



A joined-up approach to sustainable packaging

Our series of web seminars covers every key topic you need to know about. Taking place from March 15 to 25.



Our sustainable product offerings for extrusion polymers

Webinar on March 19 with Frank Reil



Your hosts for today



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Welcome to our session!

Before we start... Webex housekeeping

- Please **provide your full name**: Do not appear as a “Dial-in User”
- We'll put you all on **mute** 
- Ask a question **via the chat or Q&A function (to everyone)** or “raise a hand,” so we can unmute you 
- All questions will be answered **after** the session
- Please **turn off** your video
- We recommend to use **VoIP** audio connection (“**call using computer function**”)
- Please note that this session is going to be **recorded** 
(Q&A will not be published)



■ BASF

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Sustainable Ultramid[®] Extrusion Polymers

Frank Reil

■ BASF

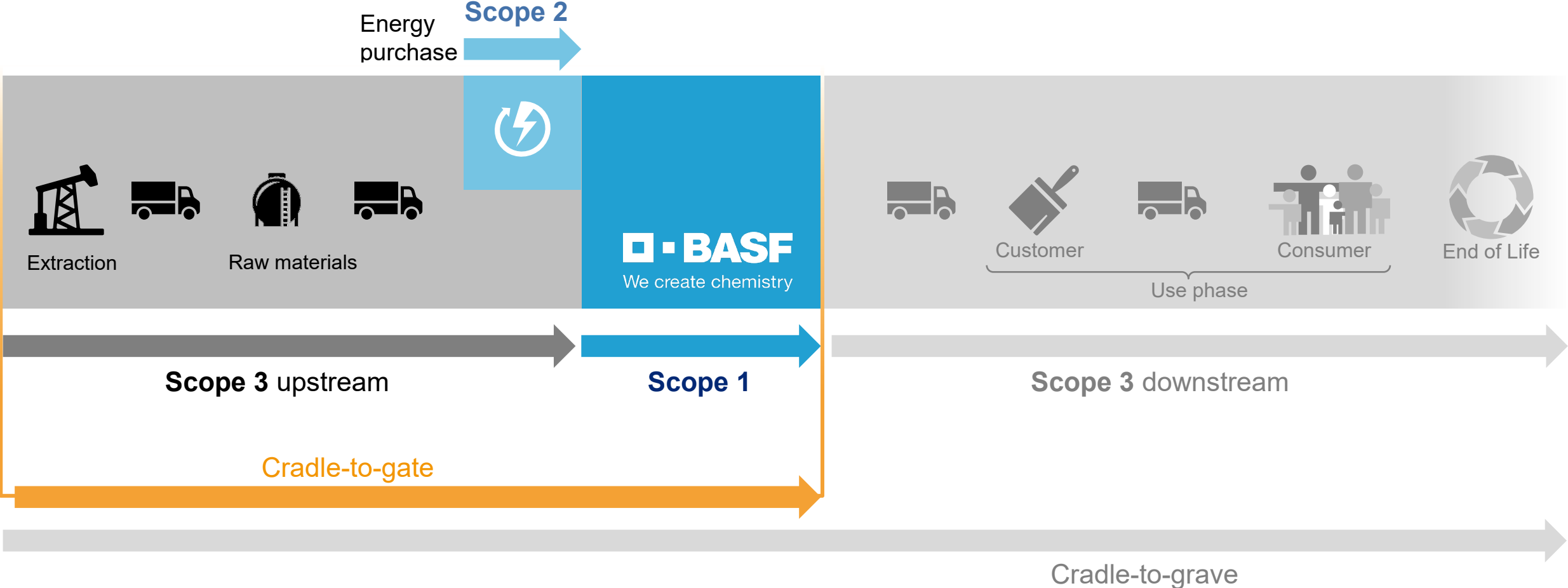
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Agenda

1. PCF values cradle-to-gate
2. Polyamide 6 value chain
3. Sustainable product offerings
4. Verbund and mass balance
5. Biomass Balance and ChemCycling™
6. Ultramid® offerings today and tomorrow
7. Impact on our customers' products

