Renewable Carbon Concept and Initiative

Webinar 10 March 2021

Christopher vom Berg (Sustainability Expert) and
Michael Carus (CEO)

Agenda

- **Welcome** and **brief introduction of nova-Institute**
- **First Block: Renewable Carbon and Renewable Carbon Initiative**
  - **The dilemma of fossil carbon**
  - **The renewable carbon concept**
  - **The Renewable Carbon Initiative**
- **Second Block: Member perspectives**

Some additional information

You can change your ZOOM name to your real name and company.

This makes it easier for us to moderate the discussion and allows you to network directly.

Feel free to ask questions any time

You can either use the ”raise hand” option or post your question in the Q&A function of ZOOM

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RENEWABLE CARBON

Bio-based CO_2-based Recycling

Circular Economy

nova-Institut GmbH – SME

private and independent research institute
interdisciplinary, international team

Technology & Markets

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

Sustainability

- Tailor-made Life Cycle Assessments
- Customised Carbon Footprint Calculation Tools
- Social Impact Assessment & Social Acceptance
- Comprehensive Sustainability Assessments
- Sustainability Integrated Technology Development (SUITED)
- Critical Reviews

Communication

- Comprehensive Communication & Dissemination in Research Projects
- Communication & Marketing Support
- Network of 60,000 Contacts to Companies, Associations & Institutes
- Targeted Newsletters for 17 Specialty Areas of the Industry
- Conferences, Workshops & nova Sessions
- In-depth B2C Research

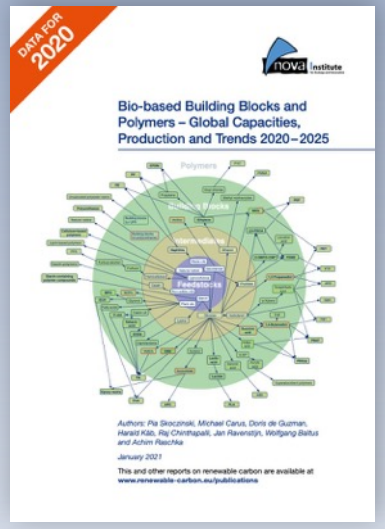
Economy & Policy

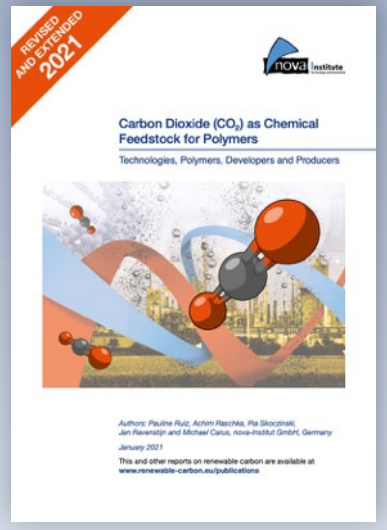
- Micro- and Macroeconomics
- Techno-Economic Evaluation (TEE) for Low & High TRL
- Target Price Analysis for Feedstock & Products
- Strategic Consulting for Industry, Policy & NGO's
- Political Framework, Measures & Instruments
- Standards, Certification & Labelling

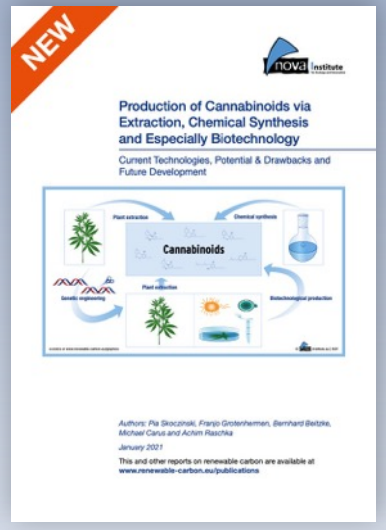
Selected Customers from all Industrial Sectors

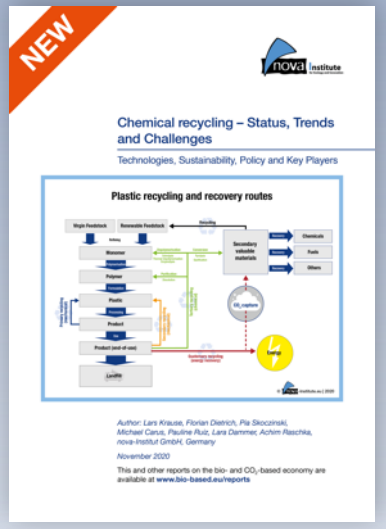
Selected Customers from Chemical Industry

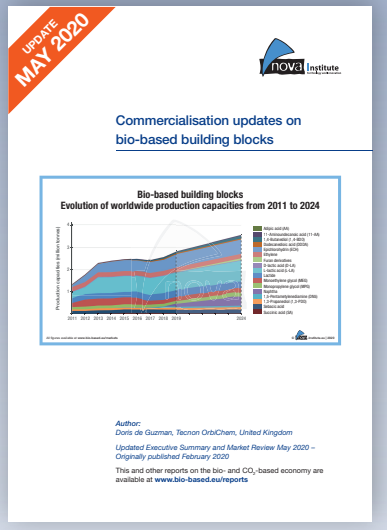
Bio-based Polymers & Building Blocks – the best market reports available

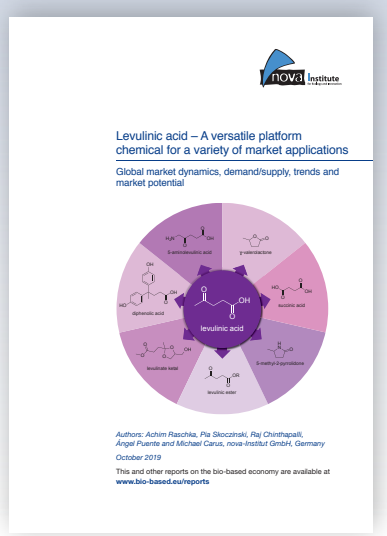


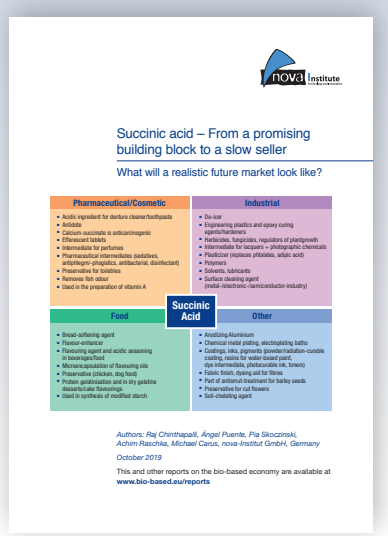


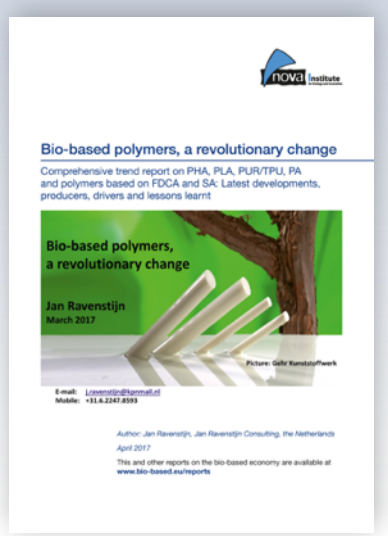


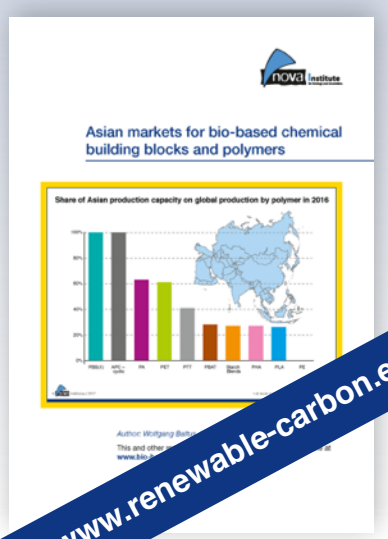












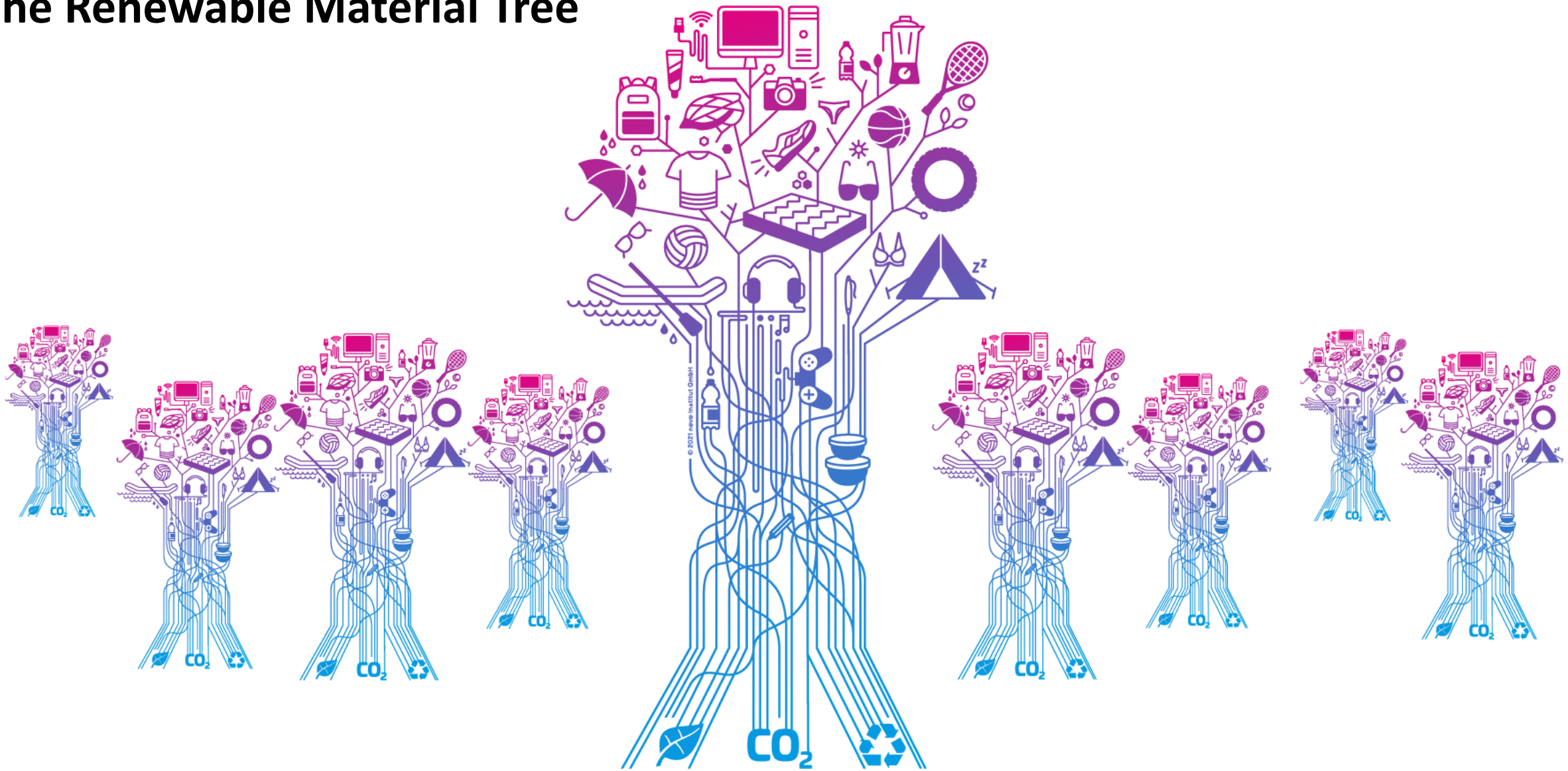
www.renewable-carbon.eu/publications

Save the Date

Contact: Mr. Dominik Vogt, +49 (0) 2233 48 14 49, Dominik.vogt@nova-institut.de

All conferences at www.bio-based.eu

The Renewable Material Tree



The dilemma of fossil carbon

Major threats and challenges to our planet are

- Climate change and
- Biodiversity loss

The main reasons for the biodiversity loss

- **Climate change**, alongside factors like land degradation and habitat loss, is emerging as a top threat to wildlife around the globe. https://www.scientificamerican.com/article/climate-change-is-becoming-a-top-threat-to-biodiversity/
- According to the Millennium Ecosystem Assessment, **climate change is likely to become one of the most significant drivers of biodiversity loss by the end of the century**. Climate change is already forcing biodiversity to adapt either through shifting habitat, changing life cycles, or the development of new physical traits. https://www.cbd.int/climate/intro.shtml
- By the end of the century, **climate change** and its impacts may be the **dominant direct driver of biodiversity loss** and changes in ecosystem services globally. https://www.greenfacts.org/en/biodiversity/l-3/4-causes-desertification.htm

