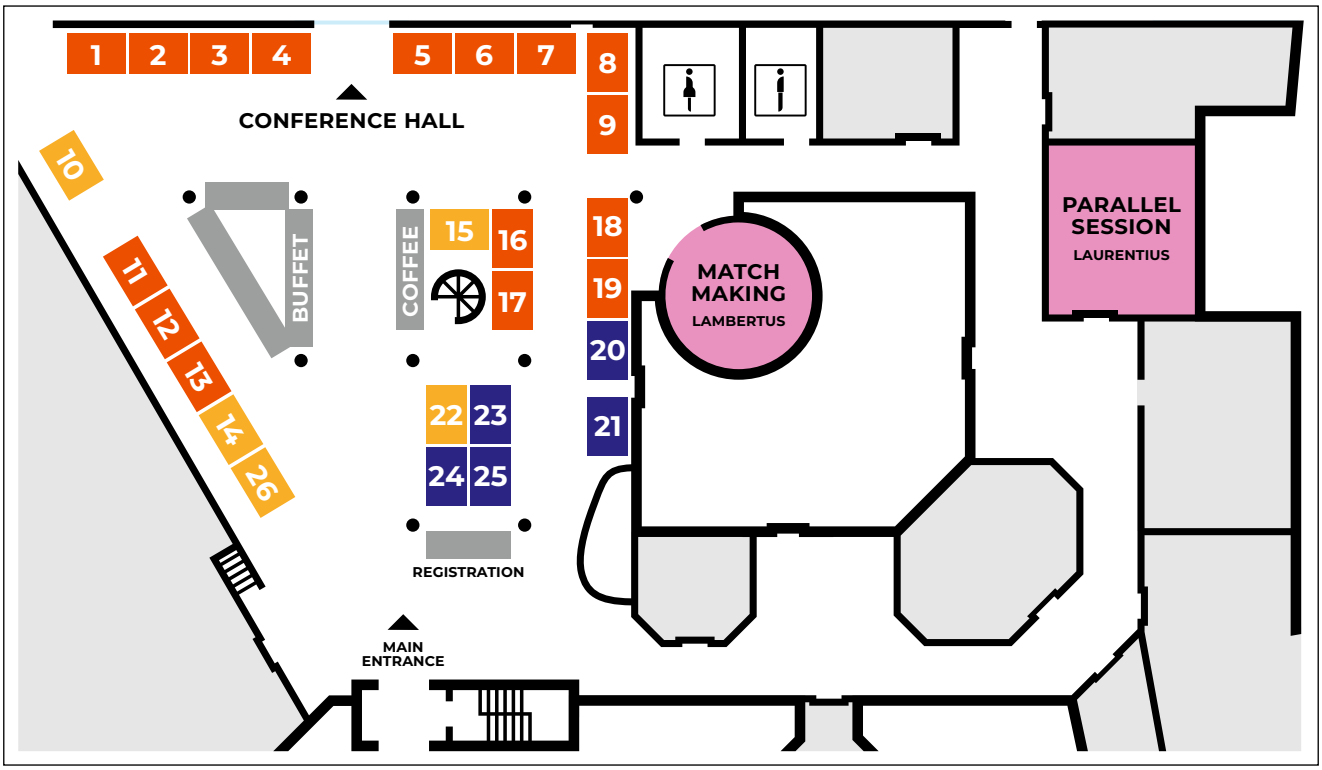


List of Exhibitors

01 LIST Technology (CH)
02 Gneuss Kunststofftechnik (DE)
03 DePoly (CH)
04 YNCORIS (DE)
05 EREMA (AT)
06 nova-Institute (DE)
07 Cyclize (DE)
08 Media Table
09 AIMPLAS (ES)
11 Fraunhofer Institute for Environmental, Safety, and Energy Technology UMSICHT (DE)
12 Aduro Clean Technologies (CA)
13 Re:Lab AB (SE)
16 Mura Technology (UK)
17 Poster Session
19 Poster Session

book your booth soon

Book your booth:
advanced-recycling.eu/exhibition-booking

Status:
21 November 2023
More exhibitors expected: advanced-recycling.eu/exhibitors

Poster Session

The poster session will take place during the lunch break (12:30 – 14:00, CET) of the second day 29 November with a few minutes presentation at a special poster area at booths number 17 and 19 on the exhibition space.

Pelin Uran, DePoly (CH)
Significance of plastic recycling with the focus on polyesters – creating a circular economy

Bernd Steinhoff, Fraunhofer LBF (DE)
Rapid evaluation of process stabilization by means of online-rheology

Kyriaki Gkaliou, Grundfos (DN)
Recycling and reuse of industrial waste composites

Ricarda Kendler, Harburg Freudenberger Maschinenbau (DE)
The internal mixer – a highly flexible and versatile machine for various recycling applications

Brent Smeyers, KU Leuven (BE)
Small-scale screening technologies for evaluation of heterogeneous catalysts in LDPE pyrolysis

David Albano, La Sapienza University of Rome (IT)
Development of physical recycle process of end-of-life photovoltaic panels for glass and metal recovery

Graziella Kassick Saft, PIEP Innovation in Polymer Engineering (PT)
Advancing Non-Woven PPE Materials: Heat-Resistant Stereocomplex PLA-rPET Blend

Mathias Kirstein, RITTEC 8.0 Umwelttechnik (DE)
Meeting product quality and sustainability targets in PET/Polyester applications using back-to-monomer recycling

Douwe Zijlstra, TNO (NL)
UPWASH: Improving the quality of waste plastic

Ilona van Zandvoort, TNO (NL)
Recycling of PLA towards development of circular materials

Juraj Petrík, Utrecht University (NL)
Towards Carbon Circularity: Pyrolysis of Mixed Plastic Waste

Borja Baltasar Perez Martinez, University of the Basque Country (ES)
New technologies for the thermochemical recycling of complex waste