Product Carbon Footprints

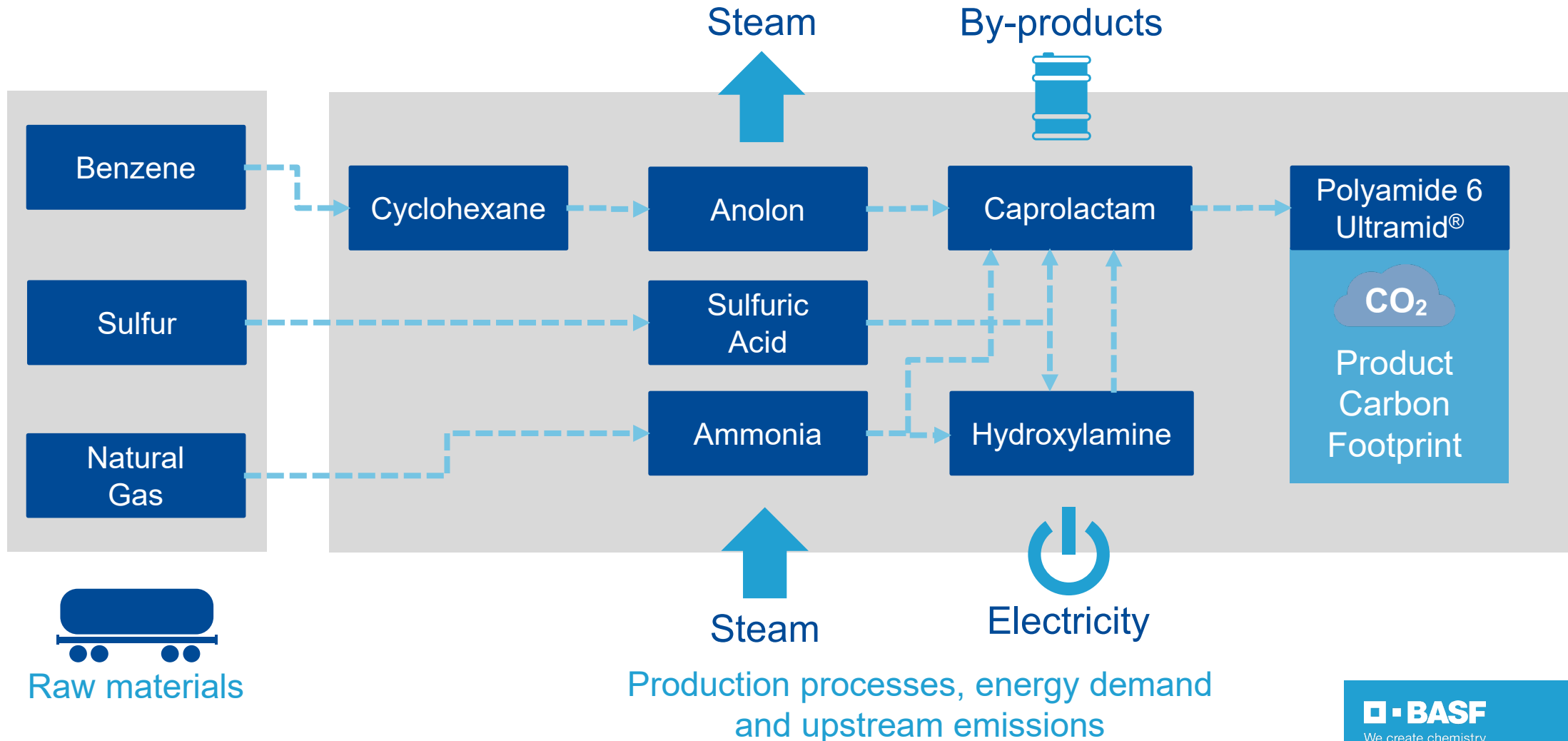
GHG volumes of scope 1 + scope 2 + upstream part of scope 3



ISO 14067:2018 defines the Product Carbon Footprint as the life cycle GHG emissions of a product