Key greenhouse gases (GHG) emitted by human activities

- Carbon Dioxide (CO_2): 76%
- Methane (CH_4): 16%
- Nitrous oxide (N_2O): 6%
- Fluorinated gases (F-gases): 2%

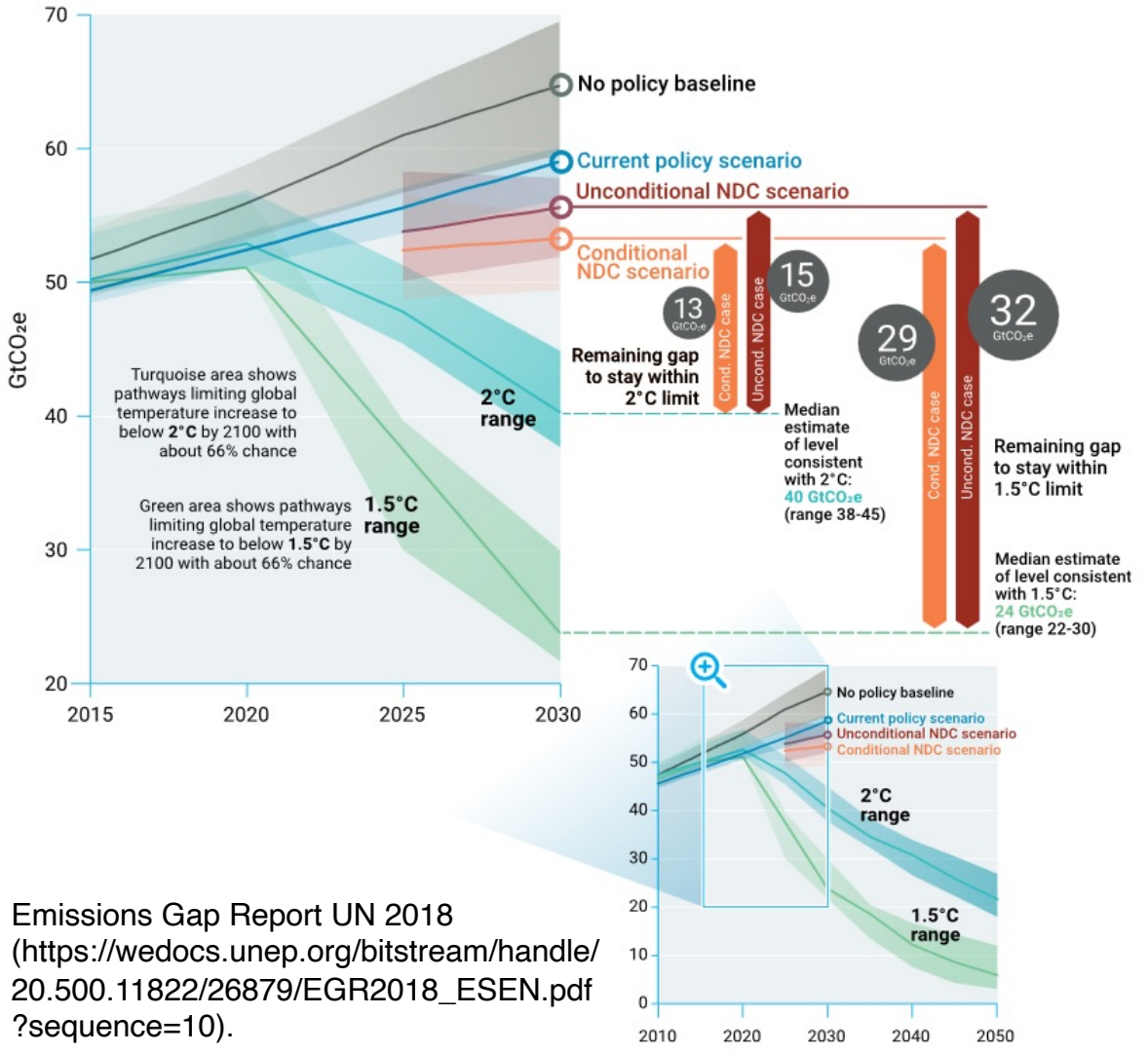
The percentages are given in relation to CO_2 equivalents in terms of global warming potential (GWP) (IPCC 2014)

- **About 94% of the GHG contain carbon.**
- **80 – 90% of the carbon containing GHG contain fossil carbon from the ground.**

The remaining carbon comes from forestry and agriculture and can be balanced by a sustainable circular bioeconomy, where the uptake and the release of carbon are the same, or by reforestation which could increase the uptake to even higher levels than the release.

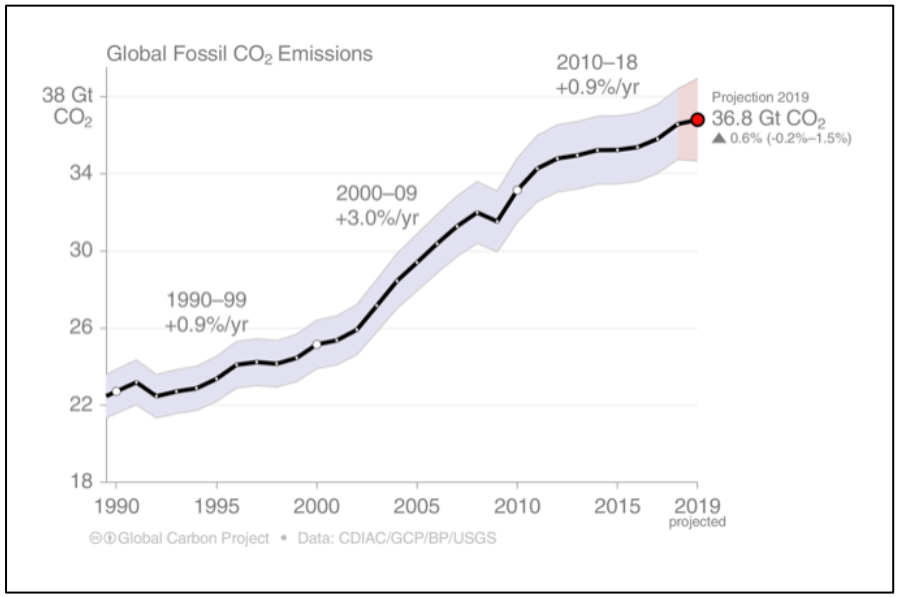
As long as the existing carbon-containing GHG are kept in a circle, there is no damage done to the climate. The use of additional fossil carbon, however, is clearly the main cause of the greenhouse effect. The solution here can only be to take the problem by the roots and stop bringing more fossil carbon into circulation.

Figure ES.3: Global greenhouse gas emissions under different scenarios and the emissions gap in 2030 (median estimate and tenth to ninetieth percentile range)



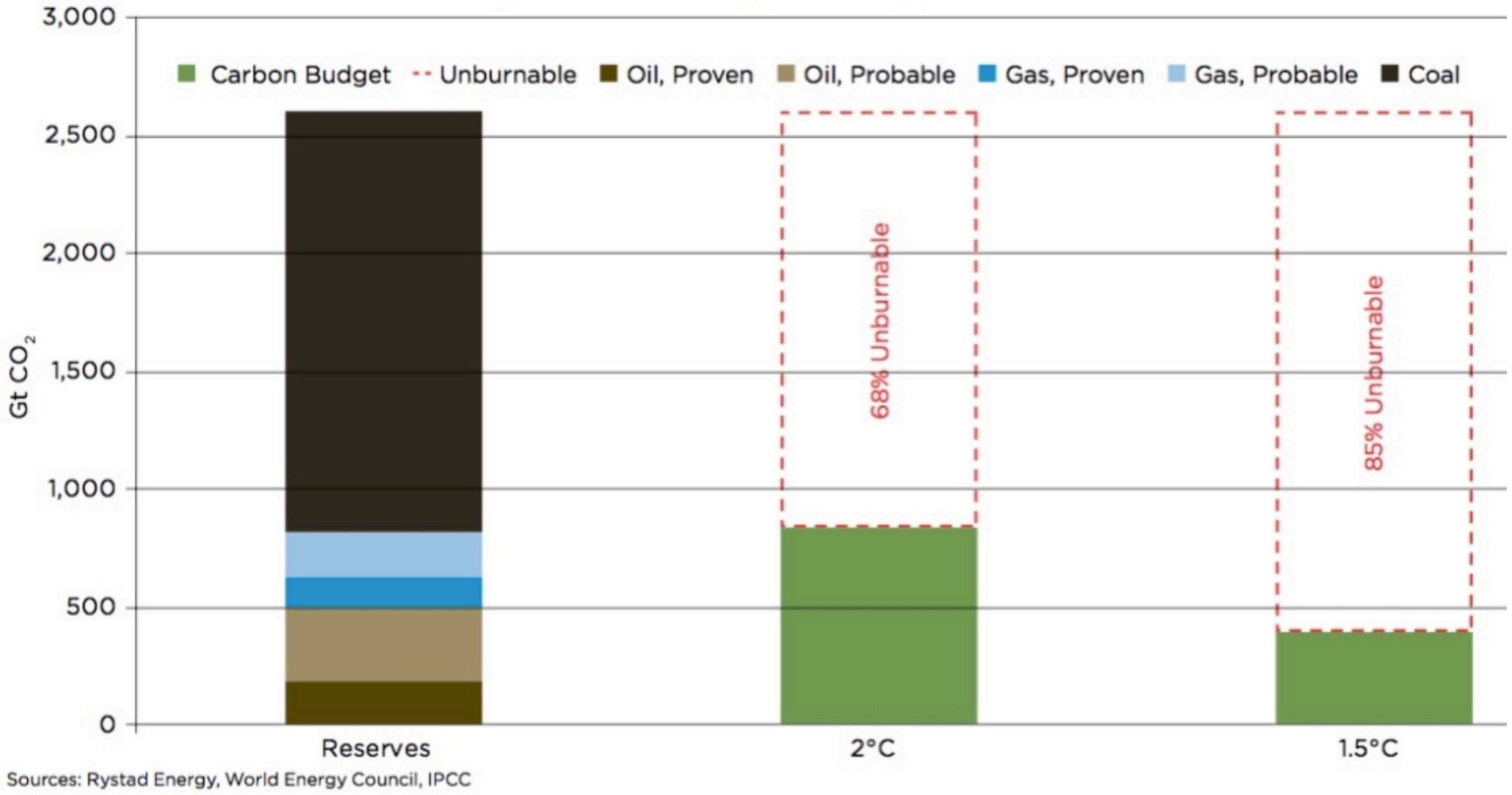
Emissions Gap Report UN 2018 (https://wedocs.unep.org/bitstream/handle/20.500.11822/26879/EGR2018_ESEN.pdf?sequence=10).