advanced-recycling.eu/poster-session

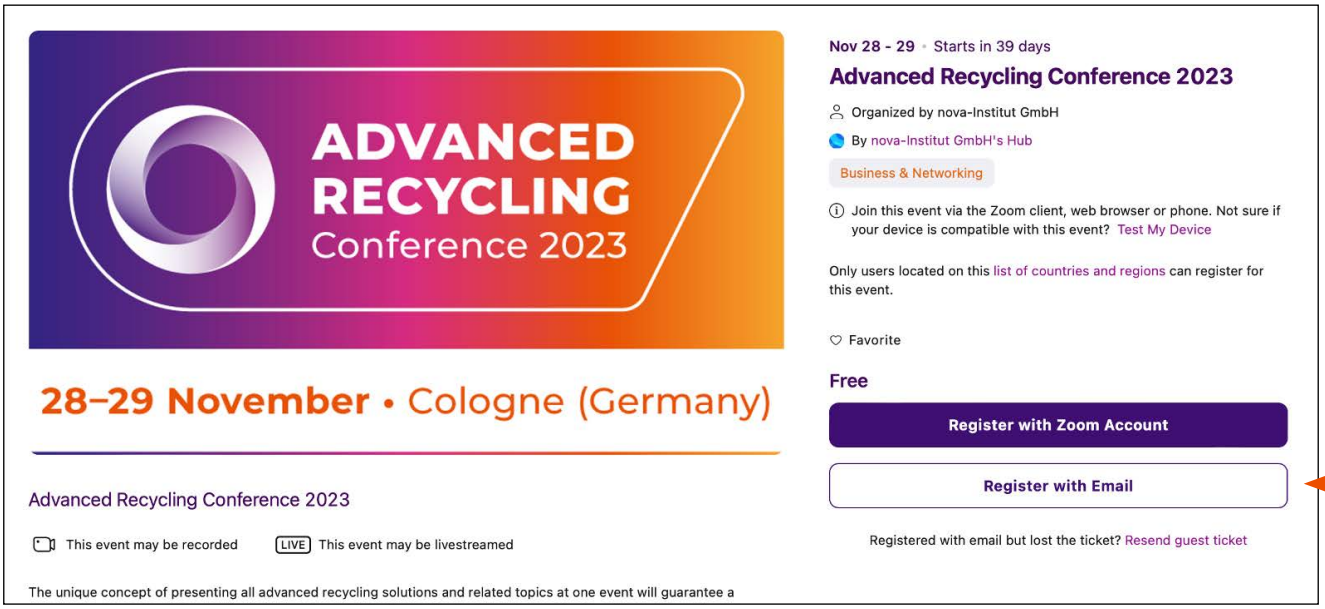
Networking and Streaming Platform

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

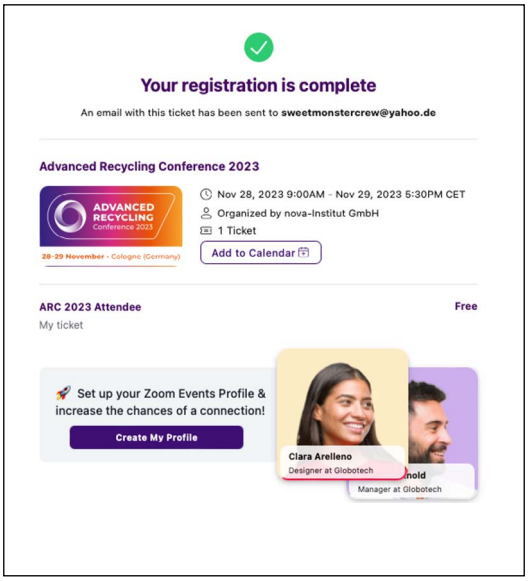
How to enter

1 The use does not require a Zoom account. You can also register with a valid 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.

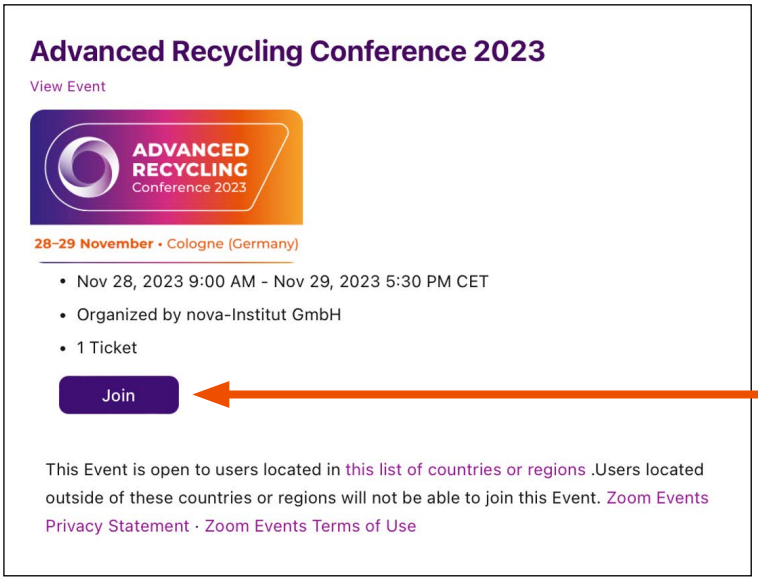


2 If you have a Zoom account, please use it to login. Otherwise please login with your email account, a verification code will be sent to you via email.



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

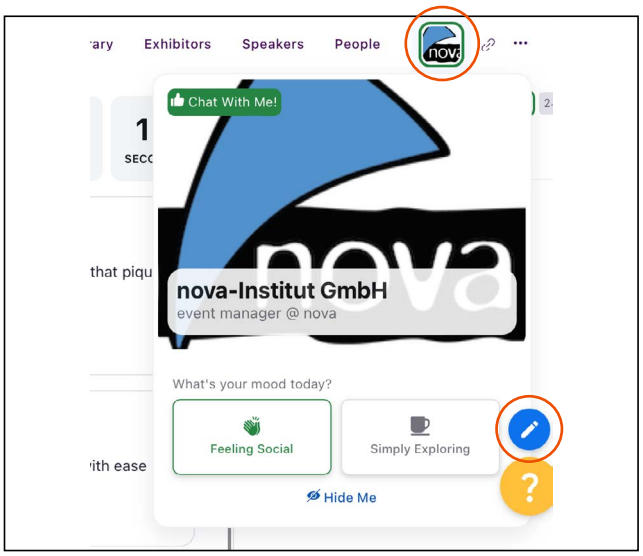
Please use this path to (re)enter throughout all conference days.



Your profile

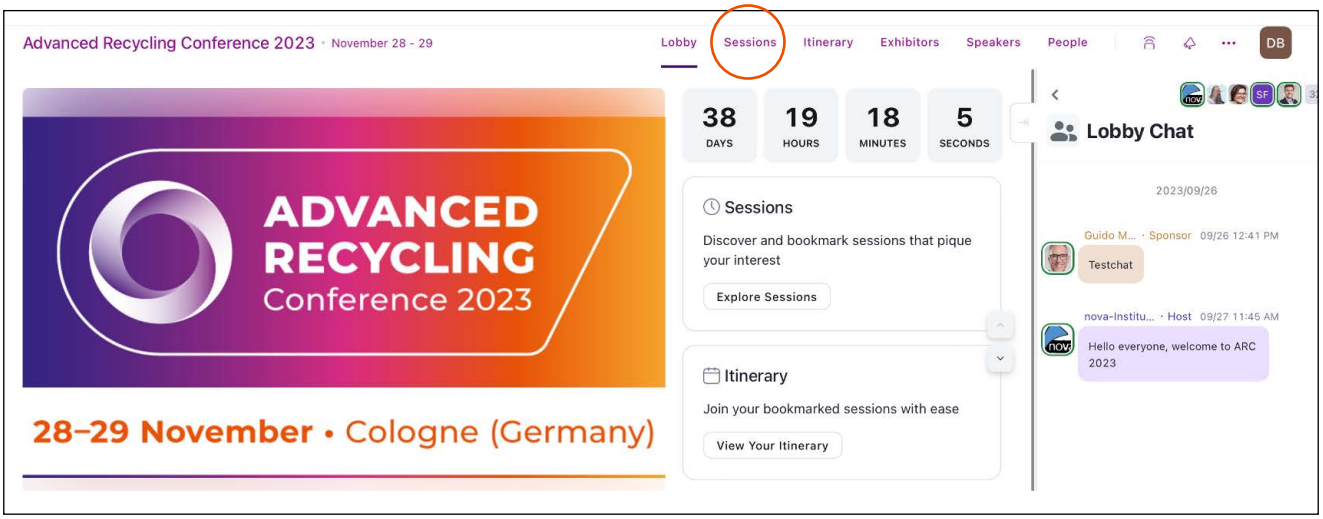
Adding more information allows others to find and contact you, by entering for example key words.

