Aktuelle Trends und Marktdaten für bio-basierte Polymere

FNR Webinar: “Rahmenbedingungen von Märkten, Gesetzen, Verordnungen und Strategien

28. Mai 2024

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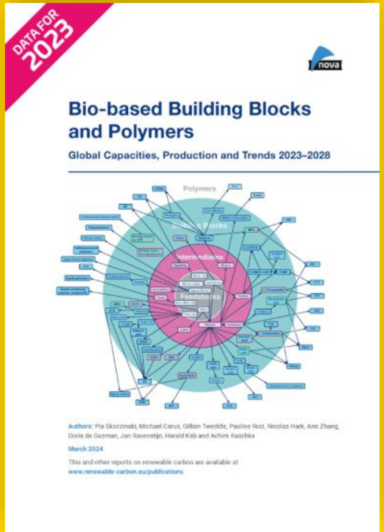
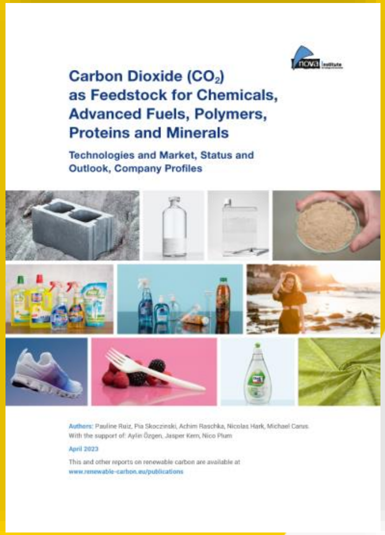
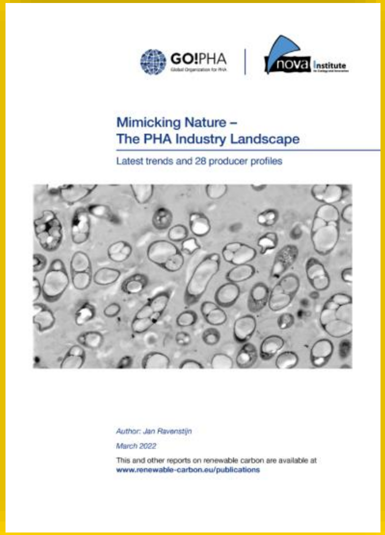
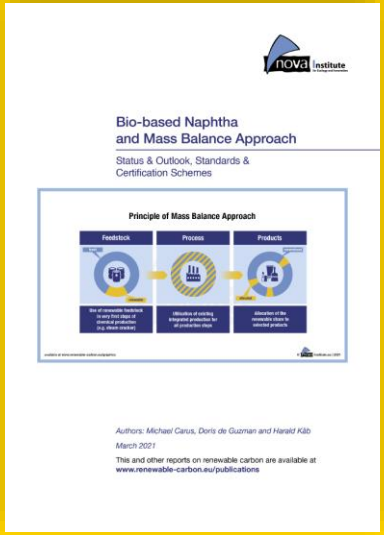
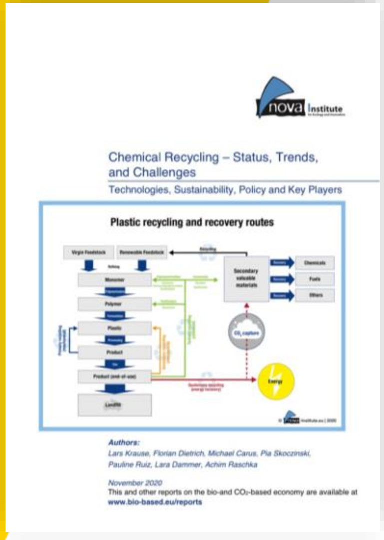
Market and Trend Reports on Renewable Carbon