Product Carbon Footprints – Example Ultramid® value chain

PCF calculation includes all steps of the Polyamide 6 value chain



Fundamentally we have two offers: BMB and Chemcycling™

	Bio Mass Balance		ChemCycling™	
Waste	Tall oil	Kitchen waste	Mixed Plastic Waste	EoL Tires
	Bio-Naphtha	Bio-Methane	Pyrolysis Oil	Pyrolysis Oil
Syngas Plant and/or Cracker at BASF Verbund				
	Adipic Acid	Ultramid® A	Ultramid® B	Ultramid® C

Our core – the BASF Verbund Ludwigshafen



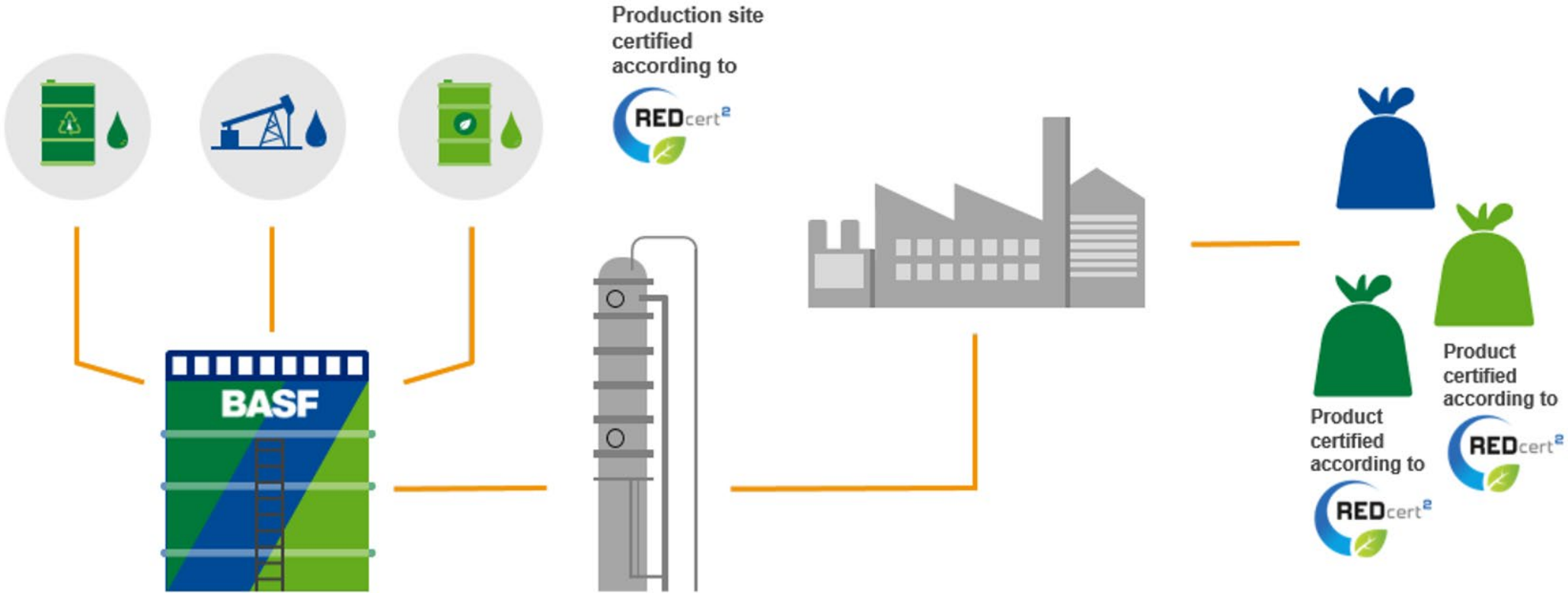
The largest integrated chemical complex in the world

Employees BASF SE	34,484*
Site area	10 km ²
Sales products**	~ 8.5 million metric tons p.a.
Road	~ 106 km
Rail	~ 230 km
Site traffic	~ 2,100 trucks daily
Shipment	~ 100,000 containers p.a.
Pipeline system	~ 2,800 km
Production facilities	~110 production facilities with around 200 production plants

* as of December 31, 2020

**from in-house production

Prerequisite is a physical link* between the circular feedstock and the sales product as well as the certification of the production site(s)



*connection can be plants, between plants and sites via pipelines, trucks, trains, etc.