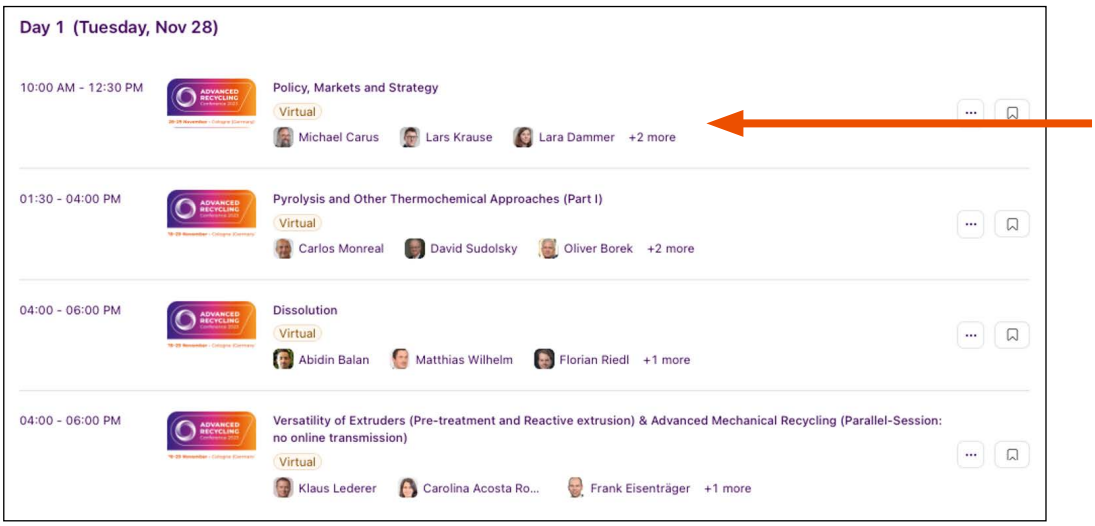
To edit your profile, click on the icon in the upper right corner.



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.





Upcoming Study on Advanced Recycling Technologies and Worldwide Capacities

The upcoming study “Mapping of advanced recycling technologies for plastics waste and worldwide capacities” presents more than 130 technologies that are available on the market or will be available soon. Most of the identified technology providers are from Europe, led by the Netherlands and Germany, followed by North America.

Also featured are initial suppliers of post-processing and upgrading technologies, which play a particularly important role in the conversion of secondary valuable materials into chemicals, materials and fuels. Various technologies at different scales are covered, including gasification, pyrolysis, solvolysis, dissolution, and enzymolysis. All technologies and the companies are comprehensively presented. Depending on the technology, different products can be obtained and re-introduced into the cycle at different points in the plastics value chain (Figure 1). The largest capacities that can be covered by a single plant are currently found in thermochemical processes.

Furthermore, the study describes technical details, the suitability of available technologies for specific polymers and waste fractions, and the implementation of existing pilot, demonstration and even (semi-)commercial plants. In addition, all recent developments as well as partnerships and joint ventures are systematically described.

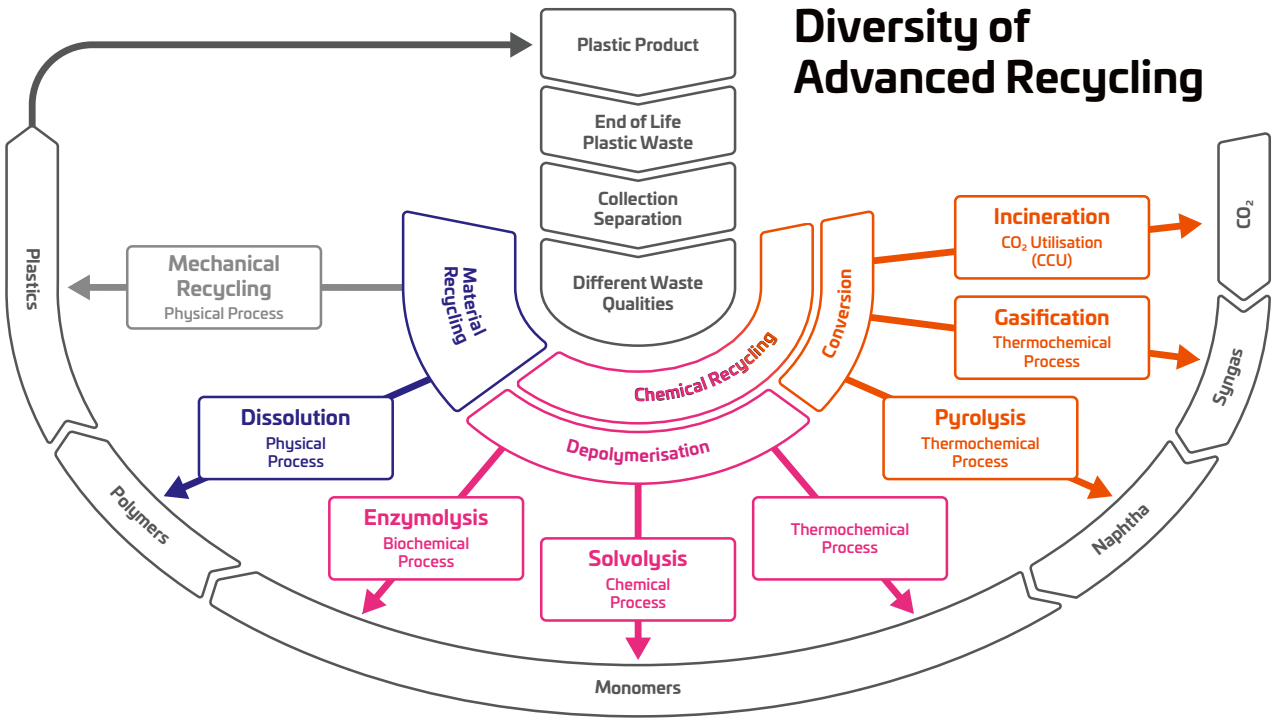


Figure 1: Full spectrum of available recycling technologies divided by their basic working principles and their products.

For the first time a comprehensive overview about the worldwide advanced recycling capacities provides deep insights into the status quo

From all installed advanced recycling plants more than 60 and therewith the majority is operating in Europe[1] (Figure 2), followed by the Rest of the World, CIS, NAFTA, Middle East & Africa, China, Latin America, and Japan. With advanced recycling, Europe addresses 358 kt plastics waste[2] per annum which corresponds to nearly one quarter of the worldwide input capacity of advanced recycling. In Europe, with 275 kt per annum the majority is addressed via pyrolysis, followed by solvolysis, dissolution, and enzymolysis (Figure 3).