- GWP in 2019: 55 Gt CO_2e
- In 2030 (1.5 Grad C range): about 24 Gt CO_2e are allowed (left)
- All time record: 36.8 Gt fossil CO_2 emissions in 2019 (below)



STOP Fossil Carbon Use

Figure 2: Global Fossil Fuel Reserves Compared to Carbon Budgets for Likely Chance of 2°C and Medium Chance of 1.5°C[28]



Source: Oil Change International, 16-09

- Globally, **a third of oil**, **half of gas** and **over 80 per cent of coal reserves** should remain unused in order to meet the target of 2°C.
  (McGlade & Ekins 2015)
- All of the **fossil carbon extracted from the ground** will sooner or later be **released into the atmosphere**
- Only a **full phase-out of fossil carbon** will help prevent a further increase in CO_2 concentrations.

STOP Fossil Carbon Use

„It is not CO_2 that is at the core of the climate problem, but the additional fossil carbon that we take out of the ground and which gets released in the atmosphere as CO_2 or other emissions. If the inflow is prevented, the CO_2 content of the atmosphere will no longer increase.“

Michael Carus, May 2020

“Renewable Energy”
Decarbonisation of the Energy Sector

There is a clear and more or less consistent Energy Policy to a 100% renewable energy system based on **solar, wind, hydro** and other renewable energies.

Apart from bioenergy, bio- and CO_2-based fuels, all of these deserve the term **“decarbonisation”**.

Green electricity and **green hydrogen** for the **energy** and **fuel sector**.

Chemical and material industry?

There is no corresponding policy or strategy for the material sector, especially for the chemical and plastic industry.

The term **decarbonisation** is simply **inaccurate** for organic chemistry, which is based on carbon. It is used out of lack of knowledge and as a direct analogue to the energy sector, but absolutely not applicable to the chemical, plastics or biomass sectors.

The term is not only inaccurate, but also potentially harmful because it avoids the **question of the "right" carbon sources.**

And this is exactly what we have to provide. We need a future oriented renewable carbon strategy. And there are only three sources of renewable carbon.

Chemical Industry and Climate Change

Global Efficiency Intelligence 2018: The global chemical industry is responsible for approx. **7% of the global anthropogenic GHG emissions** or around 20% of industrial GHG emissions.

Source: www.globalefficiencyintel.com/new-blog/2018/chemical-industrys-energy-use-emissions?rq=Chemical%20Industry

This share of 7% could rise to 15% in 2030 and **25% in 2050**.

IEA 2020: Petrochemical feedstock accounts for 12% of global oil demand, a share that is expected to increase driven by increasing demand for plastics, fertilisers, detergents and other products.
Petrochemicals are rapidly becoming the **largest driver of global oil demand**. The growth in demand for petrochemical products means that petrochemicals are set to account for over a third of the growth in oil demand to 2030, and **nearly half to 2050**, ahead of trucks, aviation and shipping.

Why?

- Higher CAGR for chemistry (7%) compared to energy (1-2%) in the next decades
- Ongoing decarbonisation of the energy sector

The chemical industry could become one of the main GHG emitter in the future.

European Green Deal

- European Commission president **Ursula von der Leyen,** presented the European Green Deal in December 2019
  - Roadmap for making the EU's economy more sustainable

- 16 September 2020: **European Green Deal – reducing emissions by at least 55% by 2030**
  - The President revealed that the European Commission is proposing **to increase the 2030 target for emissions reduction from 40% to at least 55%.** This will put the EU on track for climate neutrality by 2050 and for meeting its Paris Agreement obligations.

Source: https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1657

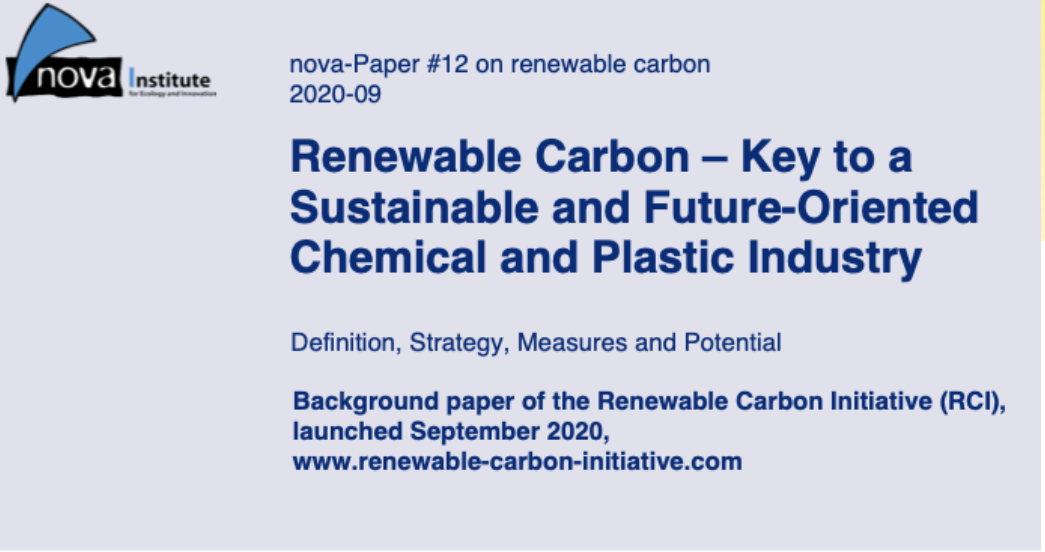
The Renewable Carbon Concept

Renewable Carbon is the Key to a Sustainable and Future-Oriented Chemical and Plastic Industry

Renewable Carbon is the Key

Key points of the renewable carbon concept

- **80% from the GHG** emissions are directly related to **additional fossil carbon from the ground**.
- **Decarbonisation** with renewable energies is a **good strategy for the energy sector**, but no issue for chemicals and materials, because most of them are based on carbon (just like humans ☺).
- There is a **lasting need for carbon** for chemicals and materials. All fossil carbon use has to end, as the carbon contained in the molecules of chemicals and plastics is prone to end up in the atmosphere sooner or later. **Only a full phase-out of fossil carbon will help to prevent a further increase in CO_2 concentrations**.
- The key challenge is to **replace demand** for fossil carbon by alternative carbon sources.
- The **equivalent to decarbonisation** in the energy sector is a transition to **renewable carbon** in the chemical and material industries.
- Those alternative carbon sources are **biomass**, **CO_2** and **recycling** of carbon containing waste streams (bio and plastic waste).
- We call them “**renewable carbon**”.



nova-Paper #12 on renewable carbon
2020-09

Renewable Carbon – Key to a Sustainable and Future-Oriented Chemical and Plastic Industry

Definition, Strategy, Measures and Potential

Background paper of the Renewable Carbon Initiative (RCI), launched September 2020, www.renewable-carbon-initiative.com

RENEWABLE CARBON

www.renewable-carbon.eu

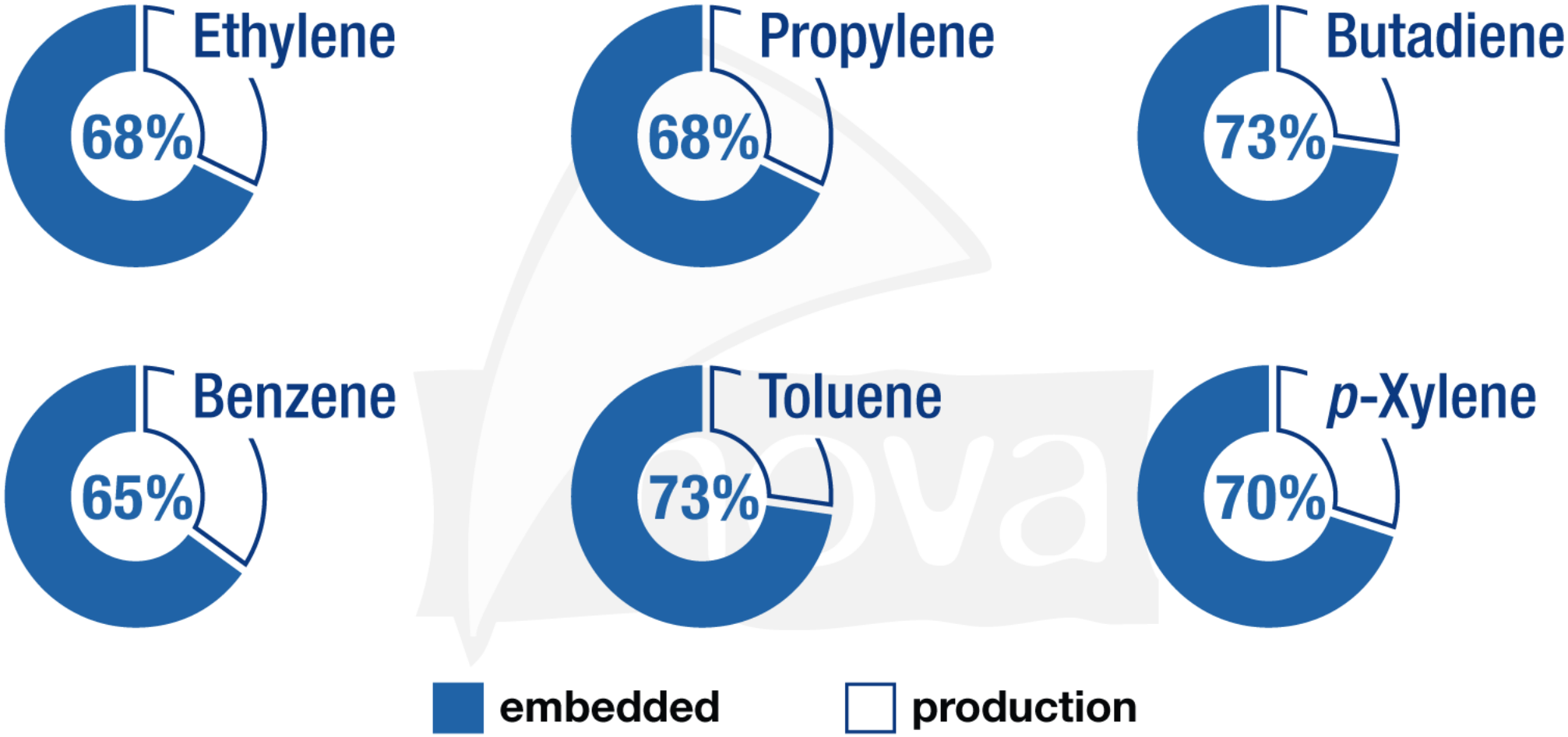
Authors: Michael Carus, Lara Dammer, Achim Raschka, Pia Skoczinski and Christopher vom Berg
nova-Institute, Hürth (Germany)

nova-Papers are proposals to stimulate the discussion on current topics of the renewable carbon economy, by creating new perceptions based on scientific facts and by inviting relevant stakeholders to participate in decision-making processes and debates.

This paper is the background paper of the “Renewable Carbon Initiative (RCI)”, which was published in September 2020.