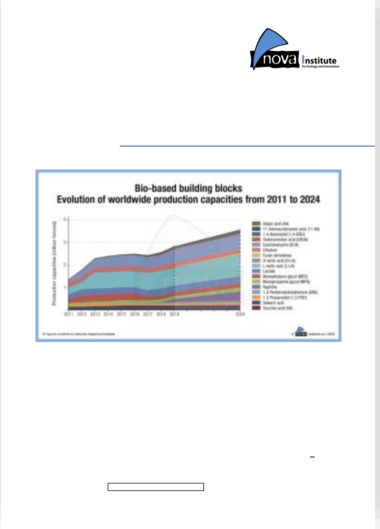






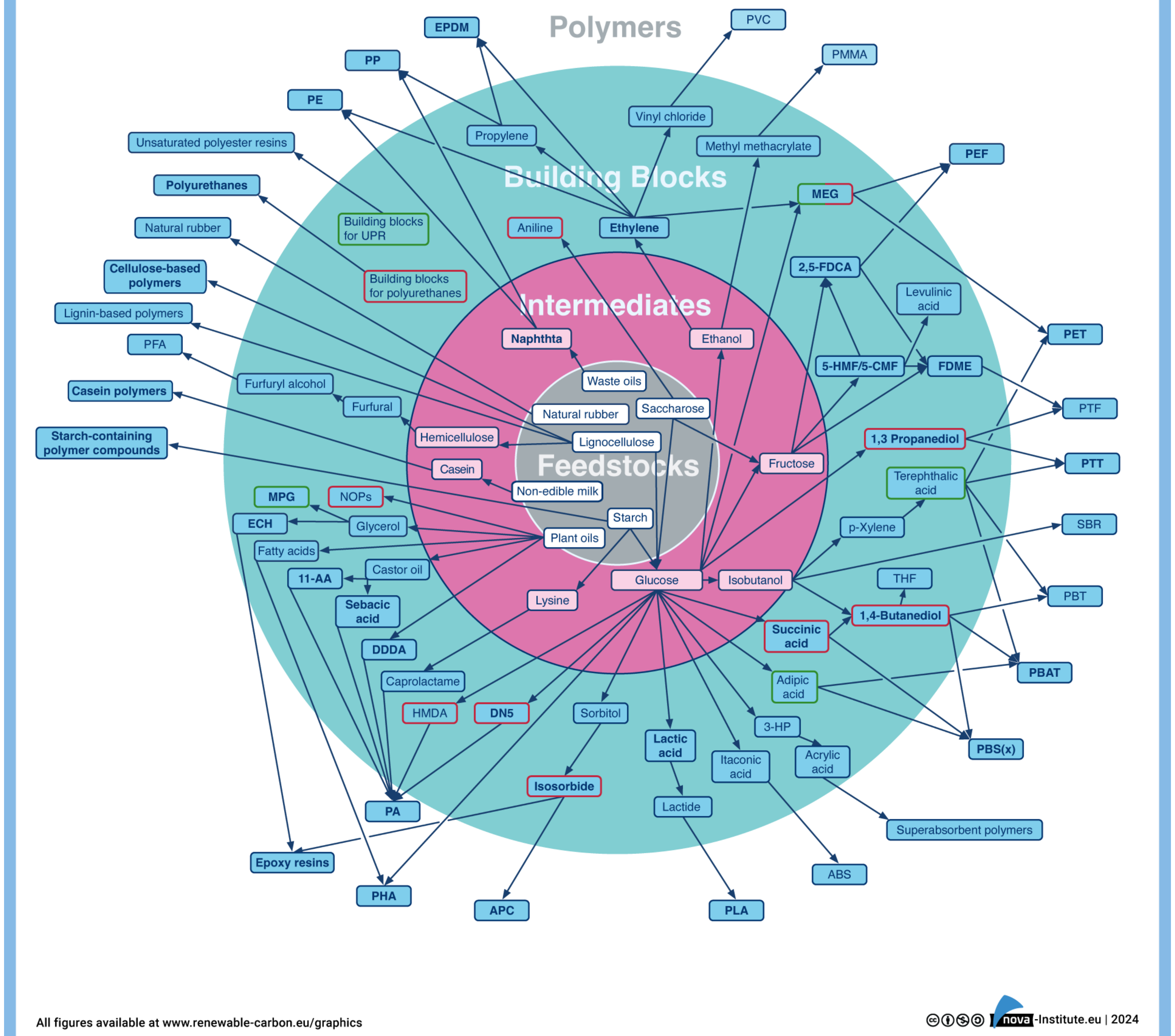






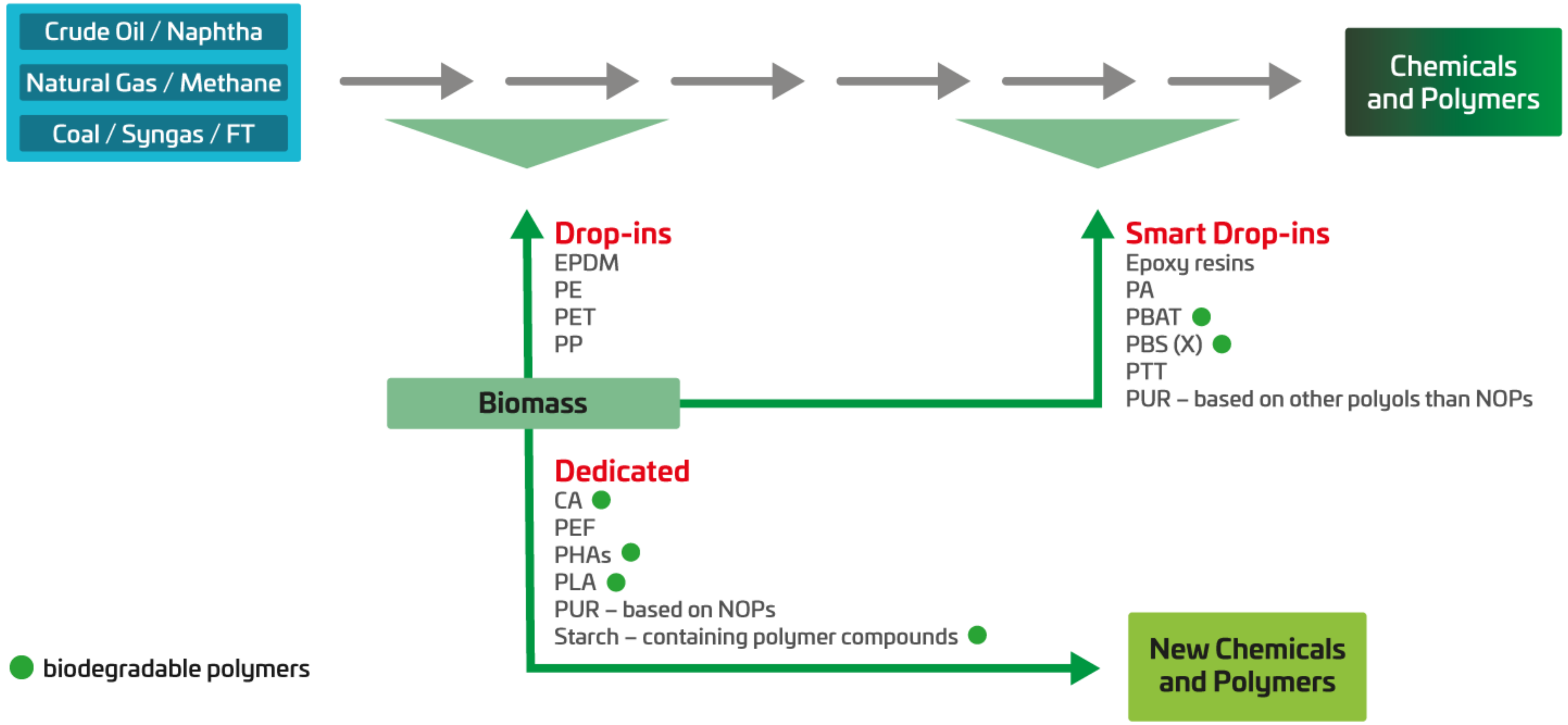
The Best Available on Bio- and CO_2-based Polymers & Building Blocks and Chemical Recycling

renewable-carbon.eu/
commercial-reports



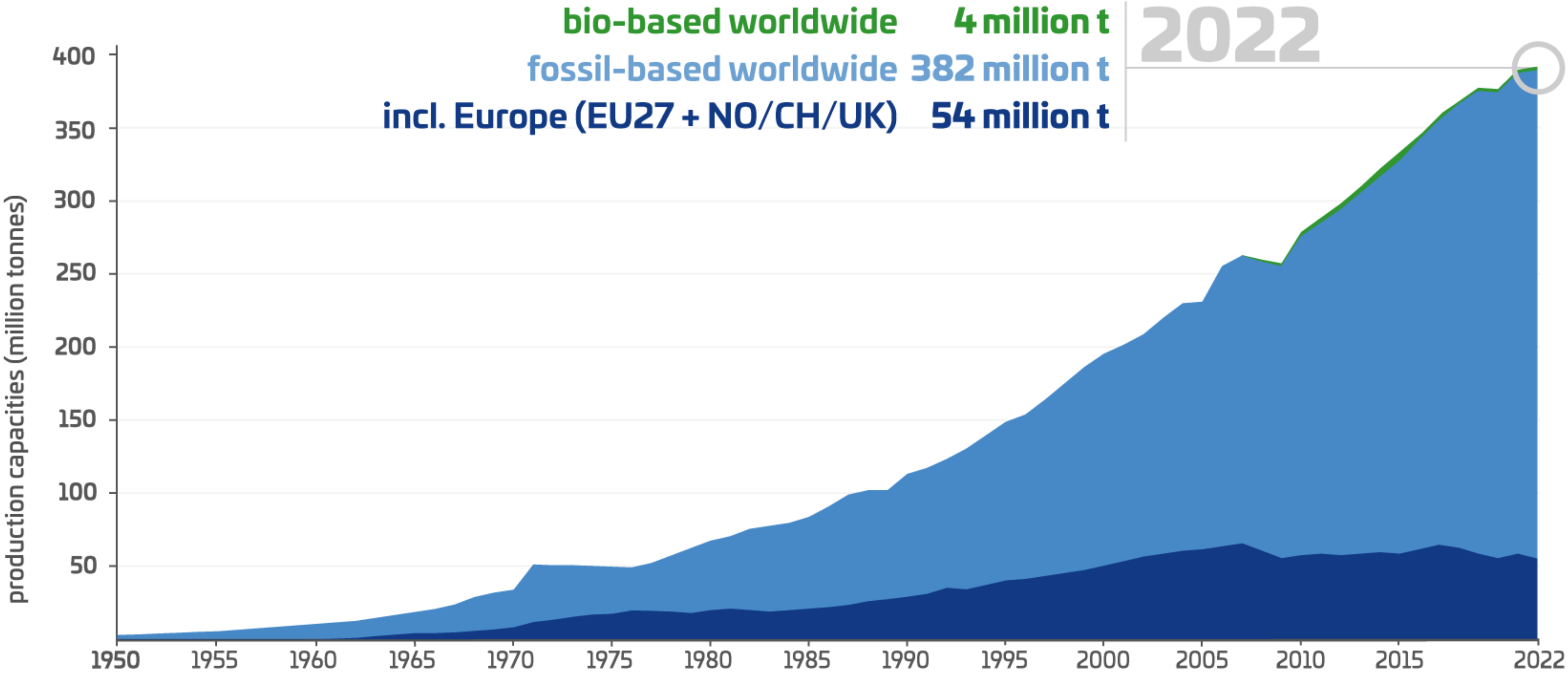
Polymers
Building Blocks
Intermediates
Feedstocks
EPDM
PP
PE
PVC
PMMA
Unsaturated polyester resins
Polyurethanes
Natural rubber
Cellulose-based polymers
Lignin-based polymers
PFA
Casein polymers
Starch-containing polymer compounds
Propylene
Vinyl chloride
Methyl methacrylate
PEF
MEG
Building blocks for UPR
Building blocks for polyurethanes
Aniline
Ethylene
2,5-FDCA
Levulinic acid
Naphtha
Ethanol
PET
5-HMF/5-CMF
FDME
Waste oils
Natural rubber
Saccharose
Lignocellulose
Hemicellulose
Furfuryl alcohol
Furfural
PTF
1,3 Propanediol
Fructose
PTT
Terephthalic acid
Casein
Non-edible milk
MPG
NOPs
ECH
Glycerol
Starch
p-Xylene
SBR
Fatty acids
Plant oils
Castor oil
11-AA
Glucose
Isobutanol
THF
Sebacic acid
Lysine
1,4-Butanediol
PBT
Succinic acid
DDDA
PBAT
Caprolactame
Adipic acid
HMDA
DN5
Sorbitol
3-HP
PBS(x)
Lactic acid
Itaconic acid
Acrylic acid
Isosorbide
PA
Lactide
Superabsorbent polymers
Epoxy resins
ABS
PHA
APC
PLA
All figures available at www.renewable-carbon.eu/graphics
nova-Institute.eu | 2024

Schematic Differentiation of Pathways of Drop-in, Smart Drop-in and Dedicated Bio-based Chemicals and Polymers[1]



[1] Selected bio-based polymers are shown for each classification group. Biodegradable polymers are highlighted with a green dot.