In Europe 271 kt of products are obtained from advanced recycling. A detailed evaluation of the products (Figure 4) reveals that 41 % can be utilised for the production of new polymers and plastics in the form of purified polymers, as well as monomers/oligomers and naphtha. Additionally, 35 % of the products are representing Secondary Valuable Chemicals (SVC, such as pyrolysis oil, carbon black, wax, and other), which can have a wide range of applications. With that, only 24 % of the obtained products are falling in the fuels and energy category in the first place.

A detailed overview of the technologies and their suppliers

Pyrolysis

Pyrolysis represents a thermochemical recycling process in which mixed plastic waste (mainly polyolefins) and biomass are converted or depolymerised into liquids, solids, and gases in the presence of heat and absence of oxygen. The products range from various liquid fractions such as oils, diesel, naphtha and monomers to syngas, coal and waxes. Depending on the nature of the products, they can be used as renewable feedstocks to produce new polymers.

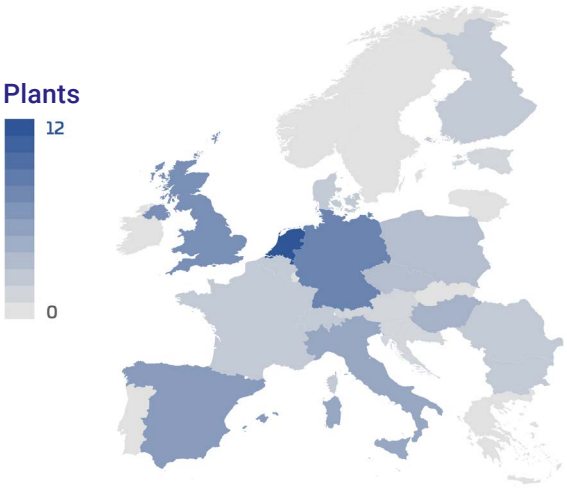


Figure 2: Number of installed advanced recycling plants in EU 27+3.

[1] EU 27+3 including Norway, Switzerland, and United Kingdom
[2] All kind of synthetic plastics and polymer wastes such as plastic packaging, tyres, polyester textiles

Here, a majority of the 81 identified technology providers are from Europe, followed by North America. With 31 companies, the majority of suppliers are small companies, followed by micro/start-up, medium and large companies such as Blue Alp (Eindhoven, Netherlands), Demont (Millesimo, Italy), INEOS Styrolution (Frankfurt, Germany), Neste (Espoo, Finland), Österreichische Mineralölverwaltung (OMV) (Vienna, Austria), Repsol (Madrid, Spain), Unipetrol (Prague, Czech Republic), VTT (Espoo, Finland) and Chevron Phillips (The Woodlands, TX, USA). At 40,000 tons per year, pyrolysis currently achieves the second largest capacity.

Solvolysis

Solvent-based solvolysis describes a chemical process based on depolymerisation that can be carried out with various solvents. In this process, polymers (mainly PET) are broken down into their building blocks (e.g. monomers, dimers, oligomers). After the breakdown, the building blocks are separated from the other plastic components (e.g. additives, pigments, fillers, non-targeted polymers). After purification, the building blocks are polymerised to synthesise new polymers.

Compared to pyrolysis, there are fewer suppliers active on the market, which also offer smaller capacities of up to 10,800 tons per year. Of the 24 identified solvolysis technology providers, the majority is based in Europe, followed by North America.

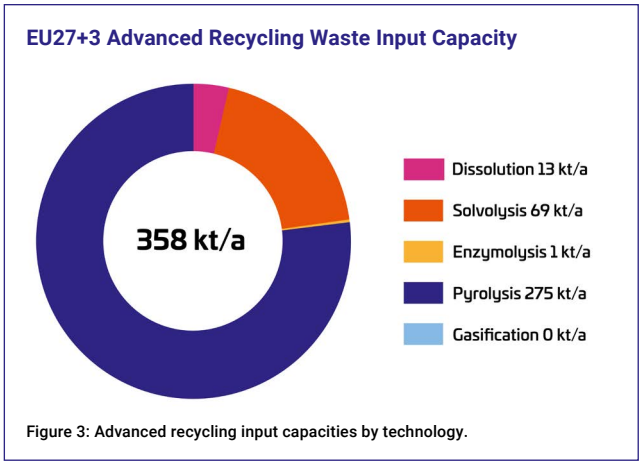


Figure 3: Advanced recycling input capacities by technology.

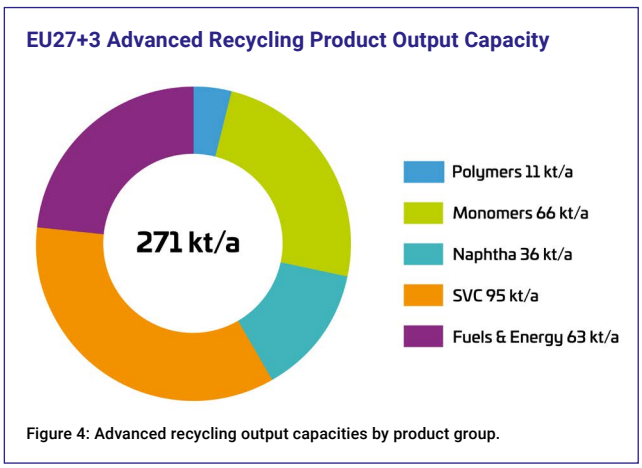


Figure 4: Advanced recycling output capacities by product group.

With nine companies, the majority of suppliers are among the small companies, followed by large, medium and micro/start-up companies. Large companies include Aquafil (Arco, Trentino, Italy), Eastman Chemical Company (Kingsport, TN, USA), IFP Energies Nouvelles (IFPEN) (Rueil-Malmaison, France), International Business Machines Corporation (IBM) (Armonk, NY, USA), DuPont Teijin Films (Tokyo, Japan), and Dow (Midland, MI, USA).

Gasification

Gasification is another thermochemical process that can convert mixed plastic waste and biomass into syngas and CO_2 in the presence of heat and oxygen. Currently, the largest capacities achieved are up to 100,000 tons per year. Most of the suppliers are based in North America. With four companies each, most of the suppliers are small and medium-sized enterprises. The only large company identified was Eastman (Kingsport, TN, USA).