Free download: www.renewable-carbon.eu/publications

The invisible carbon footprint



All figures available at **www.bio-based.eu/markets**

Ethylene, propylene, butadiene – Calculations by nova-Institute
Benzene, toluene, *p*-xylene – Source: BioBTX

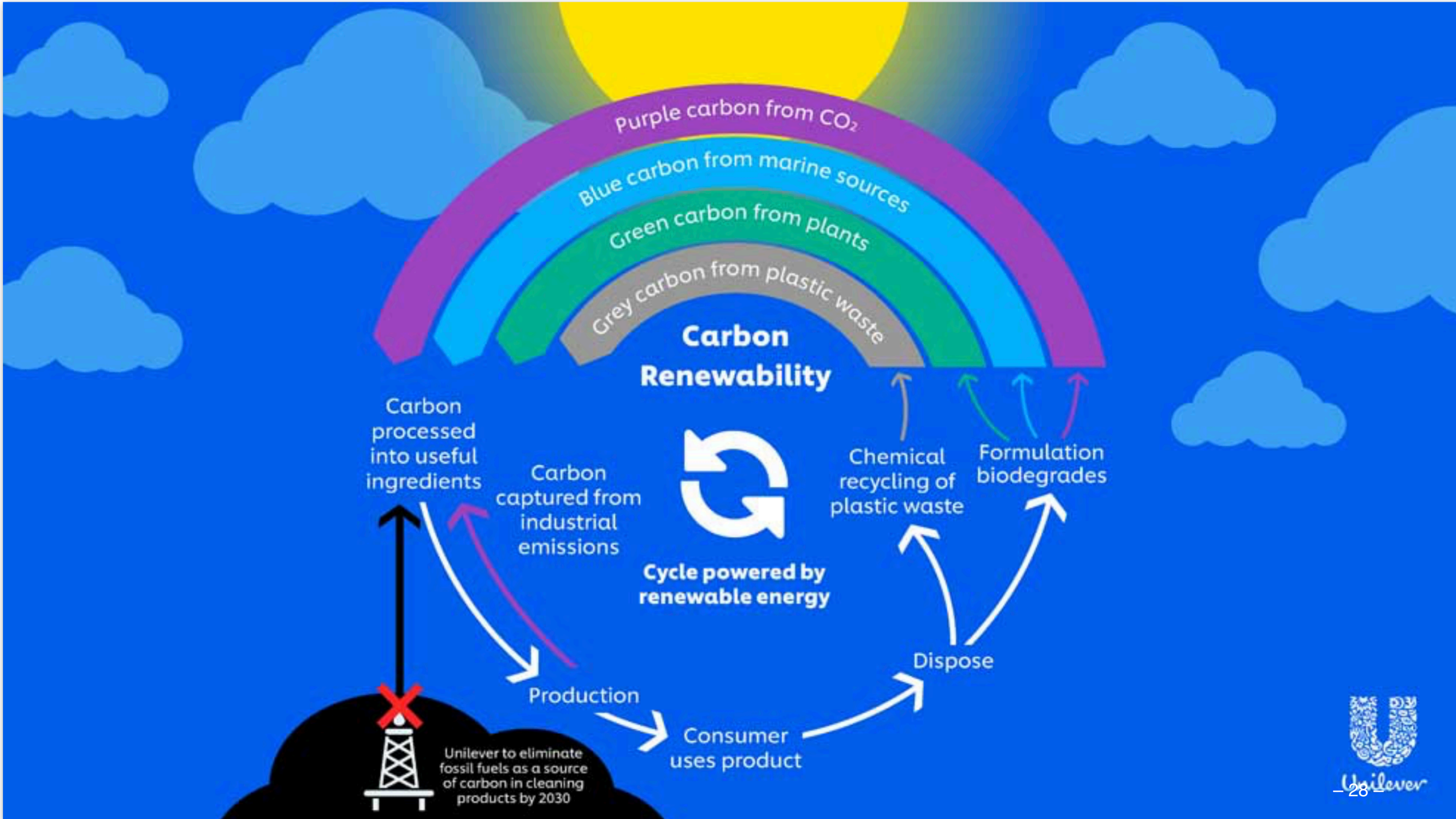
RENEWABLE CARBON

entails all carbon sources that avoid or substitute the use of any additional fossil carbon from the geosphere.

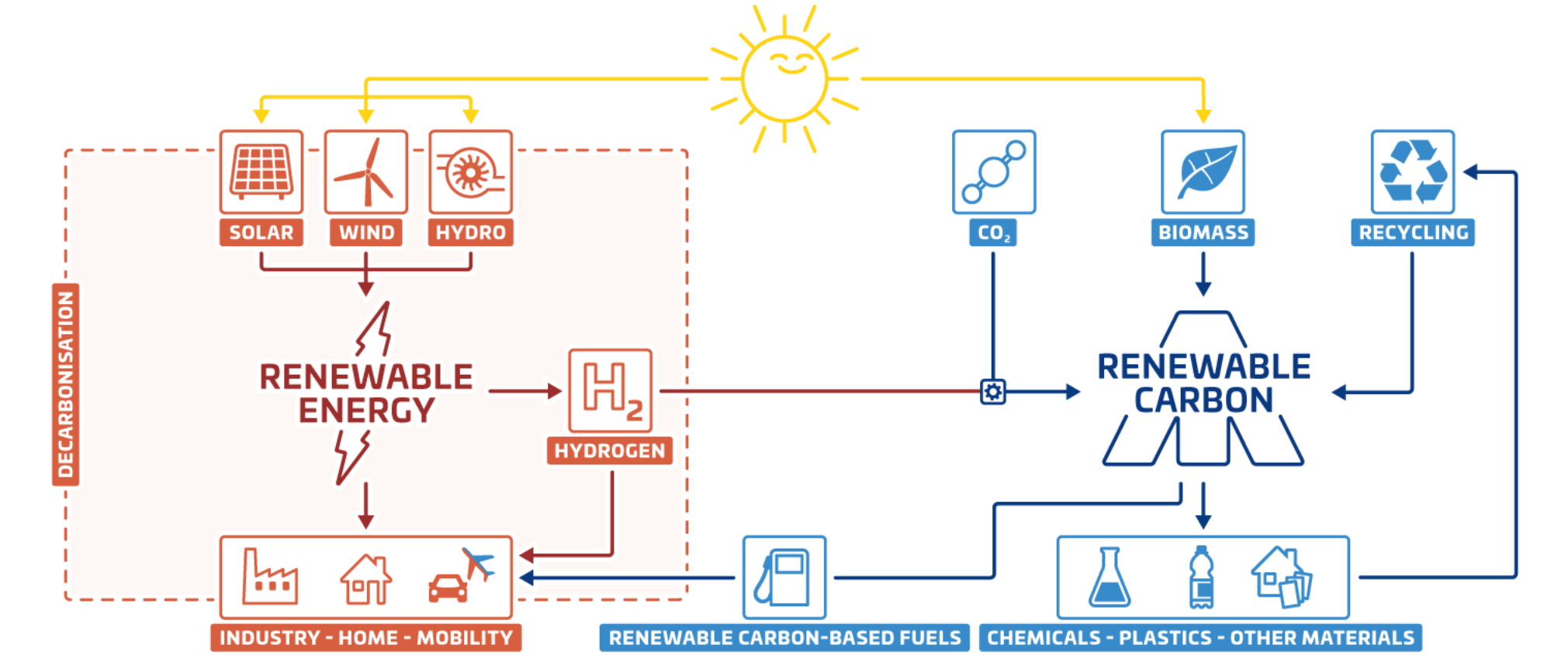
Renewable carbon can come from the atmosphere, biosphere or technosphere – but not from the geosphere. Renewable carbon circulates between biosphere, atmosphere or technosphere, creating a carbon circular economy.

Fossil carbon shall be completely substituted by renewable carbon, which is carbon from alternative sources: biomass, CO_2 and recycling. This is the only way for chemicals and plastics to become sustainable, climate-friendly and part of the circular economy – part of the future!

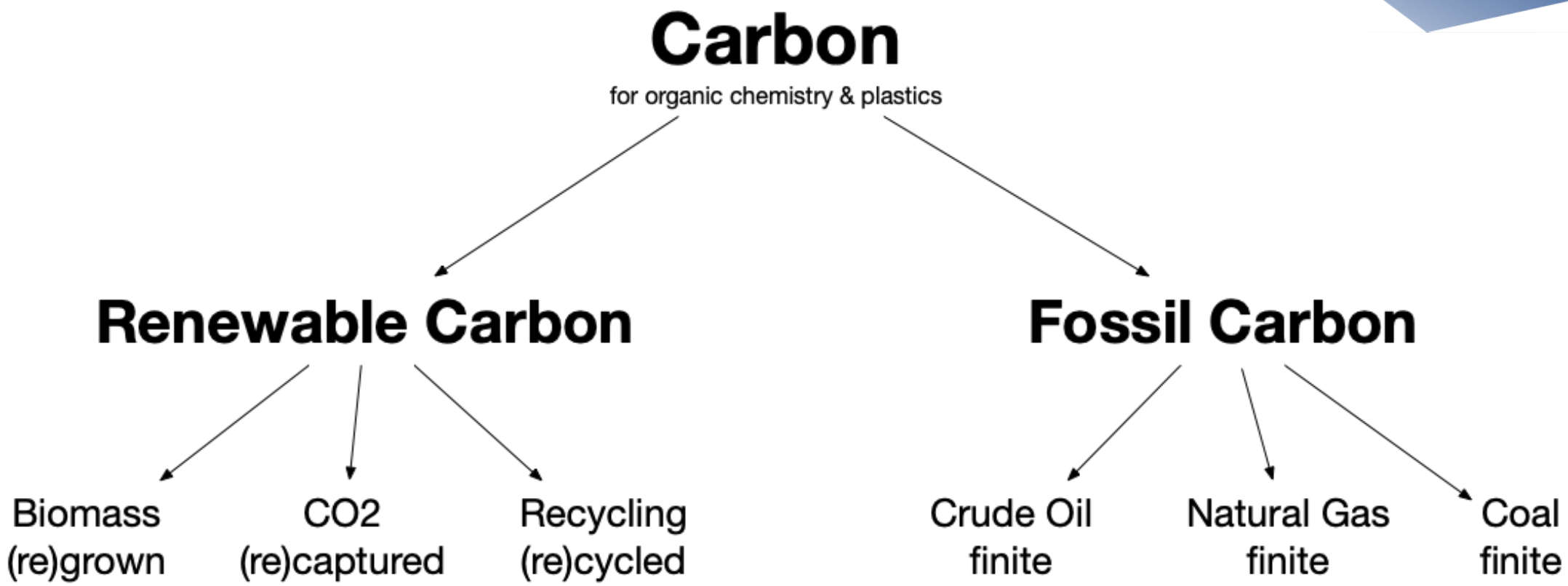
#renewablecarbon


Purple carbon from CO_2
Blue carbon from marine sources
Green carbon from plants
Grey carbon from plastic waste
Carbon Renewability
Carbon processed into useful ingredients
Carbon captured from industrial emissions
Cycle powered by renewable energy
Chemical recycling of plastic waste
Formulation biodegrades
Production
Consumer uses product
Dispose
Unilever to eliminate fossil fuels as a source of carbon in cleaning products by 2030
Unilever

Renewable Energy and Renewable Carbon for a Sustainable Future



All figures available at **www.bio-based.eu/graphics**

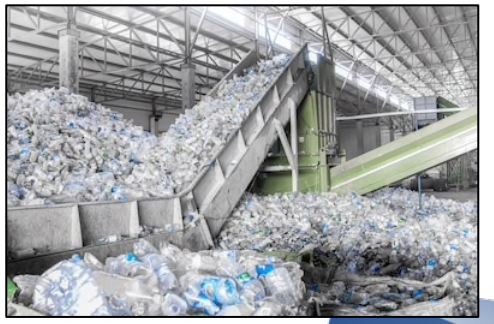

Carbon
for organic chemistry & plastics
Renewable Carbon
Fossil Carbon
Biomass
(re)grown
CO2
(re)captured
Recycling
(re)cycled
Crude Oil
finite
Natural Gas
finite
Coal
finite

The Renewable Carbon Family
the three sources of renewable carbon

- Renewable carbon gained from all types of **biomass** (first and second generation, side stream, biowaste), from the *Biosphere*

- Renewable carbon from **direct CO_2 utilisation**, from the *Technosphere* and *Atmosphere*

- Renewable carbon from mechanical and chemical **recycling** of already existing plastics and other organic chemistry products, from the *Technosphere*



Summer survey 2020 by nova and COWI

First survey on the existing of renewable carbon in the chemical industry and sent a questionnaire to the 50 largest chemical companies producing in Europe. About 20% of the companies returned the completed questionnaire. **"What is the share of the different carbon sources in the total carbon use in your European production?"**

The results of the survey clustered chemical companies by their branch and share of renewable carbon into the following four groups:

- **Traditional petrochemical companies show renewable carbon shares of 1-5%**
- **Several wood-based chemical companies show renewable shares of 80-90%**
- **In between is a group of mainly chemical companies with a traditional focus on plant oils and animal fats showing 40-50% renewable carbon shares**
- **Notably, a small number of petrochemical companies, which had renewable carbon shares of <1% in the past, already developed to shares around 20%**

Currently, the largest share of renewable carbon is provided via **biomass** from agriculture and forestry, but **recycling** shares are increasing and the **utilisation of CO_2** begins in a serious way. Most of the chemical companies have already or are currently developing concepts and strategies to increase the share of renewable carbon.