Sustainability of renewable raw materials

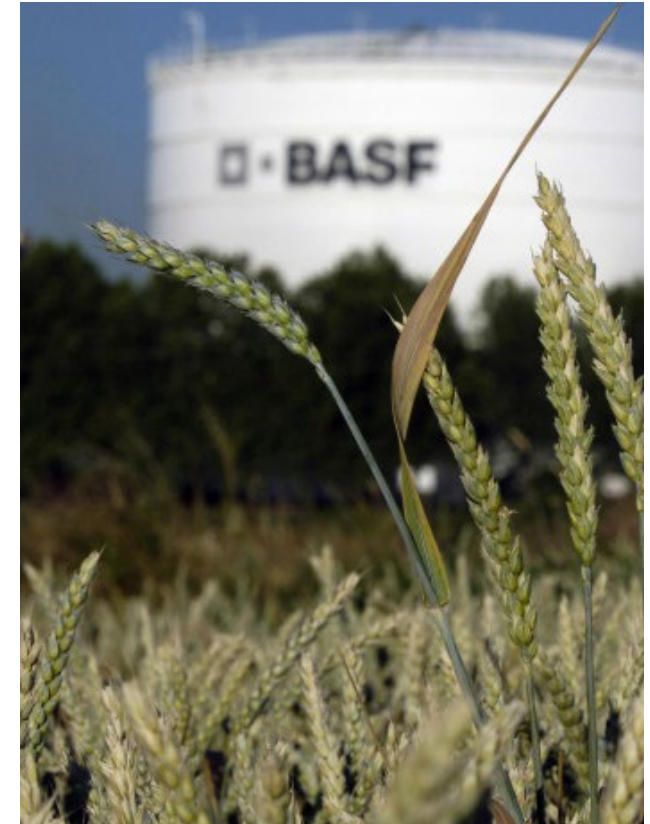
Renewable raw materials for the BASF Verbund:

- Biogas from organic waste (e.g., kitchen waste)
- Bio-naphtha from vegetable and organic waste oils

International sustainability criteria are applied to feedstock

- Reduction of greenhouse gas emissions
- Environmental and socially responsible biomass production
- Protection of areas with high biodiversity value
- Protection of land with high carbon stocks

→ New feedstocks explored and developed in line with international sustainability standards (e.g. ISCC, RSPO, and others according to RED) and in dialog with NGOs



The role of chemical recycling in a Circular Economy

Different loops are necessary for a successful transition towards circularity

Chemical recycling (pyrolysis)

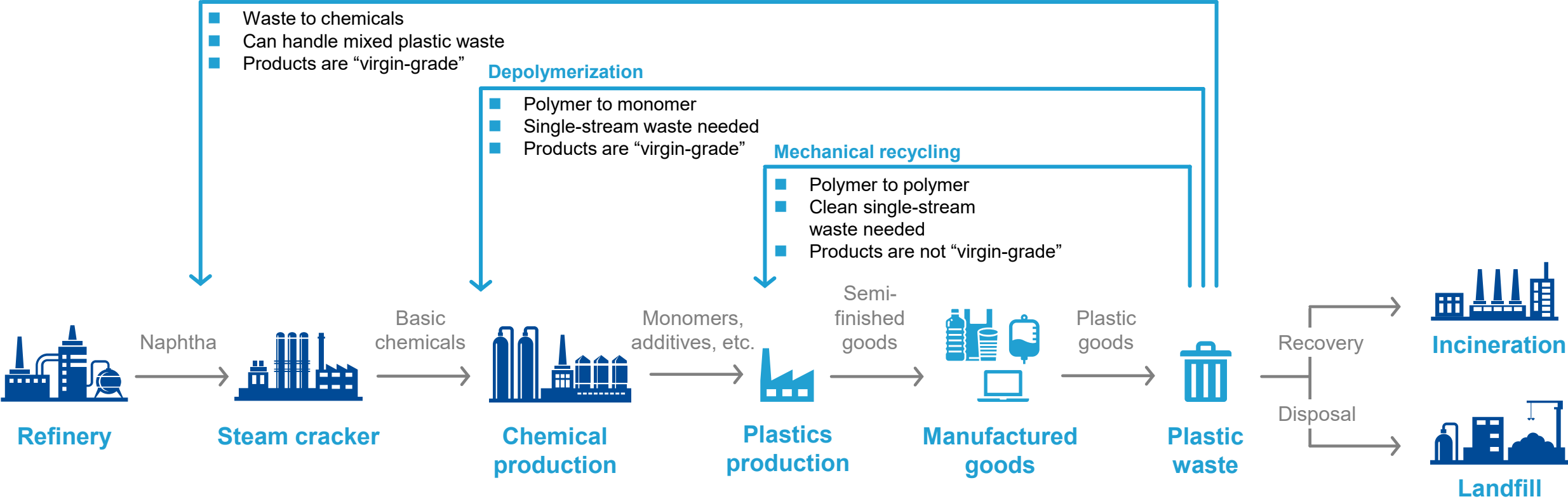
- Waste to chemicals
- Can handle mixed plastic waste
- Products are “virgin-grade”