Plastics Production From 1950 to 2022

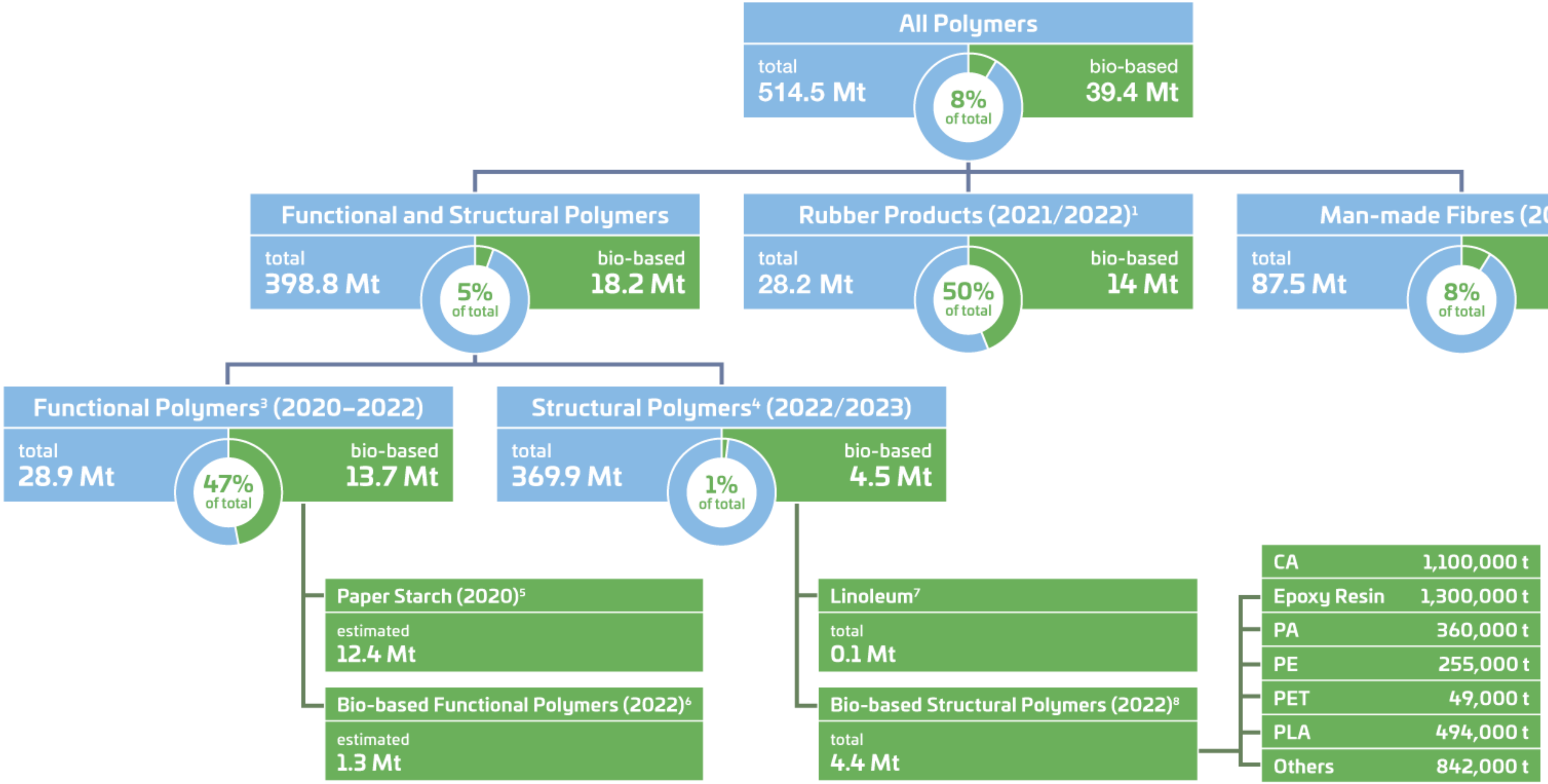


Includes thermoplastics, polyurethanes, thermosets, elastomers, adhesives, coatings and sealants and PP-fibres for fossil-based plastics.
Includes thermoplastics, polyurethanes, elastomers and fibres for bio-based plastics. Not included PET-, PA- and polyacryl-fibres.

available at www.renewable-carbon.eu/graphics

Source: nova estimate based on Plastics Europe Plastics – the fast Facts 2023.

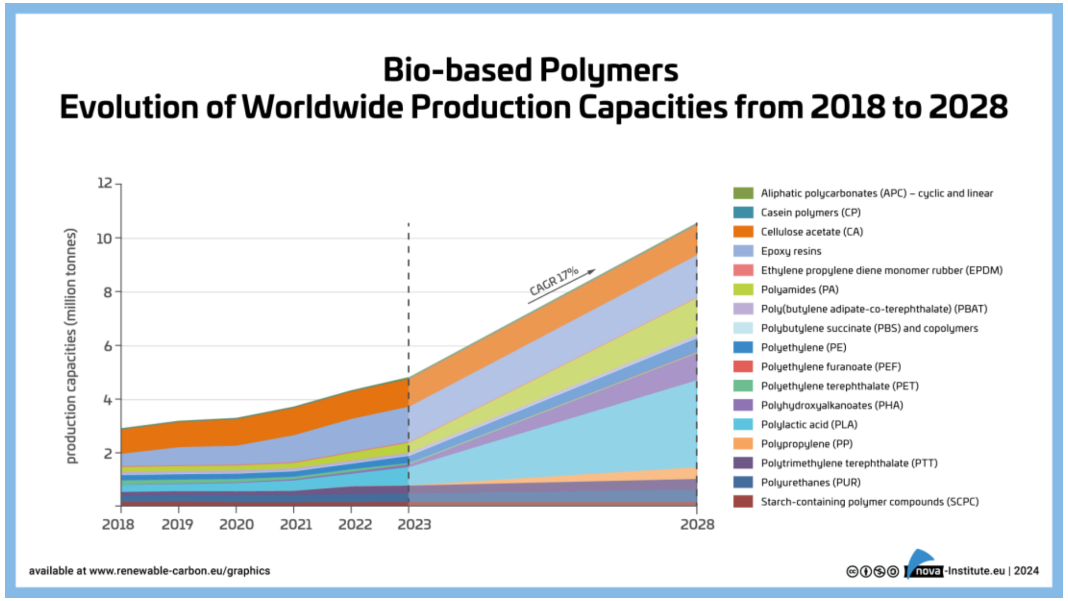
Polymers and Bio-Based Shares Worldwide (2020–2023)



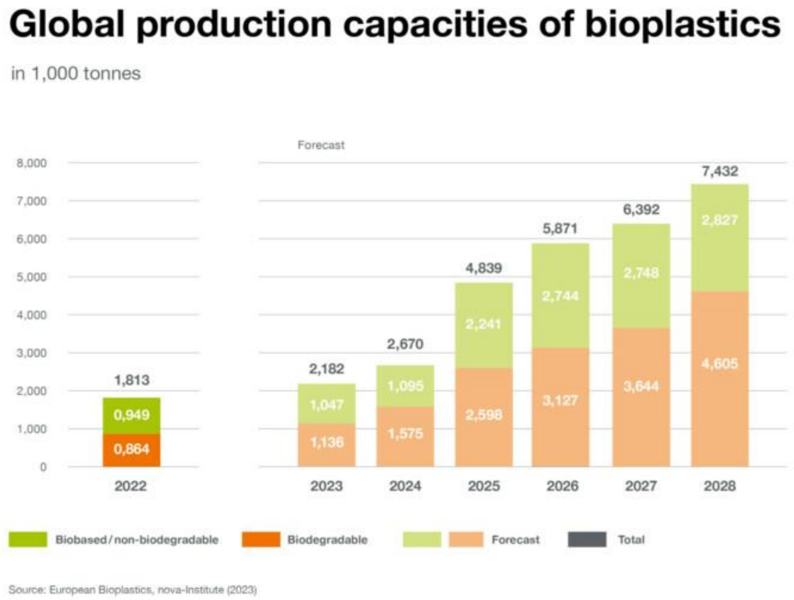
Sources: : [1] Ifbb Biopolymers facts and statistics, 2022; ETRMA, 2021; [2] The Fiber Year 2023; [3] Calculations by nova-Institute based on different company and industry reports; [4] Calculations by nova-Institute based on Plastics Europe Plastics – the fast Facts 2023; [5] Calculations by nova-Institute based on CEPI, FAOSTAT, Starch Europe; [6] Calculations by nova-Institute based on different industry reports; [7] FAOSTAT; [8] nova-Institute: Bio-based Building Blocks and Polymers – Global Capacities, Production and Trends 2023-2028, www.renewable-carbon.eu/publications