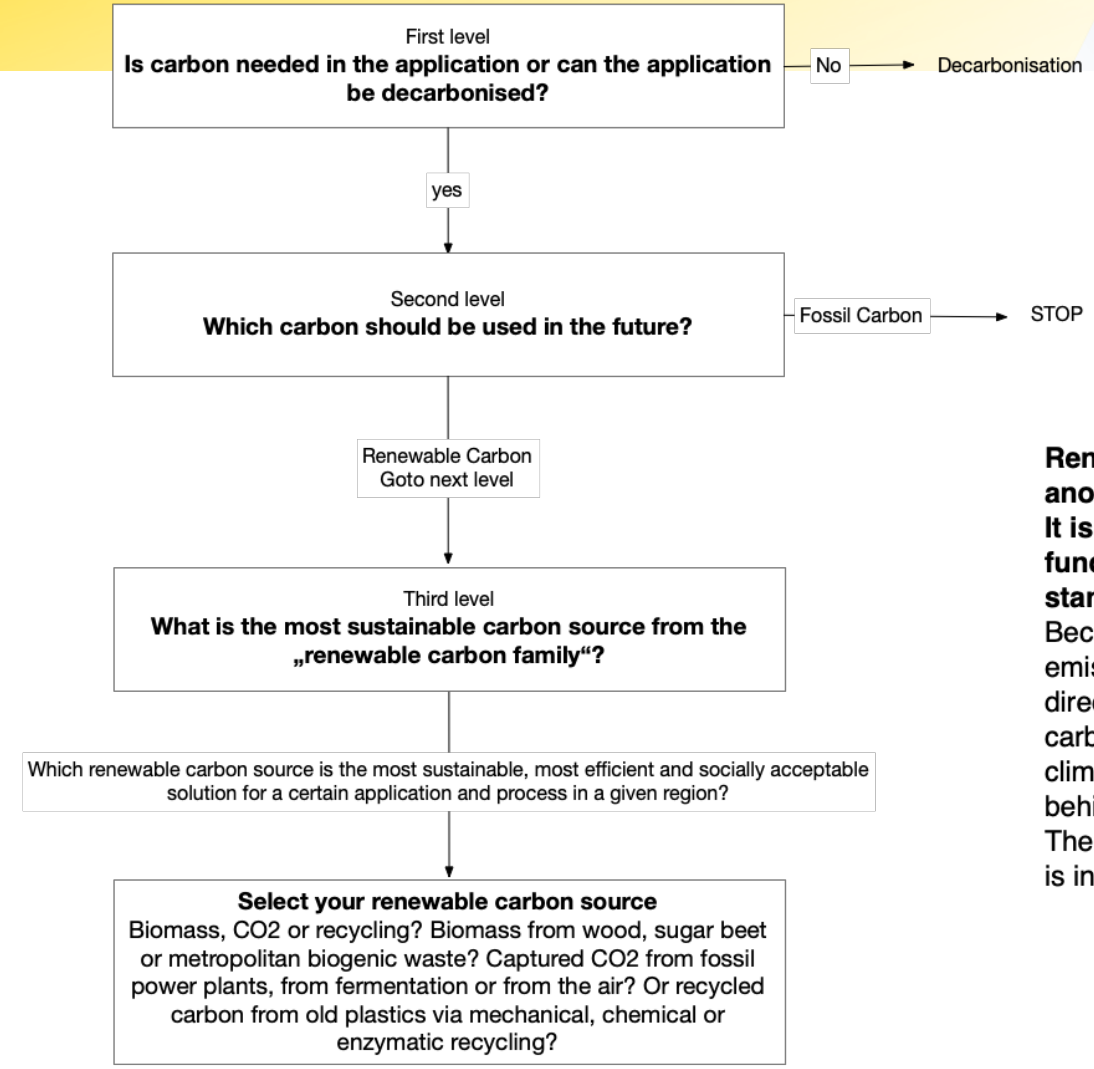
nova-Institute and COWI estimate that the **current average renewable carbon share in the European chemical and plastic industry lies between 20 and 25% – 15% from biomass and 5-10% from recycling**.

Strategy in detail

- All three carbon sources are essential for a complete transition to renewable carbon, and
- all of them should be similarly used by the industry and supported by politics.
- **Don't fight a brother war!** There'd only be one winner: Fossil carbon.
- **Share to win!**
- To replace all the additional fossil carbon, we need the smartest mix of all three.
- We need a future materials policy – a policy on renewable carbon.
- **Which of the renewable carbon options come into play should be decided by technology and market forces and not by politics**. This depends on regional factors and concrete applications.

Sustainability in the renewable Carbon concept

A three-level approach to sustainable materials

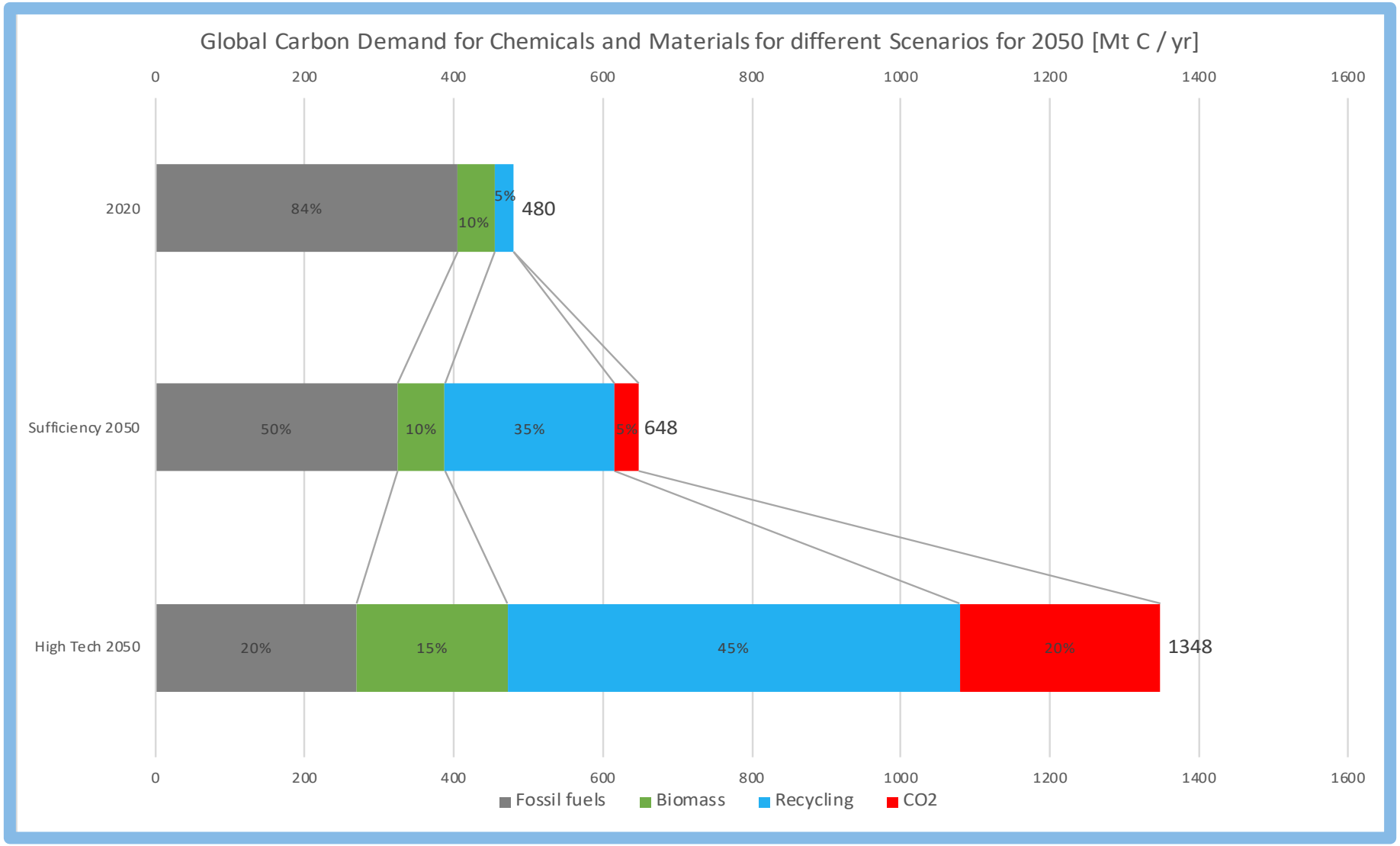


Different sustainability metrics including GHG emissions, energy consumption, eutrophication, land use, biodiversity, food security, small holder income, toxic emissions and many more.
Specific sustainability certification systems for bio-based, CO2-based and recycling, and also some overarching for all renewable carbon sources.

Renewable carbon is not just another sustainability indicator. It is the overarching, fundamental indicator that stands above the others. Why?
Because 80% of greenhouse gas emissions and climate change are directly linked to additional fossil carbon from the ground. And climate change is the driving force behind biodiversity loss.
The renunciation of fossil carbon is indispensable.

World Carbon demand of the Chemical and Plastic Industry 2015-2020, and shares of fossil, bio-based and recycled carbon

Scenarios for Global Demand of Embedded Carbon for chemicals and materials in 2050



Renewable Carbon is the key

The **chemical and plastics industry** may only develop into a sustainable sector once it bids farewell to fossil raw materials such as crude oil, natural gas and coal for good and **uses nothing but renewable carbon as a raw material in organic chemistry**.

The **equivalent to decarbonisation in the energy sector** is a transition to **renewable carbon in the chemical, plastics and fibre industries**.