Depolymerization

- Polymer to monomer
- Single-stream waste needed
- Products are “virgin-grade”

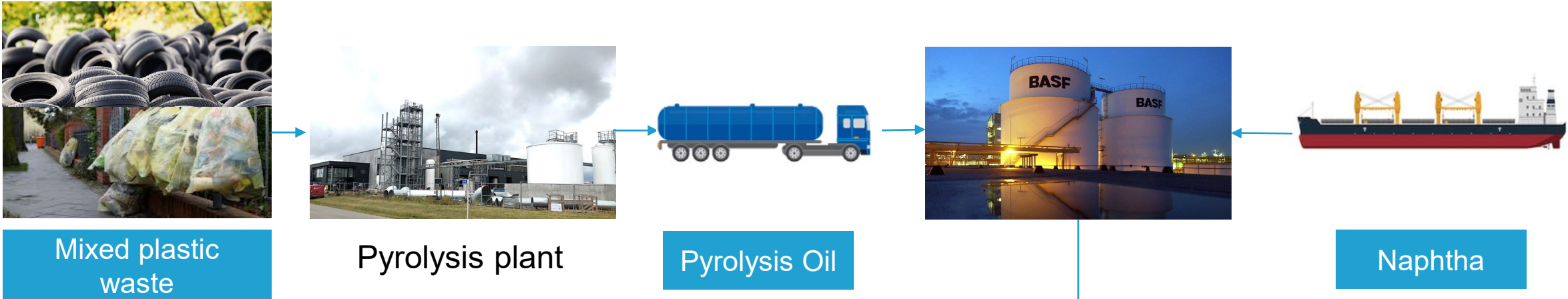
Mechanical recycling

- Polymer to polymer
- Clean single-stream waste needed
- Products are not “virgin-grade”



ChemCycling™ is complementary to mechanical recycling.

Mixed plastic or EoI tire waste is recycled into pyrolysis oil and PA 6



Ludwigshafen



Syngas Plant

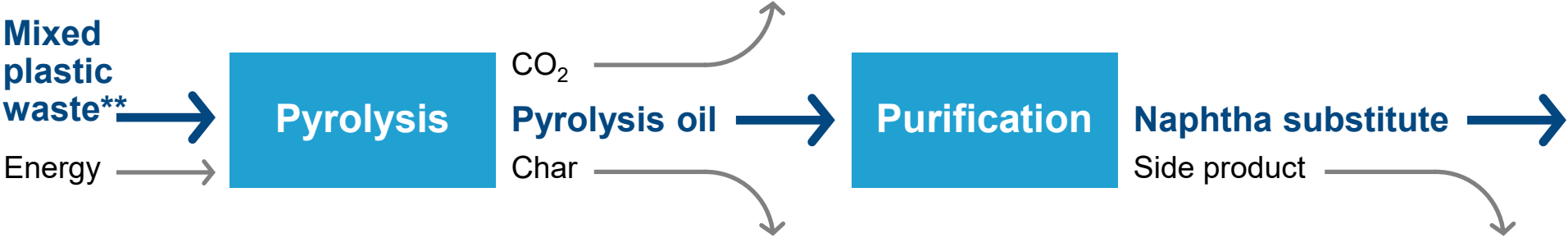
Cracker



Pyrolysis of mixed plastic waste

An efficient process to produce a secondary raw material for the chemical industry