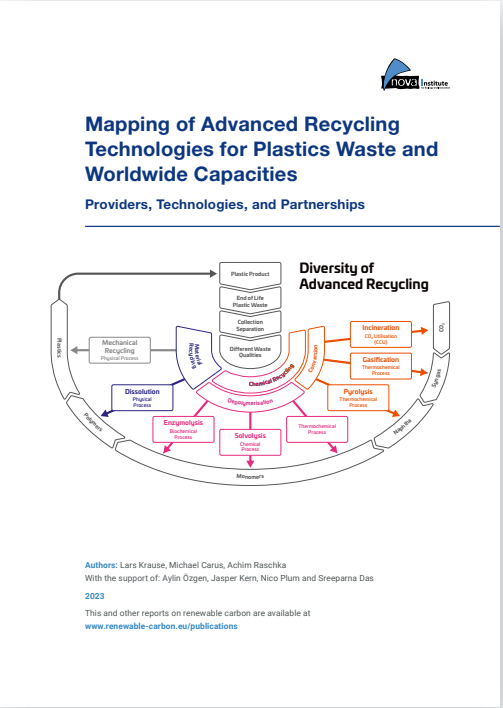
Dissolution

Dissolution describes a solvent-based technology based on physical processes. It allows targeted dissolution of polymers from mixed plastic waste in a suitable solvent, while retaining the chemical structure of the polymer. Other plastic components (e.g. additives, pigments, fillers or non-targeted polymers) remain undissolved and can be separated from the dissolved target polymer. An antisolvent is then added to initiate precipitation of the target polymer. The polymer can thus be obtained directly; unlike solvolysis, this process does not require a polymerisation step.

Currently, the process reaches a maximum capacity of 8,000 tons per year, with most technology suppliers coming from Europe, followed by North America. With four companies, most of the suppliers are mainly small companies, followed by micro/start-up, medium-sized and one large company, which is represented by Shuye Environmental Technology (Shantou, China).

Enzymolysis

An alternative route is offered by enzymolysis, a technology based on biochemical processes that use various types of biocatalysts to depolymerise a polymer into its building blocks. The technology is currently in an early stage of development and is only available on a laboratory scale. Currently, only one supplier of an enzymolysis technology has been identified, which is a small company in Europe.



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DePoly

contact@depoly.co
Sion, Switzerland
www.depoly.co

DePoly's recycling innovation creates a **sustainable circular economy for plastics**.

Problem

PET plastic is made from fossil fuels, and only perfect PET, like clean beverage bottles, can be recycled, representing <10% of plastics. The remaining 90% are incinerated, landfilled or polluted in our environment, forcing the production of new plastics from oil.

Timeline

- 2020: DePoly SA formed
- 2021: operational TRL7 pilot plant
- 2023: 12.3 M CHF Seed round
- 2024: 500T/y demonstration plant
- 2027: first 50kT/y commercial plant

Solution

DePoly technology recycles unsorted, dirty PET waste into **virgin-grade raw materials**.

Those PET precursors, PTA and MEG, are used by industry to produce new plastics without the need for fossil fuels, while diverting valuable materials from landfills and incineration.

Competitive Advantage

- **No pre-washing**, pre-sorting, or separating out other materials
- **Room temperature** and standard pressure process
- **Robustness** to handle contaminated and mixed material, high flexibility in selecting feedstock
- **Simple design & low CAPex** allows us to scale flexibly to meet diverse customer needs
- **Infinite recycling**: monomers of virgin quality, no degradation

Opportunities

DePoly technology offers our customers tailored solutions to:

- Increase PET plastic collection and recycling rates
- Increase the **supply of rPET**
- **Create circular economy** for PET plastics and polyester textiles
- Increase **material recovery**
- Improve **supply chain resilience**
- Reduce carbon footprint
- Reduce the dependency on Earth natural resources

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WE DRIVE THE CIRCULAR ECONOMY.

Whether it is inhouse, postconsumer, bottle or chemical recycling: closing the loop in a precise and profitable way if machines are perfectly tuned for the respective application. Choose the number one technology from EREMA when doing so: over 6500 of our machines and systems produce around 14.5 million tonnes of high-quality pellets like this every year – in a highly efficient and energy-saving way.

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EREMA®
PLASTIC RECYCLING SYSTEMS

The program of the Advanced Recycling Conference illustrates the dynamic development of the plastics recycling sector.

Recent developments in markets and policy indicate a clear transformation and long-lasting change in the circular economy of plastics.

While the European Green Deal has set the overarching aim for the European Union, markets and big industrial players as well as emerging start-ups and everything in-between have set off on a journey to implement and establish advanced recycling solutions worldwide. Still, some milestones in this quest can only be achieved through co-operation, partnerships, acquisitions, or fusions which could be observed throughout many announcements of past years.

Especially the most recent developments point towards strategies that build bridges between conventional mechanical recycling and advanced recycling technologies in which both elements complement each other.

Versatile and innovative landscape of advanced recycling technologies

The current landscape offers a versatile set of different technologies that serve as an interface between a wide range of waste streams and products to further improve existing or establish new value chains. This landscape offers material recycling in which physical processes are utilised (mechanical recycling and dissolution).

Furthermore, the landscape offers a wide range of chemical recycling technologies utilising biochemical, chemical, and thermochemical processes whereby the borders of some processes may be floating.

Not all pathways could be ecologically or economically meaningful for all different waste streams which is still extensively evaluated and discussed. A Life Cycle Assessment (LCA) is the most widely recognised and accepted methodology for analysing potential environmental impacts to assess environmental sustainability. Several LCAs on different recycling technologies and value chains are already published.

However, critical aspects remain to be discussed and clarified, for instance on how to conduct such assessments in detail and which parameters to consider in order to compare the different technologies, feedstocks, and products with each other to draw meaningful conclusions. Besides the recycling technologies, pre- and post-processing as well as upgrading technologies represent important pillars for the establishment of meaningful value chains and together contribute to the evolution of the circular economy.

We are happy to offer you a comprehensive program that gives all attendees the opportunity to gain deep insights into all these recent developments. Aside the talks we will have several opportunities for networking with a variety of stakeholders along the entire plastics value chain.

advanced-recycling.eu/program

DAY 1
28 November 2023 • 10:00–17:40 (CET)

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

10:10 – 12:10

Main Session
Policy, Markets & Strategy
Grand Hall

Chairpersons: Lars Krause & Michael Carus, nova-Institute

10:10

Michael Carus
nova-Institute (DE)
Importance of Advanced Recycling for the Renewable Carbon Economy

10:30

Lars Krause
nova-Institute (DE)
Advanced Recycling Overview and Worldwide Capacities

10:40

Nicolas Hark
nova-Institute (DE)
From Mass Balance to End-of-Waste Criteria: What's New in Policy for Advanced Recycling

10:50

John Sewell
Chemical Recycling Europe (BE)
How to Make Chemical Recycling a Success Story in Europe

11:10

Luis Hoffmann
Sulzer Chemtech (CH)
How Collaboration Enables Circular Plastics

11:30

Dimitri Daniels
Der Grüne Punkt (DE)
Mechanical and Chemical Recycling to Achieve Circularity of Plastic Packaging

11:50 **Panel Discussion with all Session Speakers**

12:10
Lunch Break & Networking

13:40 – 15:40

Main Session

Pyrolysis & Other Thermochemical Approaches (Part 1)

Grand Hall

Chairpersons: Achim Raschka & Lars Krause, nova-Institute

13:40

Carlos Monreal
Plastic Energy (UK)
Supporting a Circular Economy for Plastic Waste Through Chemical Recycling