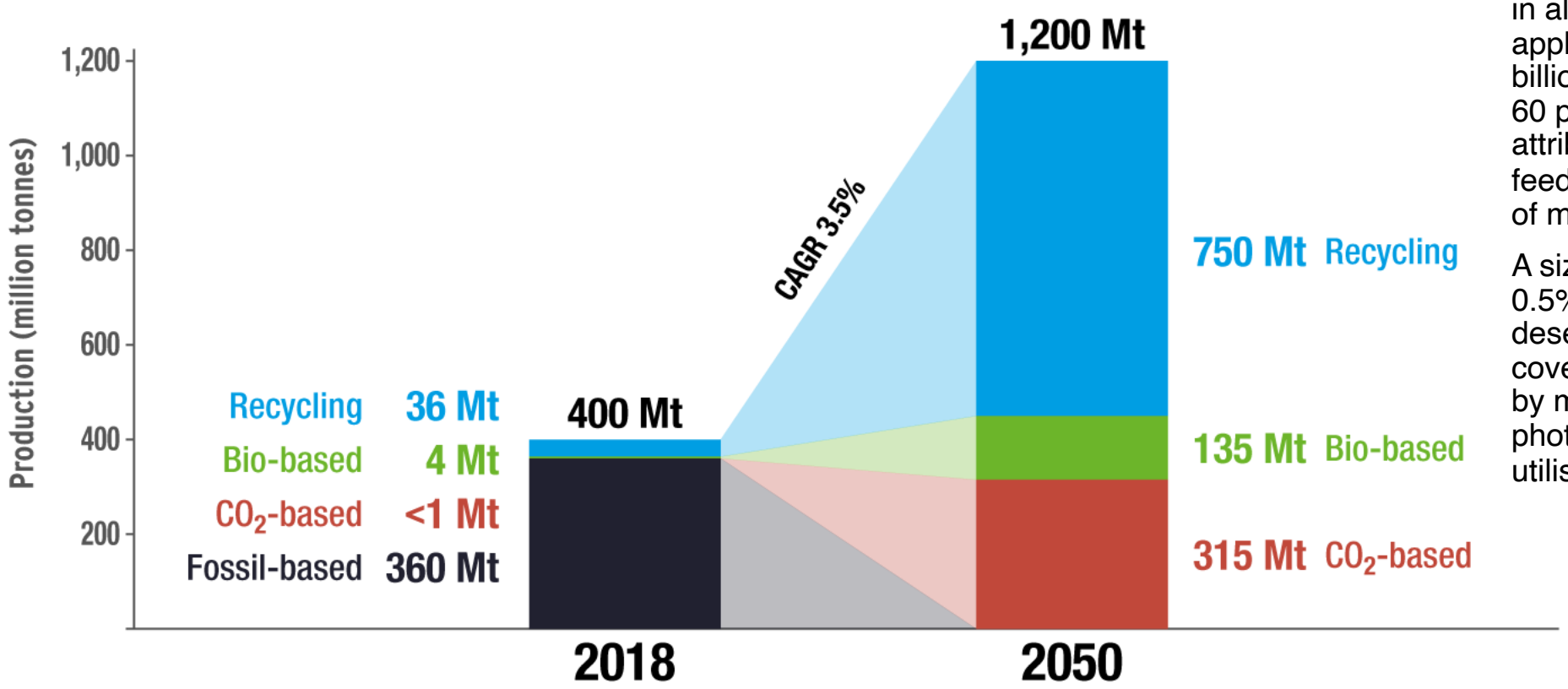
For the first time since the industrial revolution, technology allows us to **decouple the chemical, plastics, fibre and other material industries from the use of fossil carbon**.

Plastic production today (world)

We need all alternatives!

	Fossil-Based Plastics	Bio-Based Plastics	Recycled Plastics	CO_2-based Plastics
Production in 2020	360 – 380 Million tonnes	4 Million tonnes	20 – 40 Million tonnes	850,000 tonnes
CAGR 2020-2025	3 – 4%	8%	10%	>10%

World Plastic Production and Carbon Feedstock in 2018 and Scenario for 2050 (in Million Tonnes)



The virgin plastic production of 364 Million t in 2018 will increase to 450 Million t in 2050, completely based on renewable carbon. The total demand for plastics of 1,200 Million t in 2050 will be mainly covered by recycling.

The total of biomass required to do so would amount to roughly 1% of biomass currently used around the globe in all fields of application (13 – 14 billion tonnes, of which 60 per cent alone are attributable to animal feed for the production of milk and meat).

A size of less than 0.5% of the Sahara desert would suffice to cover this 70 per cent by means of photovoltaics and CO_2 utilisation.

available at **www.renewable-carbon.eu/graphics**

Renewable Carbon from Biomass

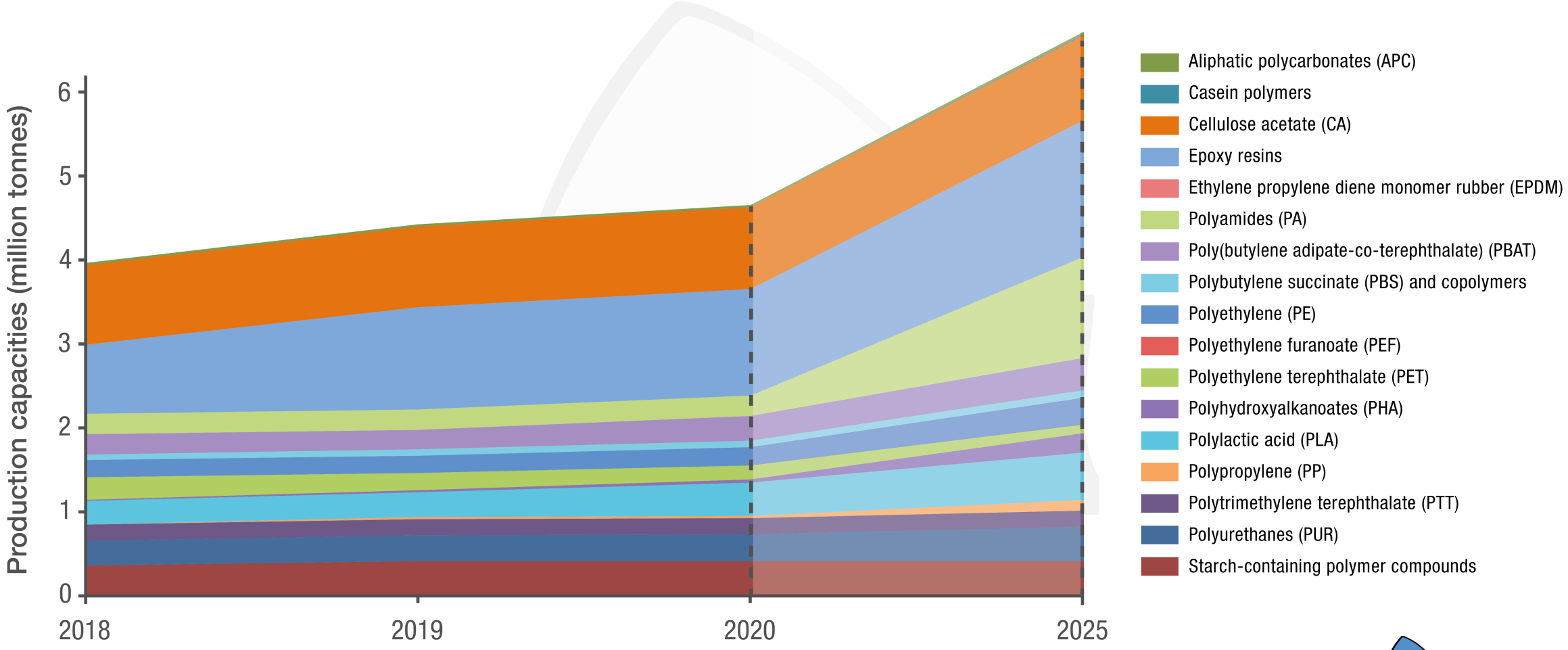
Pros in a nutshell

- Food crops:
  - Commodities, established in high volume, good logistics
  - Food crops: Protein-rich by-products
- Wide range of non-food feedstocks – no direct food competition, positive image
  - wood and lignocellulosic by-products and side streams
  - biogenic waste from industry and households
- Low GHG footprint compared with fossil resources
- New green chemical pathways
- Biotechnology as sustainable process technology

Cons in a nutshell

- Limited total volume
- Low land-efficiency
- Potential pressure on land and biodiversity
- Potential competition with food crops and a possible threat to food security

Bio-based polymers
Evolution of worldwide production capacities from 2018 to 2025



available at **www.renewable-carbon.eu/graphics**

What does this mean for textile fibres?

- **Natural fibres** (cotton, bast fibres, wool …)
- **Cellulose fibres** (from woody and agricultural biomass)
- **Bio-based polymers** (sugar, starch, plant oil, lignocellulose)
- **CO_2-based polymers**, for example PU fibres from CO_2
- **Mechanical and chemical recycled fibres** (natural fibres, cellulose fibres, fossil- and bio-based polymers)
- **Cellulose fibres** from alternative feedstocks (waste streams)

High growth areas

- Fine Chemicals CAGR 5-10 %: body care, detergents, cosmetics, pharma
- Bio-based building blocks CAGR 11 %
- Bio-based polymers CAGR 8 % (far above fossil-based with 3–4 %)
- Bio-based Naphtha, high demand
- ... also there is no political support (except R&D), but barriers (SUPD)
- but demand from the brands! (see Renewable Carbon Initiative)

Renewable Carbon from CO_2

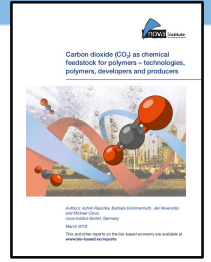
Pros in a nutshell

- Very high potential in volume (almost unlimited)
- Low demand for land and water, low carbon footprint
- High TRL technologies available
- Almost all chemicals and plastics can be produced from CO_2
- High employment potential
- Inexhaustible source of carbon for the next millennia
- Even “black” CO_2 carbon utilisation lead to relevant GHG reduction (see next slide)

Cons in a nutshell

- Potential lock in effects using fossil point sources
- Competition on limited renewable electricity
- High investment necessary

Ways to Use CO_2 for Polymers



Renewable Energy

- several educts
- epoxides: propylene oxide, ethylene oxide, limonene-based epoxide; alcohol: glycerol, others
- olefins: ethylene
- CO_2
- H_2

Chemo-catalytic reaction → different intermediates → polyesters, polyureas, non-isocyanate polyurethanes (NIPU), others

Chemo-catalytic reaction → cyclic/acyclic carbonates: glycerol carbonate, others → aliphatic polycarbonates or polyalkylene carbonates (PAC): polypropylene carbonate (PPC), polyethylene carbonate (PEC); cycloaliphatic polycarbonates: polylimonene carbonate; aromatic polycarbonates

Chemo-catalytic reaction → bisphenol A → aromatic polycarbonates

Chemo-catalytic reaction → isocyanates → polyurethanes (PUR), others

Chemo-catalytic reaction → polyols → polyurethanes (PUR), others

Chemo-catalytic reaction → acrylates → polyacrylates

Syngas production → Fischer-Tropsch → naphtha → polyolefins, others

Methanol production → MTO → olefins: ethylene, propylene → polyolefins

Gas fermentation, Electrofermentation, Two-step hybrid process → lactic acid, succinic acid, adipic acid → polyhydroxyalkanoates (PHA); polylactic acid (PLA), polybutylene succinate (PBS(X))

Gas fermentation, Electrofermentation, Two-step hybrid process → ethanol, butanol, isobutanol, others → polyethylene terephthalate (PET), polyethylene furanoate (PEF), polyethylene (PE), others

Electrochemistry → monoethylene glycol (MEG), ethylene, others → polyethylene terephthalate (PET), polyethylene furanoate (PEF), polyethylene (PE), others

available at **www.renewable-carbon.eu/graphics**

Chemical conversion

Biotechnological conversion

The plastic bottle is the first to use recycled carbon emissions

Beauty giant L'Oréal, carbon recycling company LanzaTech and broad energy company Total have joined forces to unveil a cosmetic plastic bottle made from recycled industrial carbon emissions.

The sustainable packaging — the first of its kind — demonstrates the commitment of the three partners to circular economy practices.

The plastic is made in three steps. First, LanzaTech captures industrial carbon emissions and converts them into ethanol through a complex biological process.

Second, Total uses an innovative dehydration process, developed in partnership with IFP Axens, to convert the ethanol into ethylene and polymerise it into polyethylene. The polyethylene has the same technical characteristic as its fossil fuel counterpart. L'Oréal then uses the polyethylene to produce the plastic bottle packaging.

L'Oréal, LanzaTech and Total are now exploring options to scale up production of the new sustainable plastic material. The partners hope that other companies will join them in adopting the innovative sustainable packaging into their supply chains.