- About 70% of the mixed plastic waste can be converted into pyrolysis oil
- Almost no external thermal energy used: Pyrolysis gas generates the energy required for the process
- Only a small amount of the input materials are residues and must be incinerated
- Plastics based on pyrolysis oil can achieve 100% identical quality as fossil-based plastics*



→ Suppliers | BASF →

15 * under application of a mass balance approach
** from a sorting plant

Polyamide multi-layer packaging can be chemically recycled

- Pyrolysis led to ~ 70% oil. Yield can be affected by reactor type and operating temperature
- Trial example:
 - Lower barrier film: 97% Polyolefins, 3% EVOH Yield: 72%
 - Higher barrier film: 66% Polyolefins, 25% PA, 9% EVOH Yield: 70%
- Pyrolysis oil contains heteroatoms (e.g., N, O). Hydrotreatment is a solution to eliminate them
- Gas phase consists of NH_3 , CO and HCN. Post-treatment of off-gases is typical in the chemical industry!

How will these results translate to real-life scenarios?

- Multi-layer PA containing film is a very small fraction(<5 %) of post consumer waste
- Mid-term, hydrotreatment recommended for **any** pyrolysis oil produced from post consumer waste!
- Short term, a Syngas plant can be used as it has higher tolerance for Nitrogen
- BASF commitment to process 250kt of Plastic Waste by 2025, with special attention to Polyamide

Sustainable PA6 Ultramid® Ccycled™ products with TDS, Food Contact Certificate and third-party certification are already available

Product Information
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August 2020



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® = registered trade mark of BASF SE

Ultramid® B36 LNV-Ccycled™ postC 1

Product description

Ultramid® B36 LNV-Ccycled™ postC 1 is a polyamide 6 grade of intermediate to high viscosity that is well suited for the production of cast and blown film. Clarity and thermoformability are enhanced by the incorporation of nucleating and slip agent.

Specification	Test method	Unit	Value
Relative Viscosity (RV) 1% [m/v] in 96% [m/m] sulfuric acid	According to ISO 307 (calculated by Huggins method)		3.49 - 3.71
Viscosity Number (VN) 0,5% [m/v] in 96% [m/m] sulfuric acid	According to ISO 307	ml/g	210 - 226
Moisture content	According to ISO 15512	% [m/m]	max. 0.06
Extractables	According to ISO 6427-chips not ground/16h	% [m/m]	max. 0.4
Lubricant	BASF method	(mg/kg)	250 - 550
Nucleating agent	BASF method	(mg/kg)	250 - 550
Film grade	BASF method		1 - 3

General properties

Test method	Unit	Typical value	
Melting point	According to ISO 3146	°C	220
Density	According to ISO 1183	g/cm ³	1.12 - 1.15
Bulk density		kg/m ³	780
Pellet size		mm	2 - 2.5
Pellet shape			round
Water absorption, 23°C/50% rh		%	2.6
Water absorption, saturation in water 23°C		%	9.5



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Food Contact Certificate

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Product: ULTRAMID® C40 L Ccycled™ postC 2
Revision: 01.01.2021

Version: 1.0

Contact:

BASF SE
Carl-Bosch-Straße 38
67056 Ludwigshafen, Germany
plastics.safety@basf.com

European Union

Presuming appropriate processing the product can be used in the countries of the European Community for food contact materials or articles according to article 3 of Regulation (EC) No 1935/2004 (Regulation (EC) No 1935/2004 of the European Parliament and of the Council of 27th October 2004 on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC and 89/109/EEC). Compliance with the provisions of Regulation (EC) No 1935/2004 especially the suitability of the articles for the given application, the effect on smell and taste of the food, and observance of any given limitations, must be ensured by the person who introduces the articles into circulation (see the last paragraph).