Difference between nova and EUBP

4.8 million tonnes in 2023
10.5 million tonnes in 2028

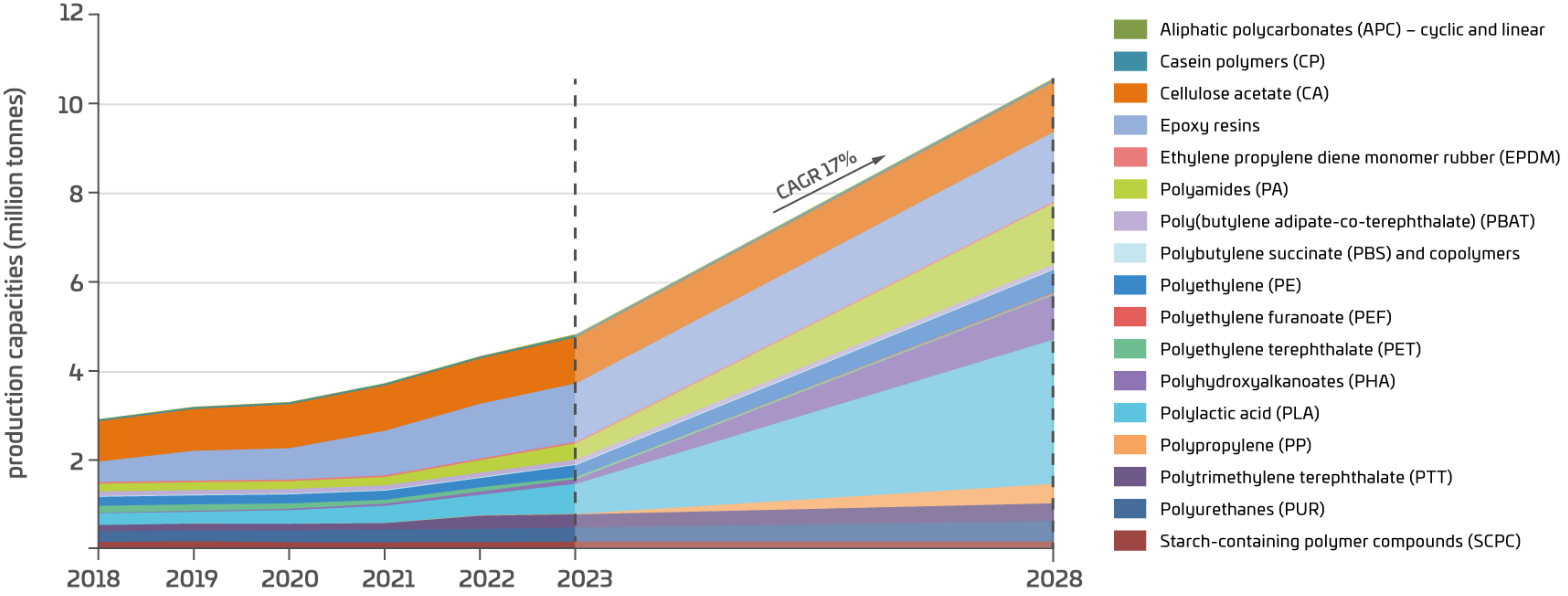


2.2 million tonnes in 2023
7.4 million tonnes in 2028



EUBP data does not include aliphatic polycarbonates (APC), cellulose acetate (CA), epoxy resins, ethylene propylene diene monomer rubber (EPDM) and polyurethanes (PUR).

Bio-based Polymers
Evolution of Worldwide Production Capacities from 2018 to 2028



Significant Findings from 2022 to 2023

	2022	2023
Capacity	4.3 million tonnes	4.8 million tonnes
Production	4 million tonnes	4.4 million tonnes

Main drivers for capacity increase to 2023:

- Asian expansion in **PLA** capacity
- Asian expansion of **PA** capacity
- Asian expansion of **epoxy resin** production
- South American capacity increase for **polyethylene (PE)**
- Worldwide **PHA** capacity increase

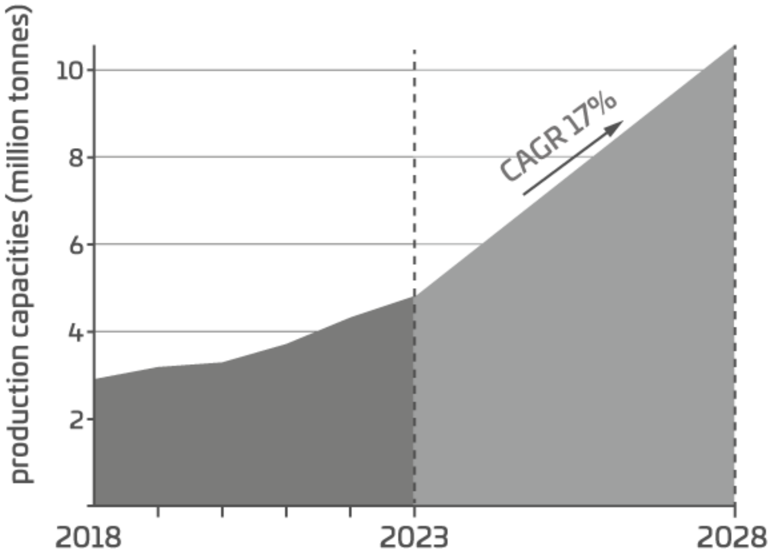
Significant Findings – Forecast 2023 to 2028

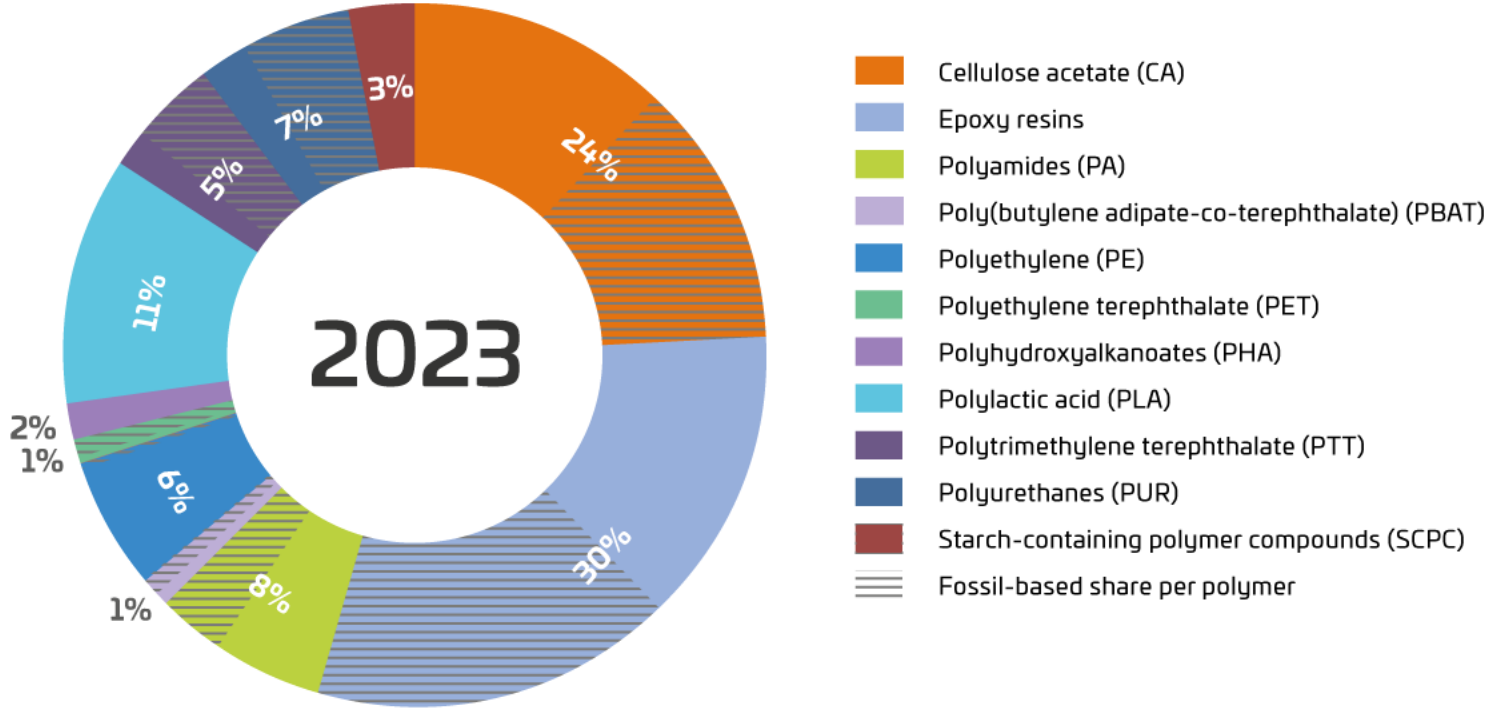
	2023	2028
Capacity	4.8 million tonnes	10.5 million tonnes