Non-energetic demand from the Chemical Industry

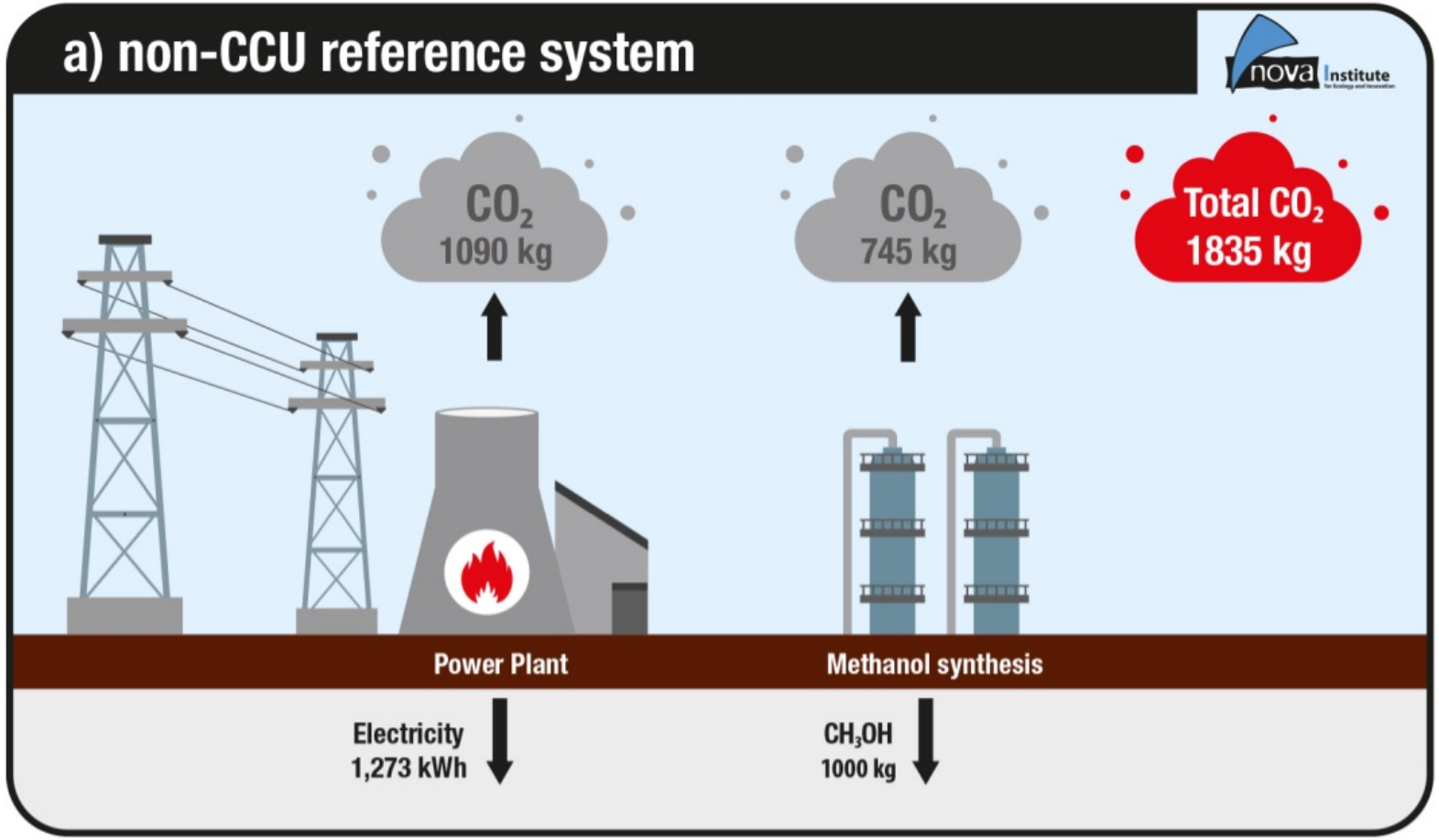
Our calculation shows that a range of 15 to 20 PWh would be required to cover the entire carbon demand of the chemical industry today by CO_2 utilisation with renewable energy, depending on the efficiency of electrolysis and further processes. **For the production of 20 PWh solar power, only 0.9% of the Sahara region is needed for PV**.

The PV yield in the Sahara is typically about 250 GWh/km²/y (Breyer 2019, LUT University). That means: To produce 20 PWh from PV an area of 80,000 km² is needed. Compared to the total area of the Sahara of 9,200,000 km² this is only 0.9% of the Sahara region.

The energy won from this area could cover the global non-energetic carbon demand of the chemical and plastics industry as it was in 2018 when applying it to carbon capture and utilisation (CCU) processes.

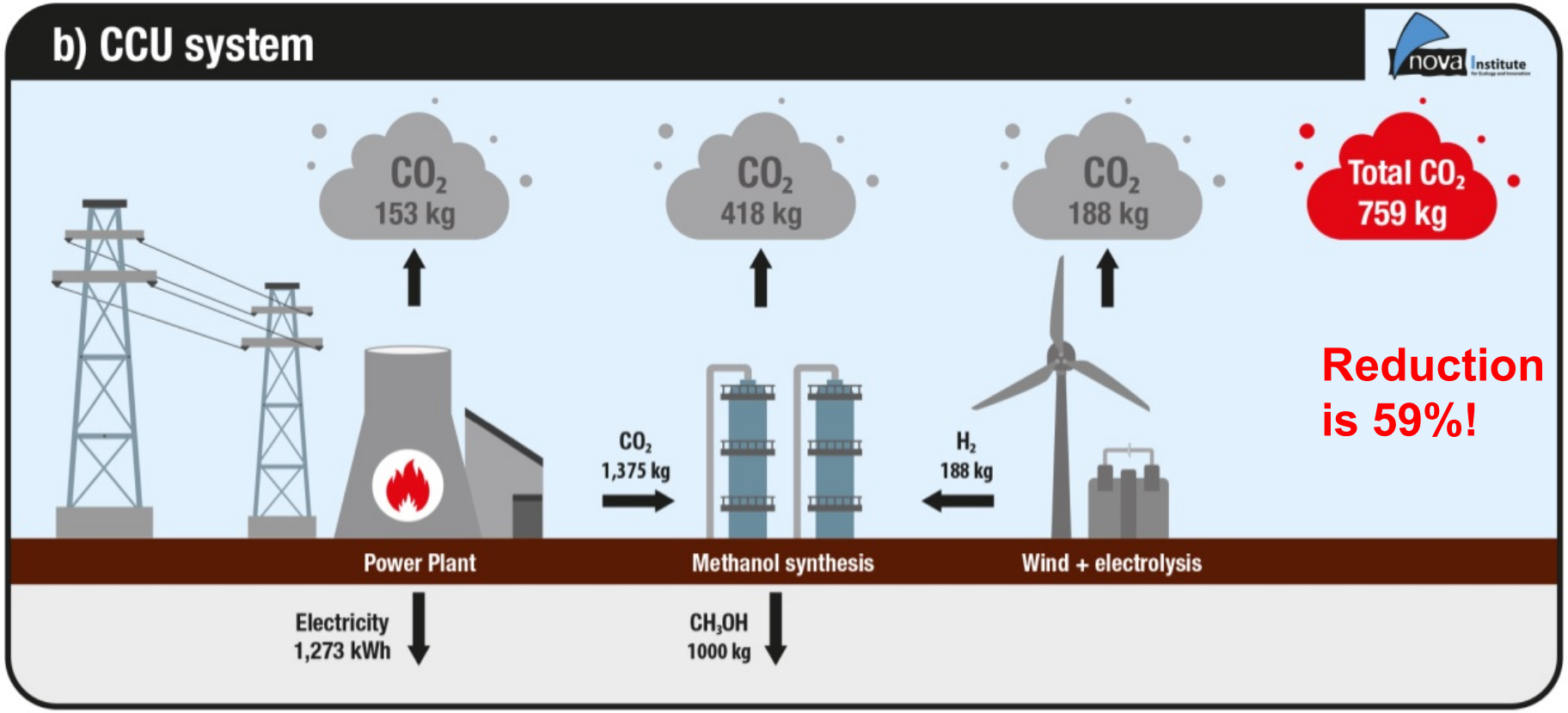
The total area of deserts is even 30,000,000 km².

Separate production of electricity and methanol (based on real data)



Source: Von der Assen, N., Voll, P., Peters, M. and Andre´ Bardow, A.: Life cycle assessment of CO2 capture and utilization: a tutorial review. Chem. Soc. Rev. 2014-01-20.

Joint production of electricity and methanol via CCU & wind energy (real data)



Source: Von der Assen, N., Voll, P., Peters, M. and Andre´ Bardow, A.: Life cycle assessment of CO2 capture and utilization: a tutorial review. Chem. Soc. Rev. 2014-01-20.

Renewable Carbon from Recycling

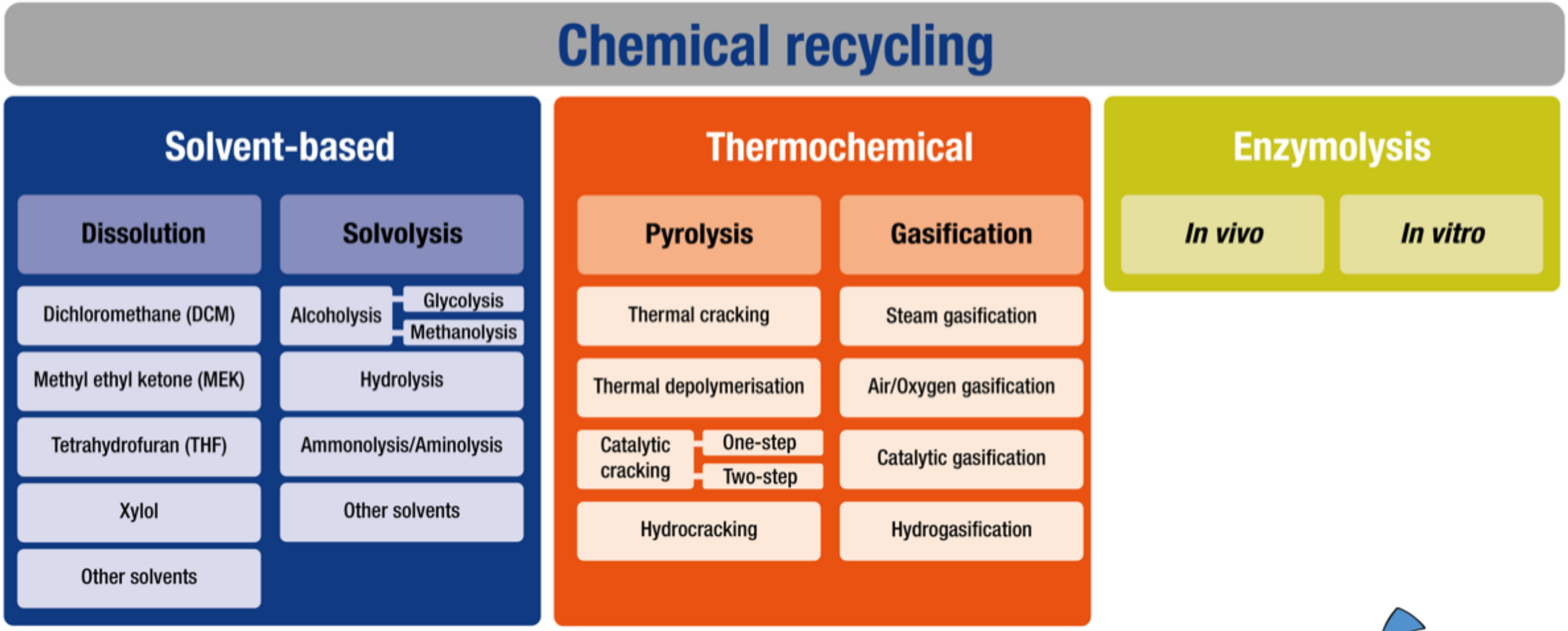
Pros in a nutshell

- Most important end-of-life option for plastics in the future circular economy
- Strong recycling targets in the European Union will guarantee access to renewable carbon from recycling
- Chemical recycling: Basically no loss of quality compared to virgin feedstock