The specific restrictions mentioned in Commission Regulation (EU) No 10/2011 most recently amended by Commission Regulation (EU) 2019/1338 of 8 August 2019 have to be ensured.

The composition of the product complies with the requirements of the Commission Regulation (EU) No 10/2011 of 14 January 2011 on plastic materials and articles intended to come into contact with food most recently amended by Commission Regulation (EU) 2019/1338 of 8 August 2019.

The following restrictions have to be ensured:

- Caprolactam (FCM-No 212): SML(T) = 15 mg/kg expressed as caprolactam
- Hexamethylenediamine (FCM-No 305): SML = 2.4 mg/kg

Additional information and/or restrictions are mentioned in Commission Regulation (EU) No 10/2011 as amended for the substances mentioned under the respective FCM-No. (<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:012:0001:0089:EN:PDF>).

The meaning of the abbreviations is:

SML = specific migration limit expressed in mg per kg food
SML(T) = specific migration limit for a group of substances expressed in mg per kg food
FCM-No = unique identification number of the substance



Hereby it is confirmed that the product

Ultramid B33 L BMBcert

is handled / produced by one of the registered operating sites* of the system participant

BASF SE

Carl-Bosch-Str. 38, 67056 Ludwigshafen, Germany

which complies with the requirements of the certification scheme

REDcert²

for the certification of sustainable material flows in the chemical industry. The inspection report documents that the following claims comply with the system principles:

- Fossil resources saving product
- Fossil resources saving product by using renewable raw materials in the value chain
- This product supports / comes with / leads to / entails a 100% substitution of fossil with renewable raw materials in the value chain.

REDcert²-929-35267737-P-0099

This certificate is valid from 01-06-2020 to 31-05-2021.

This product certificate is only valid in connection with the site certificate (issued by TÜV NORD CERT GmbH):

REDcert²-929-35267737



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Commercialized projects: Mozzarella Packaging & Sausage Packaging



Copyright: Tönnies/Zott

Claims and certificates

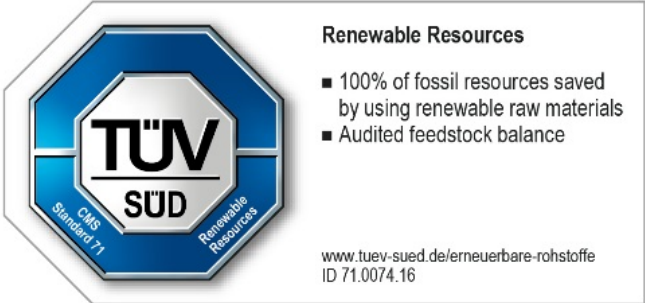


“ Fossil resource saving product. 100 % of the fossil feedstock required for the manufacturing of this product was replaced in the production site by renewable raw materials. ”