Main drivers for capacity increase to 2028:

- Asian expansion in **PLA** capacity
- Asian expansion of **PA** capacity
- Worldwide **PHA** capacity increase
- North American capacity increase for **polypropylene (PP)**
- Asian expansion of **epoxy resin** production

Bio-based Polymer Capacities and Production Worldwide 2023





The share of aliphatic polycarbonates (APC), casein polymers (CP), ethylene propylene diene monomer rubber (EPDM), polybutylene succinate (PBS) and copolymers, polyethylene furanoate (PEF) and polypropylene (PP) is <1%

Biodegradable Polymers in Various Environments

According to Established Standards & Certification Schemes

Update 2021

NOTES

proven biodegradability

proven biodegradability for certain grades

biodegradability not proven

The biodegradability of plastics derived from these biodegradable polymers can only be guaranteed if all additives and (organic) fillers are biodegradable, too. Dying and finishing of cellulosic fibres, for example, may prevent their biodegradation in the environment.

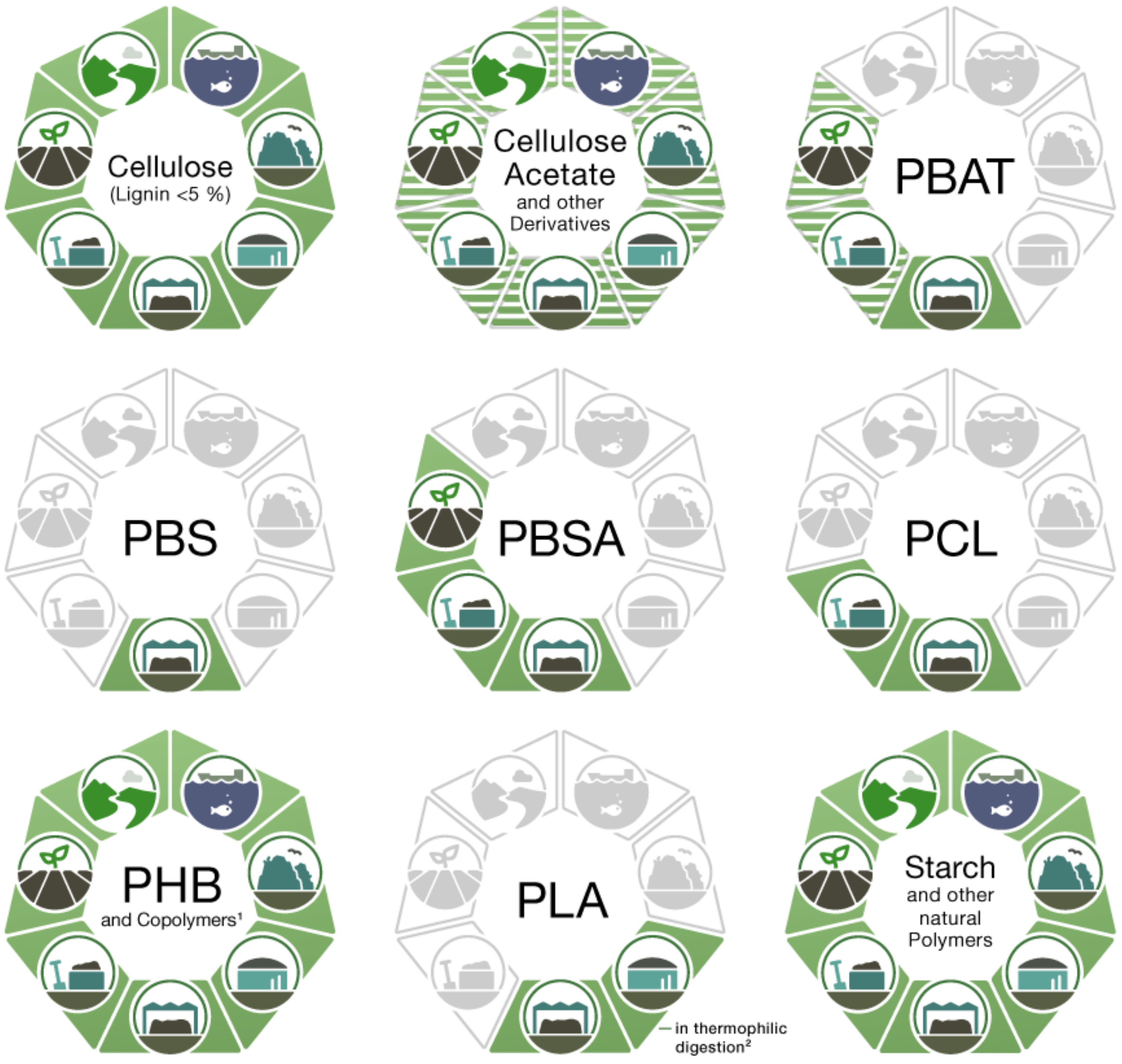
Biodegradability depends on the complex biogeochemical conditions at each testing site (e.g. temperature, available nutrients and oxygen, microbial activity, etc.). Therefore, these generalised claims about biodegradation can only serve as approximations and need to be confirmed by standardised testing under lab conditions. In-situ behaviour can vary, depending on the mentioned conditions, size of the plastic, grade of the polymer and other factors. For instance, biodegradation testing is often performed after milling, showing the inherent nature of the material to biodegrade. In reality, the same level of biodegradation will be obtained, be it possibly within a different timeframe.

SLOWER BIODEGRADING POLYMERS

The polymers shown in the poster are rapidly biodegraded in the labelled environments, within the time frame of the corresponding standards or certificates. Some biopolymers, such as PBS or PLA in soil and also lignin/wood for virtually all environments, also biodegrade, but (much) more slowly. Full biodegradation can take several years to decades to be achieved. In addition, for some applications with a use phase in a certain environment (e.g. geotextiles), too rapid biodegradation is not desired, as their function should first be given for a few years. However, for these cases no standards exist so far.

[1] incl. P3HB, P4HB, P3HB4HB, P3HB3HV, P3HB3HV4HV, P3HB3Hx, P3HB3HO, P3HB3HD

[2] PLA is likely to be biodegradable in thermophilic anaerobic digestion at temperatures of 52°C within the time frame mentioned in standards. This does not apply to mesophilic digestion.



ENVIRONMENTS

IMPORTANT TEST CONDITIONS, CERTIFICATION SCHEMES AND STANDARDS

For more details, refer to the original documents.

MARINE ENVIRONMENT

Temperature 30°C, 90 % biodegradation within a maximum of 6 months. Certification: TÜV Austria OK biodegradable MARINE. Research on standards (both on test methods and requirements) is on-going.

FRESH WATER

Temperature 21°C, 90 % biodegradation within a maximum of 56 days. Certification: TÜV Austria OK biodegradable WATER. Research on standards (especially on requirements) is on-going.

SOIL

Temperature 25°C, 90 % biodegradation within a maximum of 2 years. Certification: TÜV Austria OK biodegradable SOIL and DIN CERTCO DIN-Geprüft Biodegradable in Soil. DIN-Geprüft Biodegradable in Soil is based on the European standard EN 17033 dedicated to mulch films but can be used for other products as well.