14:00

David Sudolsky
Anellotech (US)
Recycled BTX Made From Mixed Waste Plastics via Plas-TCat® Process

14:20

Oliver Borek
Mura Technology (UK)
Mura Technology: Key Advantages of Hydrothermal Liquefaction

14:40

Christian Haupts
Carboliq (DE)
A Roadmap Towards TRL 9 in Chemical Recycling – The Knapsack 10 kta Plan(t)

15:00

Valentijn de Neve
BlueAlp (NL)
BlueAlp – Accelerating Plastic Recycling

15:20

Panel Discussion with all Session Speakers

15:40
Coffee Break & Networking

16:00 – 17:40

Main Session

Dissolution

Grand Hall

Chairpersons: Lars Krause & Michael Carus, nova-Institute

16:00

Abidin Balan
Trinseo (NL)
Dissolution Technology: An Approach for Infinite Circularity

16:20

Matthias Wilhelm
Lober (DE)
Dissolution Recycling as a Solution for a Multilayered Problem

16:40

Florian Riedl
APK (DE)
High-Quality Recyclates from Post-Consumer Flexible Packaging Waste via the Solvent-Based Newcycling Technology

17:00

Panzheng Zhou
University of Wisconsin-Madison (US)
Computational Modeling of Dissolution-based Plastic Recycling: Solubility Prediction, Solvent Screening, and Process Design

17:20

Panel Discussion with all Session Speakers

17:40

Networking

20:00

Gala Dinner Buffet

Grand Hall

16:00 – 17:40

No Online Transmission

Parallel Session

Versatility of Extruders (Pre-treatment and Reactive Extrusion) & Advanced Mechanical Recycling

Room Laurentius

Chairpersons: Asta Partanen & Nadja Wulff, nova-Institute

16:00

Klaus Lederer
EREMA Group (AT)
Advanced Input Stream Preparation Technologies for Chemical Recyclers

16:20

Carolina Acosta Romero
AIMPLAS (ES)
Reactive Extrusion Potential in Recycling and Repolymerization

16:40

Frank Eisenträger
INEOS Styrolution (CH)
Advanced Mechanical Recycling of Polystyrene

17:00

Lars Biermann
KraussMaffei Extrusion (DE)
Closing the Material Loop of Polyethylene Terephthalate through Chemical Recycling Technologies

17:20

Panel Discussion with all Session Speakers

GOLD SPONSOR

DePoly: Revolutionising Plastic Recycling

What is the driving force behind DePoly?

Over 400 million tonnes of plastic are produced annually, and shockingly, less than 10 % of it gets recycled. The rest? It mostly goes to incineration or fills our landfills. We're here to offer a solution to this global crisis — a universal chemical **recycling process that converts plastics back into raw materials without compromising on quality.**

So how does your solution to the plastic pandemic work?

Our patented chemical recycling technology converts plastics back into their raw chemical components – PTA and MEG. These components are then repurchased by industries to make new, virgin-quality plastic items. It's the start of a truly sustainable circular plastic economy.

Plastics like PET are ubiquitous in our lives. Why has it been so difficult to recycle them?

The challenge primarily lies in the complexities of sorting, separating, and cleaning different plastic streams. Conventional recycling systems generally prefer 'perfect' plastics — those that are clean and of a simple composition. That leads to over 90 % of plastics landing in our environment or being burned, forcing the production of new plastics from fossil fuels.

Our approach is different; we've developed a robust technology that tackles all plastic waste streams, including mixed, dirty plastic waste streams, textiles, fibres, and more.

What makes DePoly's chemical recycling technology different from others?

The process we developed selectively handles PET and polyester streams that are typically rejected by conventional systems while offering materials recovery, which makes it really **robust.**

Additionally, our technology operates at room temperature and standard pressure, with **no need for any pre-washing, pre-sorting, or pre-melting** feedstock — it is, therefore, energy efficient and has a **65 % lower carbon footprint** if compared to virgin production, while it is easily scalable and customisable.

PTA (powder) and MEG (liquid) produced by DePoly

With partners like BASF Venture Capital and Beiersdorf expressing strong belief in DePoly's potential, what's next for the company?

Our current focus is on scaling up our technology. We're working on building a new showcase plant in Switzerland — it will process 500 tonnes annually and will be operational in 2025. But our vision extends beyond PET plastics. We aim to redefine the global lifecycle of all the plastic types, working towards creating a truly circular plastic economy worldwide.

Learn more at **www.depoly.co**

DAY 2
29 November 2023 • 9:00–16:40 (CET)

9:00 **Lars Krause**
nova-Institute (DE)
Conference Opening

9:10 – 10:50

Main Session
Depolymerisation
Grand Hall

Chairpersons: Pauline Ruiz & Pia Skoczinski, nova-Institute

9:10

Fabio Silvestri
gr3n (CH)
We MADE it! Towards Tangible Changes in the Plastic Industry

9:30

Vladislav Jaso
TotalEnergies Corbion (NL)
Advanced Recycling of Luminy Poly Lactic Acid (PLA)

9:50

Cecilia Mattsson
RISE Research Institutes of Sweden (SE)
DeToxoLys – Detoxification and Recycling of Contaminated Plastic Waste Streams with Hydrothermal Liquefaction (HTL)/Solvolysis

10:10

Stefan Schonauer
RWTH Aachen University (DE)
Enzymatic Recycling of Textiles

10:30
Panel Discussion with all Session Speakers

10:50
Coffee Break & Networking

11:10 – 12:30

Main Session
Pre-/Post-treatment & Upgrading
Grand Hall

Chairpersons: Lars Krause & Matthias Stratmann, nova-Institute

11:10

Tobias Rieger
Fraunhofer UMSICHT (DE)
Application of a Novel and Cheap Post-Reforming Agent to Produce High-Quality Aromatic Bulk Chemicals from MSPW Pyrolysis Oils and Dehalogenation Thereof

11:30

Trine Dabros
TOPSOE (DK)
Hydrotreating of Plastic Pyrolysis Oil: How to Maximize the Learnings From the First Industrial Plant

11:50

Beate Kummer
Polysecure (DE)
New Sorting Technology for Fractions to Improve Advanced Recycling Output

12:10 **Panel Discussion with all Session Speakers**

11:10 – 12:30 No Online Transmission

Parallel Session
Gasification
Room Laurentius

Chairpersons: Achim Raschka & Pia Skoczinski, nova-Institute

11:10

Greg Archer
LanzaTech (UK)
Enabling a Circular Economy: Low Carbon Fuel and Chemical Production from Waste

11:30

Stephan Renninger
Cyclize (DE)
Zero Emission Waste Reforming to Enable a Circular Carbon Economy in Europe

11:50

Cecilia Hofmann
Re:Lab (FR)
Gasification and Pyrolysis of Plastic Waste Under a Circular Economy Perspective: A Literature Review

12:10 **Panel Discussion with all Session Speakers**

12:30
Lunch Break & Networking (Poster Session)

14:00 – 15:00

Main Session
LCA & Environmental Aspects
Grand Hall

Chairpersons: Lars Krause & Pauline Ruiz, nova-Institute

14:00

Matthias Stratmann
nova-Institute (DE)
Advanced Recycling in LCA – The Status Quo