Cons in a nutshell

- Mechanical recycling: Limitation in quality, not allowed in many food applications
- Energy intensive processes
- Chemical recycling: early stage, no solid assessment on economic and environmental impacts

Overview about the different methods for chemical recycling of plastic waste



Political Measures to Support a Quick Transition to Renewable Carbon (see nova paper #12)

- **CO_2 emission tax (heavily discussed in public – e.g. carbon border adjustment EU)**
- **Taxation of fossil carbon** used in chemicals and plastics
  - A raw materials tax is much easier to handle than an emissions tax.
  - We are not allowed to use any more additional fossil carbon – and that is exactly what makes the tax effective and important.
  - The tax only has to be charged in a few points (extraction and import).
  - Automatically captures all sectors and applications that use fossil carbon – without exceptions
  - Recycling, biomass and CO_2 are automatically exempt from the tax.
- **Discontinuation of any funding** programmes in the **fossil** domain (estimate 20 billion US$ in the US alone
- **Higher costs for fossil CO_2 emissions** in the emissions trading system (ETS).
- Development of **certificates and labels** which indicate the **share of renewable carbon.**
- Establishing **quotas of renewable carbon** for “drop in” chemicals and plastics and a **quota for CO_2-based kerosene**.
- **Report about the percentage of renewable carbon** used in the production processes of the chemical and plastic industry (**Ranking**)

The Renewable Carbon Initiative

Renewable Carbon is the Key to a Sustainable and Future-Oriented Chemical and Plastic Industry

THE RENEWABLE CARBON INITIATIVE

lead by nova-Institute is launched in September 2020.

The aim of the initiative is to support and speed up the transition from fossil carbon to renewable carbon for all organic chemicals and materials.

The Renewable Carbon Initiative 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 RENEWABLE CARBON INITIATIVE

Shape the future of the chemical and material industry

RENEWABLE CARBON INITIATIVE

Bio-based | CO_2-based | Recycling

Circular Economy

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.

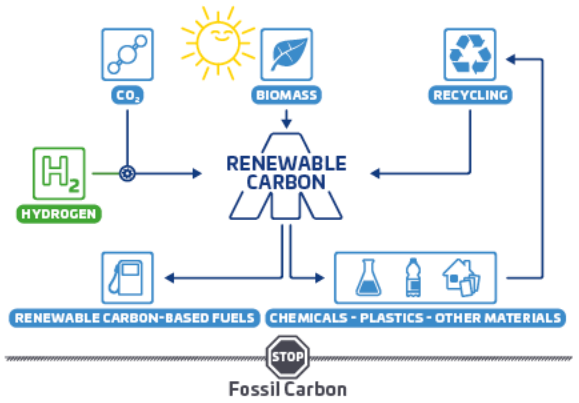
RCI addresses the core problem of climate change, which is extracting and using additional fossil carbon from the ground that will eventually end up in the atmosphere. Companies are encouraged to focus on phasing out fossil resources and to use renewable carbon instead.

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



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.

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.

JOIN NOW

RENEWABLE CARBON INITIATIVE

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

ADVOCACY

RCI drives the message of renewable carbon and represents its stakeholders to the public and decision-makers.

SHAPING THE INITIATIVE

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

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.

WORKING GROUPS

Members can form working groups on their desired topics, such as technology and policy.

ACCESS

Members receive intimate information about RCI activities, strategies and budget allocations.

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.

JOINT RESEARCH

Members will be informed about upcoming research calls and the renewable carbon community will serve as a pool for project partners. Members can commission joint market and technology reports.

Ongoing activities of the RCI

Setting up the RCI

- Continuous development of **website** content (e.g. a glossary)
- Release of a monthly **RCI newsletter for members**
- Building a **Renewable Carbon Community**

Advertising and increasing interest:

- This **webinar, another webinar in April, another one aimed at the US and Asia**
- **Cartoon** for B2C communication
- **Press releases** commenting on pressing issues

Supporting and speeding up the transition

- Work on a concept for a **renewable carbon label**
- Work on a paper connecting renewable carbon as a key indicator to **sustainability**
- Work on an overview of **GHG reduction potential of CCU**

Future activities of the RCI

Ideas that have been thrown around

- Placing renewable carbon on the **European agenda**
- **Advocacy** and **lobbying** work to create supportive regulatory and economic frameworks
  - Policy Framework analysis
- **Task forces** and **working groups** on specific topics (communication, policy, technology...)
- Setting up of **social media** accounts, e.g. Twitter
- **Trend** and **market studies** on renewable carbon related topics on member's request
- Discover **internal synergies** and overlaps in kind of a "speed dating" event

- Members can actively **suggest ideas** and discuss pros and cons of activities
- Board members decide on activities

Personal supporters

- Personal Supporters are **experts** in bioeconomy, circular economy, CO_2 utilisation, chemical recycling or related sectors.
- They **understand the need for a fundamental change** in the chemical industry and endorse the Renewable Carbon Initiative.

Why become a personal supporter?

- Become **visible** on the RCI website
- Have the chance to **find like-minded** experts
- **Stay informed** about the RCI's webinars and general activities
- **Get involved** via surveys and provide feedback and opinions
- It's **free!**

PERSONAL SUPPORTERS

RENEWABLE CARBON INITIATIVE

Bio-based CO_2-based Recycling

... and more than
180 personal supporters

MEMBERS OF THE INITIATIVE

Beiersdorf
BioBTX
Cosun Beet COMPANY
covestro
Firmenich for good, naturally
Givaudan
Henkel
IBB Netzwerk GmbH
iff
LanzaTech
Lenzing Innovative by nature
NESTE
nova
SHV ENERGY
stahl
TripleW
Unilever
uniper
UPMBIOFORE BEYOND FOSSILS

PARTNERS OF THE INITIATIVE

CO_2 VALUE EUROPE
GLOBAL CO_2 INITIATIVE UNIVERSITY OF MICHIGAN
GO!PHA Global Organization for PHA
TextileExchange Creating Material Change

www.renewable-carbon-initiative.com

Membership in the Renewable Carbon Initiative

WHO CAN JOIN?

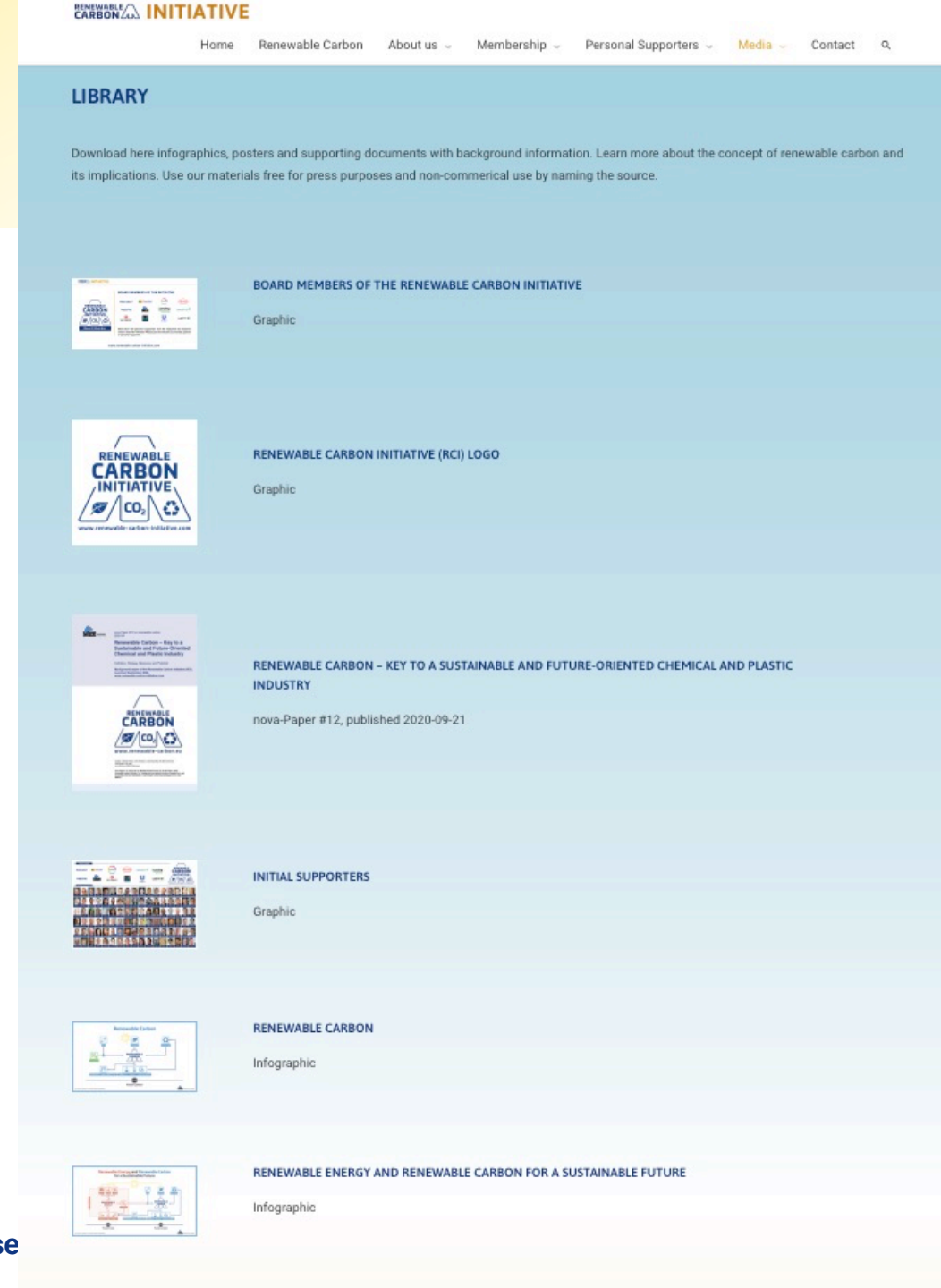
- **Companies** of all sizes, **start-ups** and **research institutes** can become members of the RCI.
  - Membership fees depend on size and type of the applicant.
  - Annual Fees (moderate fees aiming to many members):
    - Large Enterprises: 10,000 €
    - SMEs, Cluster: 5,000 €
    - Start-Ups: 2,000 €
    - Research Institutes:1,000 €
    - https://renewable-carbon-initiative.com/membership/application/

- **Associations** interested in a partnership are welcome to contact Dominik Vogt (Dominik.vogt@nova-institut.de) for further information.

More information

Available at www.renewable-carbon-initiative.com

- Press releases
- Infographics
- Board member information
- Background paper on renewable carbon
- List of personal supporters
- Membership application



nova-Team for the Renewable Carbon Initiative

Community
Members, Supporters & Associations

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Partnerships

Linda Engel
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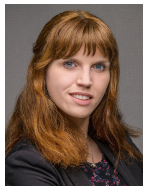

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nova-Institute is a science-based research and consultancy company. Organiser of leading expert conferences, workshops and webinars. Multidisciplinary and international team of more than 40 employees. Turnover 3.0 mln € / year

Block 2:
Member perspectives

Final Q&A

Share any questions you might have on renewable carbon and the RCI either via

Using the „raise hand“ button to ask a question directly

or

Posting your question in the chat

Thank you for your participation!

Visit us at:
https://renewable-carbon-initiative.com/

Or directly contact us:
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Christopher.vomberg@nova-institut.de