HOME COMPOSTING

Temperature 28°C, 90 % biodegradation within a maximum of 12 months. Certification: TÜV Austria OK compost HOME and DIN CERTCO DIN-Geprüft Home Compostable.

LANDFILL

No European standard specifications or certification scheme available since this is not a preferred end-of-life option for biodegradable waste.

ANAEROBIC DIGESTION

Thermophilic 52°C / Mesophilic 37°C. A specific European standard or certification scheme for anaerobic digestion is not yet available. Anaerobic digestion in a biogas plant is mentioned in EN 13432 and EN 14995: 50 % biodegradation within two months, usually followed by aerobic digestion.

INDUSTRIAL COMPOSTING

Temperature 58°C, 90 % biodegradation within a maximum of 6 months. Certification: TÜV Austria OK compost INDUSTRIAL, DIN CERTCO DIN-Geprüft Industrial Compostable and both „Seedling". EN 13432 and EN 14995 are the European reference standards and the basis of these certification schemes.

RENEWABLE CARBON

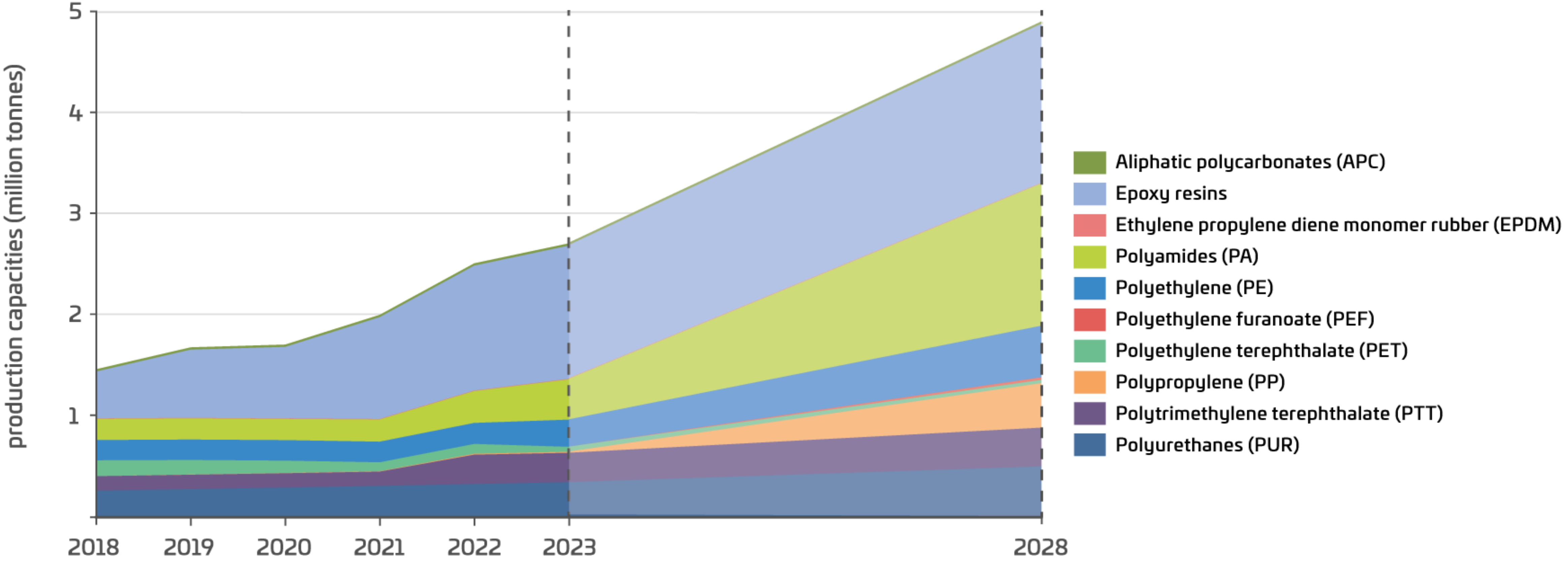
More figures available at www.renewable-carbon.eu/graphics

Partners: Marine Sciences, IKT Kunststofftechnik Stuttgart, OWS, Wageningen University & Research

Sponsors: TÜV Austria, TÜV Rheinland DIN CERTCO

Your feedback is welcome:
michael.carus@nova-institut.de

Bio-based Non-Biodegradable Polymers
Evolution of Worldwide Production Capacities from 2018 to 2028



available at www.renewable-carbon.eu/graphics

Significant Findings from 2022 to 2023

	2022	2023
Capacity	2.5 million tonnes	2.7 million tonnes
Production	2.4 million tonnes	2.6 million tonnes

Main drivers for capacity increase to 2023:

- Asian expansion of **PA** capacity
- Asian expansion of **epoxy resin** production
- South American capacity increase for **polyethylene (PE)**

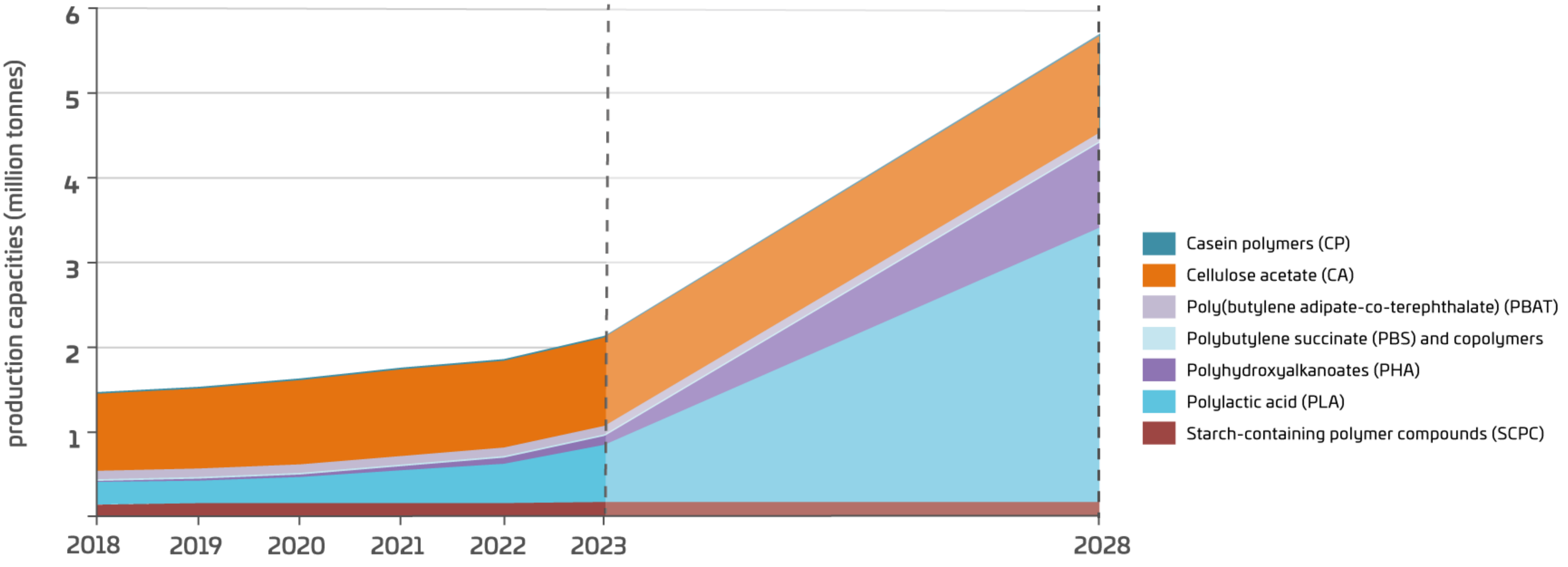
Significant Findings – Forecast 2023 to 2028

	2023	2028
Capacity	2.7 million tonnes	4.9 million tonnes

Main drivers for capacity increase to 2028:

- Asian expansion of **PA** capacity
- North American capacity increase for **polypropylene (PP)**
- Asian expansion of **epoxy resin** production

Bio-based Biodegradable Polymers
Evolution of Worldwide Production Capacities from 2018 to 2028



available at www.renewable-carbon.eu/graphics

Significant Findings from 2022 to 2023

	2022	2023
Capacity	1.8 million tonnes	2.1 million tonnes
Production	1.6 million tonnes	1.8 million tonnes

Main drivers for capacity increase to 2023:

- Asian expansion in **PLA** capacity
- Worldwide **PHA** capacity increase

Significant Findings – Forecast 2023 to 2028

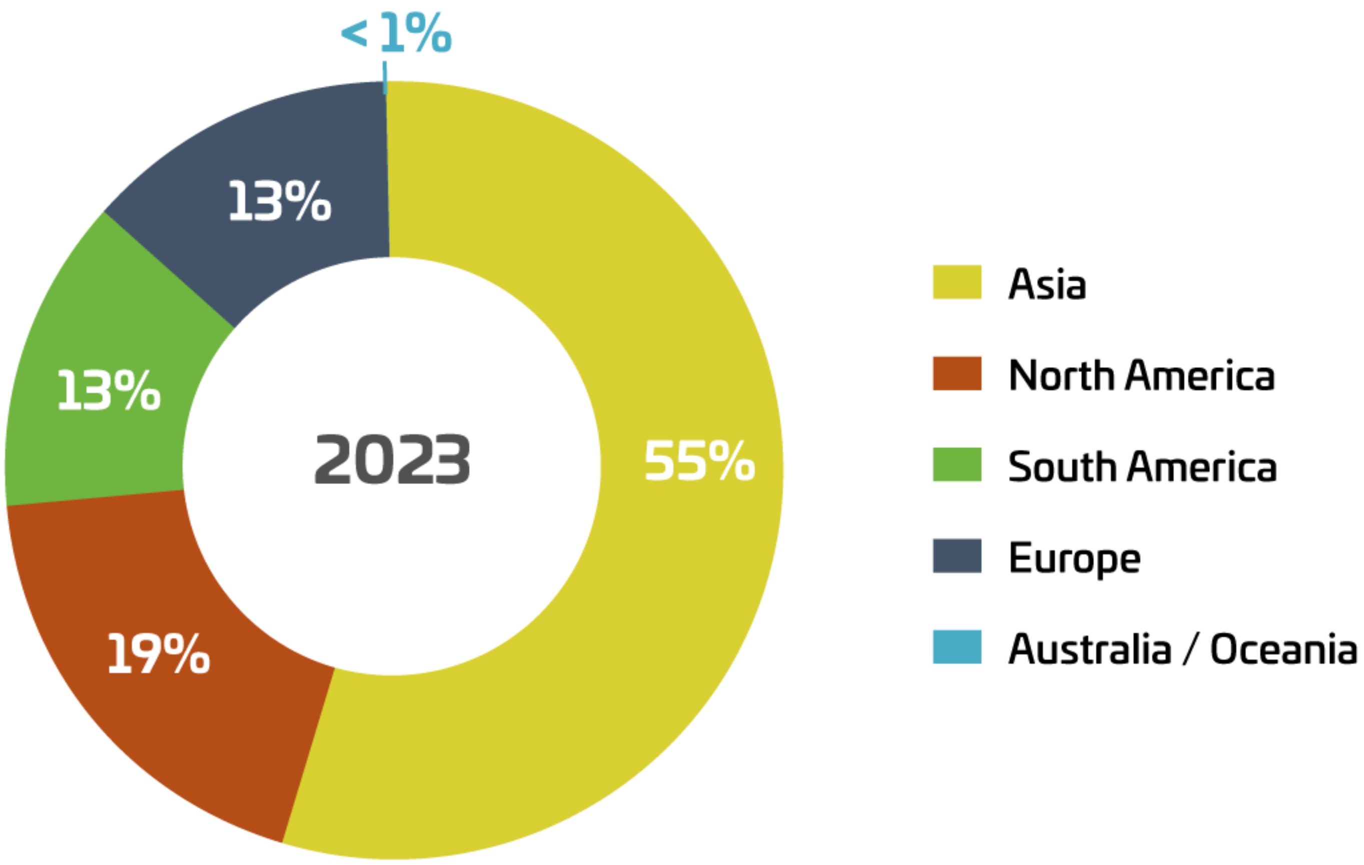
	2023	2028
Capacity	2.1 million tonnes	5.7 million tonnes

Main drivers for capacity increase to 2028:

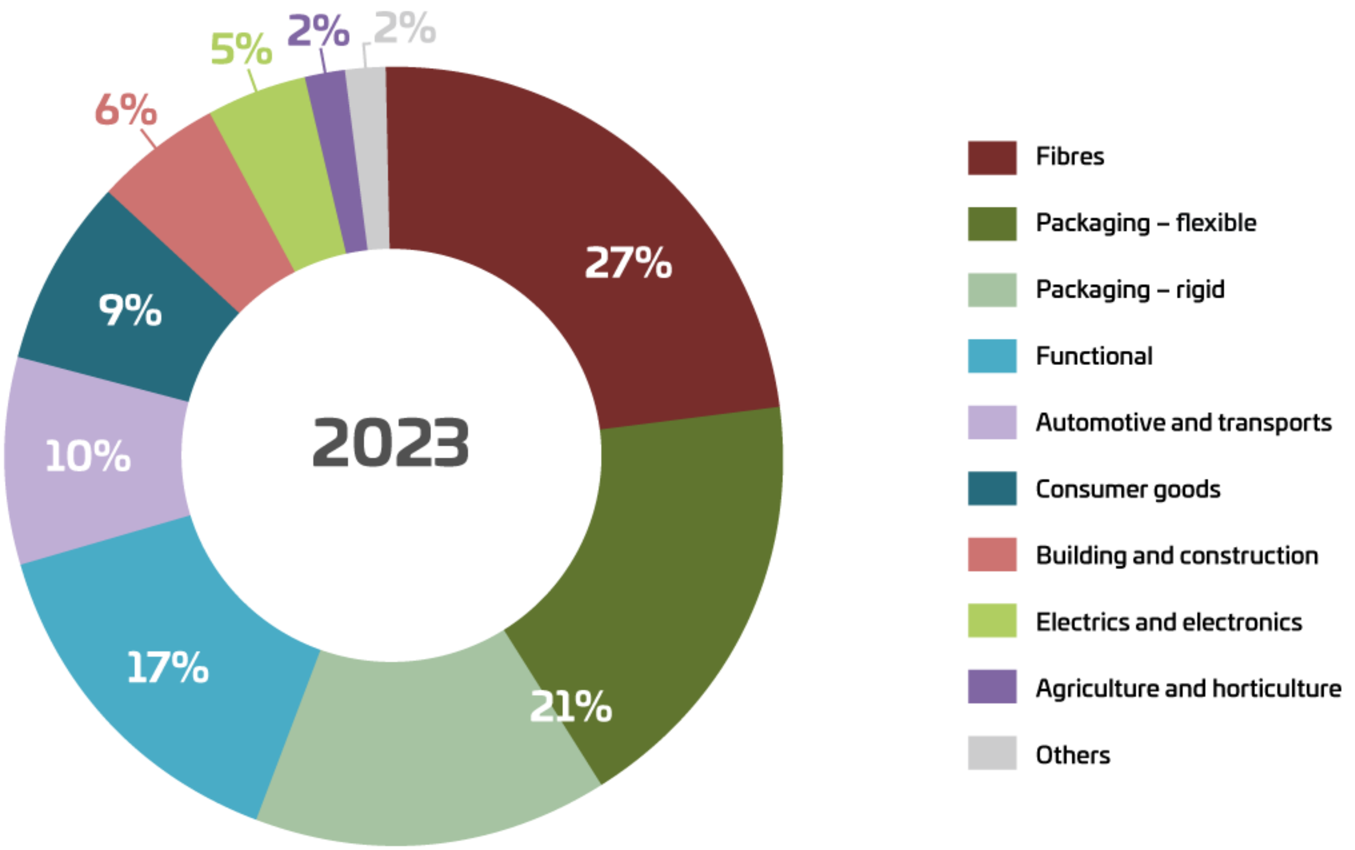
- Asian expansion in **PLA** capacity
- Worldwide **PHA** capacity increase