14:20

Edzard Scholten
BASF (DE)
Environmental and Health Aspects of ChemCycling: A Measurement Program

14:40 **Panel Discussion with all Session Speakers**

15:00 – 16:40

Main Session

Pyrolysis & Other Thermochemical Approaches (Part 2)

Grand Hall

Chairpersons: Lars Krause & Michael Carus, nova-Institute

15:00

Frank Riedewald
Composite Recycling (IE)
Lower OPEX and CAPEX Waste Plastic Chemical Recycling Facilities with Molten Metals

15:20

Jasper Munier
Clariter (LU)
You Don't Need Mass Balance When You Make High-Value, High-Purity Petrochemicals From 100% Recycled Plastic Waste

15:40

Geoff Smith
Itero Technologies (UK)
The Pyrolysis Perspective: Insights from Managing Waste Variability

16:00

Eric Appelman
Aduro Clean Technologies (CA)
Advancing Chemical Recycling Through Chemical Thinking and Chemolysis

16:20

Panel Discussion with all Session Speakers

16:40 Networking

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- Degassing, de-odourization, removal of contaminations, removal of color in the reactor etc.
- Opportunity to process high throughputs
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Pioneering Plastics

Valuable Quotes

Carolina Acosta Romero
AIMPLAS (ES)
"Reactive extrusion, a key tool for giving added value to your recycling new challenges."

David Sudolsky
Anellotech (US)
"Anellotech Update: Advanced development of unique, one-reactor Plas-TCat™ Process for direct production of light olefins and BTX from mixed plastic wastes."

Florian Riedl
APK (DE)
"Newcycling generates purified and decolorized LDPE recyclates in a quality level that enables the replacement of virgin LDPE in a wide range of flexible packaging applications."

Edzard Scholten
BASF (DE)
"Contributing to fact-based transparency on environmental and health aspects of ChemCycling®."

Jasper Munier
Clariter (LU)
"Today's plastic waste is tomorrow's gold - soon, it will be too valuable to burn or landfill."

Frank Riedewald
Composite Recycling (IE)
"Recycling of plastics and composite plastics with the molten metal reactor."

Stephan Renninger
Cyclize (DE)
"Transitioning to a circular economy of carbon will not only alleviate CO_2 emissions, but is also a significant step towards resource independence."

Dimitri Daniels
Der Grüne Punkt (DE)
"Mechanical and Chemical Recycling; two complementary routes to Achieve Circularity of Plastic Packaging."

Klaus Lederer
EREMA (AT)
"In order to support complementarity of chemical recycling and mechanical recycling, it is essential to enable chemical recyclers using lowest quality feedstocks for their processes by robust and energy-efficient raw material preparation."

Tobias Rieger
Fraunhofer Institute (DE)
"Securing the raw material base for the production of organic chemical products is strongly linked to the discovery and development of improved catalysts."

Fabio Silvestri
gr3n (CH)
"For several years, depolymerization was considered only as a research topic: with MADE, our Microwave-Assisted Depolymerization, we are moving towards the first industrial plant, while also looking for other licensees."

Frank Eisenträger
INEOS Styrolution (CH)
"This presentation will show why PS is the best recyclable polymer and which concrete projects implement PS recycling at industrial scale."

Geoff Smith
Itero Technologies (UK)
"We have been running our pilot facility for over two years, testing real-world waste in real-world conditions, constantly learning about the variability of waste feedstock. Using our experience and data, we'll explore how the variance in real-world waste works in the pyrolysis process and feedback on output products."

Lars Biermann
Krauss Maffei Extrusion (DE)
"Different routes for the chemical recycling of PET-containing post-consumer waste are presented and evaluated in terms of implementability in the PET industry."

Matthias Wilhelm
Lober (DE)
"The presentation provides an insight into the perspective of a waste disposal company for today's wastestreams and an outlook on the establishment of solvent based recycling for complex material flows."

Oliver Burek
Mura Technology (UK)
"In this presentation, Mura will introduce their HydroPRSTM Technology and explore the advantages of using Hydrothermal Liquefaction in plastic recycling."

Carlos Monreal
Plastic Energy (UK)
"Plastic Energy is working to transform the global plastic waste landscape through chemical recycling, by reducing the amount of plastics going to landfill and incineration, and decarbonising the plastics supply chain."

Beate Kummer
Polysecure (DE)
"New Sorting Technology for Fractions to Improve Advanced Recycling Output – For better qualities as input tot he chemical recycling processes we need good and defuined qualities, which can be reached by a sorting process developed by Polysecure."

Cecilia Hofmann
Re:Lab (FR)
"A comprehensive literature review comparing pyrolysis and gasification as prominent plastic waste recycling techniques for polyolefins and high-value chemical production."

Cecilia Mattsson
RISE (SE)
"Contaminated and complex polymer waste streams is hard to recycle with conventional technologies, can HTL/solvolysis be a recycling solution for removal of toxic additives?"

Stefan Schonauer
RWTH Aachen University (DE)
"Textile waste as a basis for microbially produced textile polymers."

Luis Hoffmann
Sulzer ChemTech (CH)
"Realizing the potential of advanced polymer recycling requires the creation of an entirely new value chain, which can only succeed through collective efforts in forging essential partnerships."

Trine Dabros
TOPSOE (DK)
"This presentation will address the efforts and main learnings from the preparation of the start-up of the first industrial PureStep™ reference unit."

Vladislav Jaso
TotalEnergies Corbion (NL)
"How do you integrate in the circular economy and lower your plastic carbon footprint by 70% ?"

Abidin Balan
Trinseo (NL)
"Dissolution technology as an approach to explore the potential of circularity."

Pangzheng Zhou
University of Wisconsin-Madison (US)
"Computation assisted dissolution-based plastic recycling."

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nova Market and Trend Reports on Renewable Carbon

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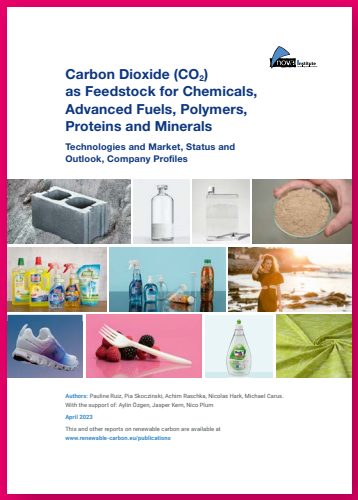