Global Production Capacities of Bio-based Polymers per Region 2023

without cellulose acetate, epoxy resins and polyurethanes



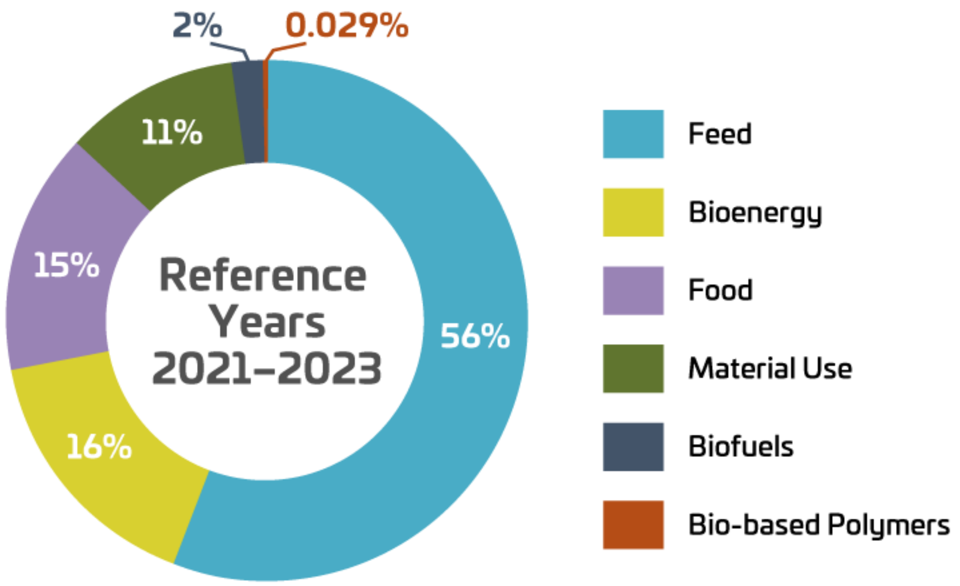
Shares of the Produced Bio-based Polymers in Different Market Segments in 2023



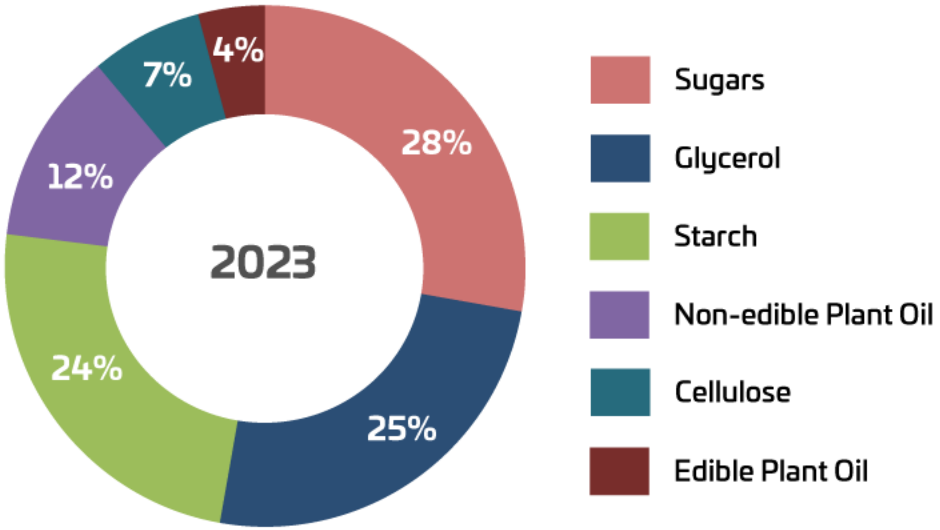
Fibres: including woven and non-woven; **Consumer goods:** including e.g. coffee capsules, biowaste bags, leisure, interieur; **Electrics and electronics:** including casing; **Functional:** including adhesives, coatings, cosmetics etc.; **Others:** including films, 3D printing, medical applications, aquaculture.

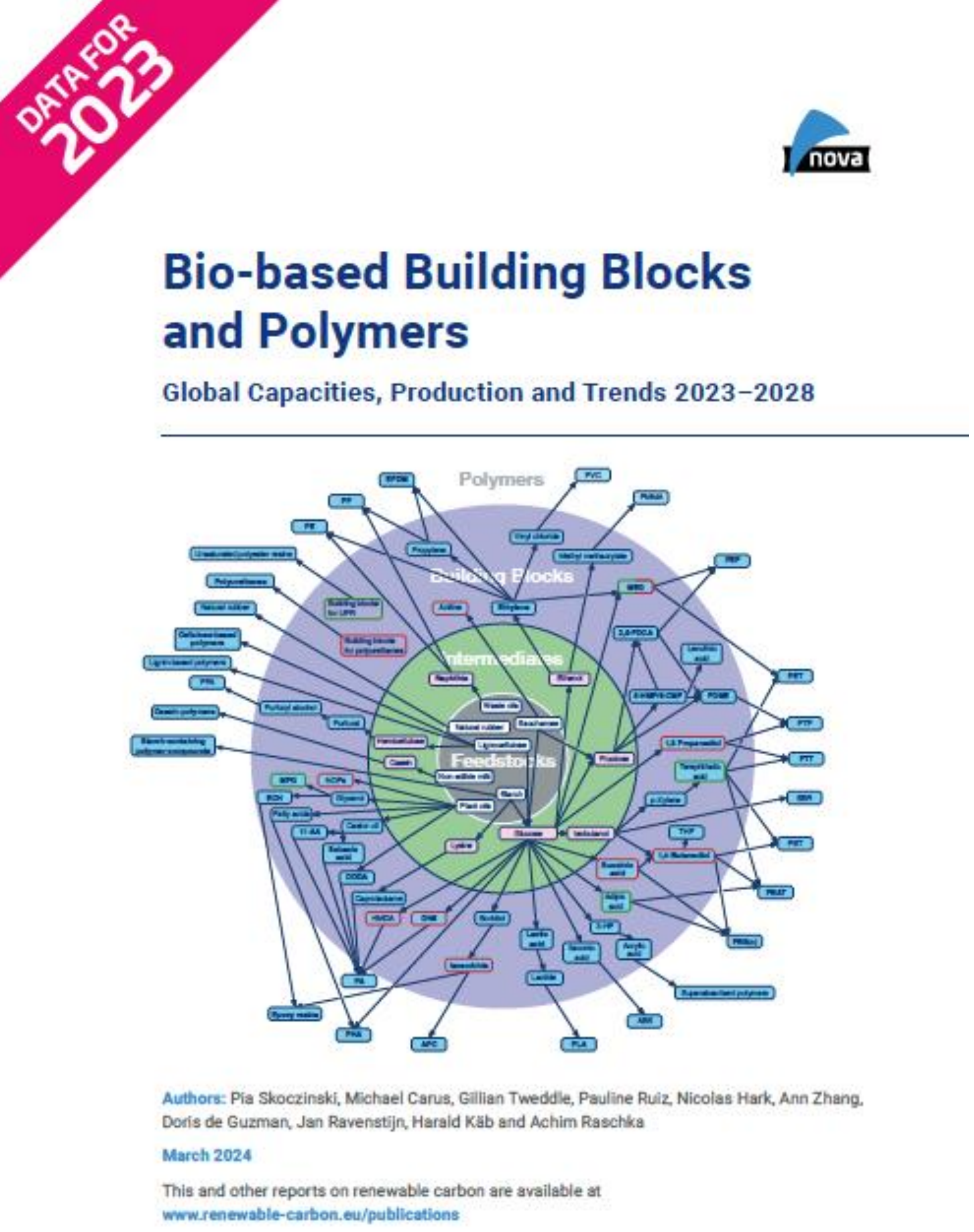
Biomass Utilisation Worldwide
First and Second Generation, Total and for Bio-Based Polymers

Worldwide biomass demand 2021
total: 13.5 billion tonnes



3.9 Mt biomass feedstock for 4.4 Mt bio-based polymers
in 2023 worldwide





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Data for 2023

- 16 bio-based building blocks and 17 polymers
- Capacity development from 2018 to 2028
- Analyses of market development and producers per building block and polymer
- A statistical report on “Mass Balance and Free Attribution (MBFA)” products available worldwide based on an extensive analysis of the ISCC database
- A detailed elaboration on the current European policy for bio-based polymers
- A comprehensive summary on biodegradability and biodegradable polymers
- Over 70 figures and over 50 tables
- 232 company profiles
- 438 pages
- € 3,000 – https://renewable-carbon.eu/commercial-reports

Thank you for your attention!

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Carbon Capture & Utilisation (CCU)
Chemicals, building blocks & polymers
Biotechnology

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11–13 June 2024 | Siegburg/Cologne

ADVANCED RECYCLING Conference 2024
20–21 November 2024 | Cologne

CELLULOSE FIBRES CONFERENCE 2025
12–13 March Cologne (Germany)

CO_2-based Fuels and Chemicals Conference 2025
29–30 April • Cologne (Germany)