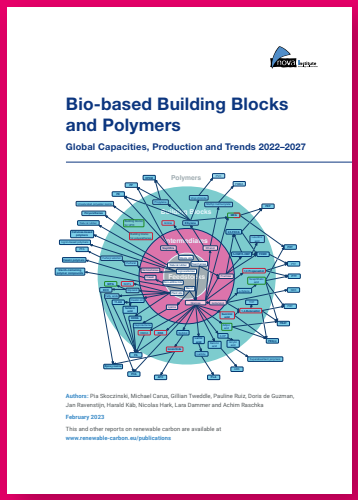

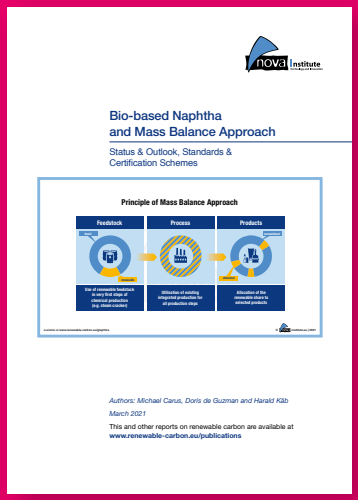

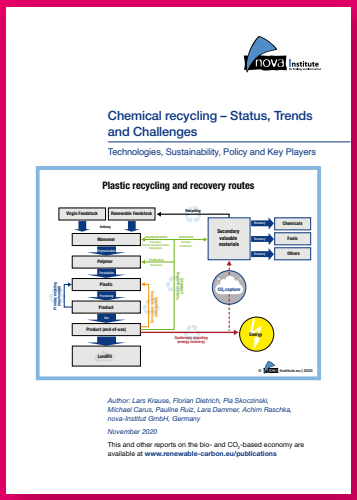

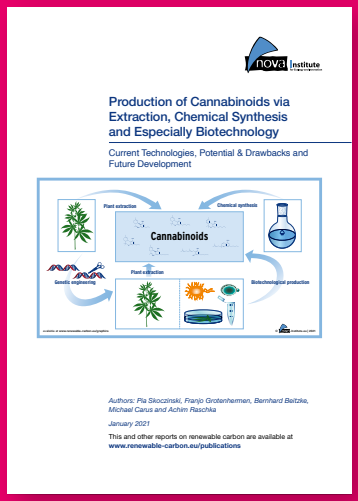

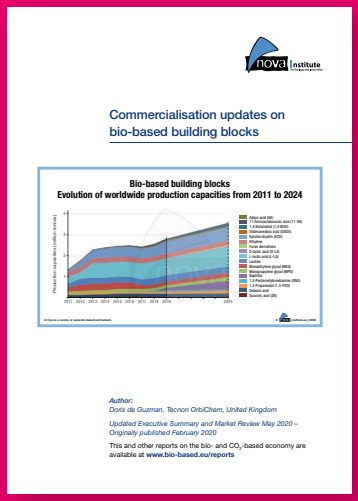

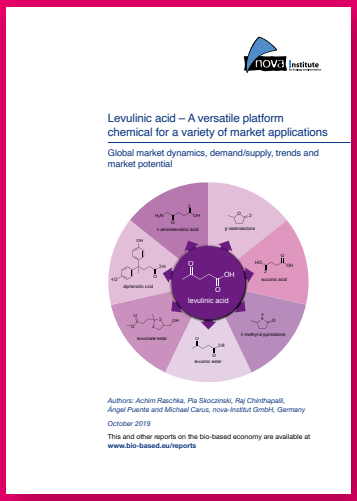

renewable-carbon.eu/publications

RENEWABLE CARBON PUBLICATIONS

nova Institute for Ecology and Innovation

RENEWABLE CARBON INITIATIVE

Bio-based CO_2-based Recycling

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 CO_2 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.

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

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

Executive Managers:
Christopher vom Berg & Michael Carus

Contact: Verena Roberts
verena.roberts@nova-institut.de

MEMBERS OF THE INITIATIVE

LARGE SUPPLIERS

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SME

avantium, Fibenol, FKuR, futerro, geno, LanzaTech*, nova, SCS global services, TCC

BRANDS

Beiersdorf, Henkel*, LEGO, reckitt, VAUDE

START-UPS

BioBTX, CHAINCRAFT, clariter, econic, Greenlyte Carbon Technologies, QORE, TripleW

RESEARCH INSTITUTES

IKT Kunststoff Technik Stuttgart, ITA RWTH Aachen University, Leibniz-Institut für Verbundwerkstoffe, NORCE

* Board Member

PARTNERS

CO_2 Value Europe, ECBF, ecp-news, EIHA, Global CO_2 Initiative University of Michigan, GO!PHA, IBB, Renewable Carbon Plastics Magazine, TextileExchange, WWF

ADMINISTRATIVE OFFICE

nova-Institute

- Initiator and scientific backbone
- Organisation, management and coordination of RCI

MEMBERS

Board

- Strategic direction
- Budget allocation
- Highly active
- Max. 20 members

General assembly

- 2–3 main representatives per member
- Identify / define priorities of RCI
- Decide on future projects

PARTNERS

- Support and promote each other
- Advise on specific topics

ACTIVITIES

- Advocacy
- Scientific background reports
- Position papers
- Networking

WORKING GROUPS - Involvement of all interested members

WG Labelling

- Development of a renewable carbon share (RCS) certificate and label

WG Policy

- Position papers
- Factsheets
- Stakeholder dialogues
- Public consultations of regulations

WG Recycling

- Chemical and mechanical recycling
- Position papers
- Strategic reports

WG Sustainability

- Deep understanding and harmonisation of sustainability assessment and reporting
- Position papers
- Strategic reports

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.

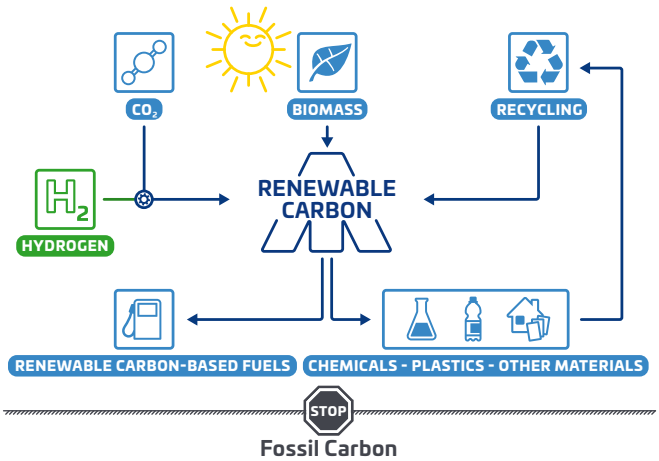
RCI addresses the core problem of climate change, which is extracting and using additional fossil carbon from the ground that will eventually end up in the atmosphere. Companies are encouraged to focus on phasing out fossil resources and to use renewable carbon instead.

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, CO_2 and recycling.

RENEWABLE CARBON



Save the Date

CELLULOSE FIBRES CONFERENCE 2024

13–14 March **2024**

cellulose-fibres.eu

CO_2-based Fuels and Chemicals Conference 2024

17–18 April **2024**

co2-chemistry.eu

RENEWABLE MATERIALS CONFERENCE 2024

11–13 June **2024**

renewable-materials.eu

ADVANCED RECYCLING Conference 2024

20–21 Nov **2024**

advanced-recycling.eu

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

- Market Research
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- Supply & Demand Analysis
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Stefanie Fulda (stefanie.fulda@nova-institut.de)

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- 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

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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. Multidisciplinary and international team of 45 scientists.

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23-11-21