Certified by TÜV SÜD

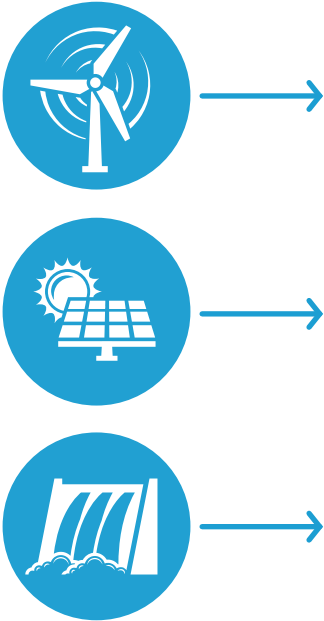
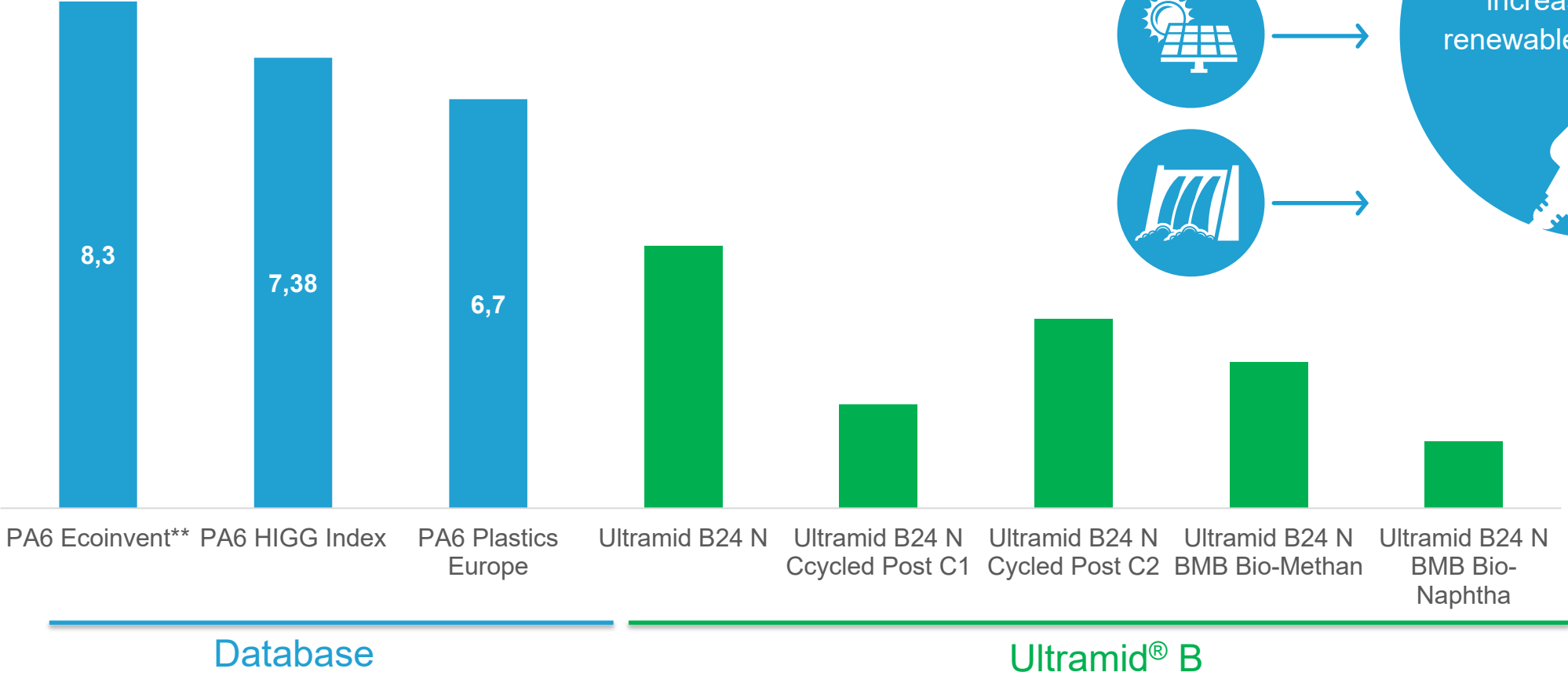
“ The replacement of fossil through renewable feedstock reduces the greenhouse gas emissions by x t CO₂ equivalents per t product. ”

Additional self-assessment of BASF for declaration according to ISO 14021



Ultramid® PCF offerings for our customer

PCF values kg CO₂ eq./kg product



Future Option
 Further PCF reduction by increased usage of renewable power sources

BASF calculates the Product Carbon Footprint based on the ISO standards 14040:2006 and 14044:2006 for life cycle assessment. Values can change if new data or processes or standards will change.

** CFP_carbon_footprint-disclosure-report-181212_Quantis.pdf

Why is BASF's Ultramid® B and C on the lower side of the range?

- BASF is backward integrated and can use own site-specific data
- BASF Verbund structure requires no packaging and transport and uses side-products
- BASF's combined heat and power generation* (cogeneration plant) is more efficient than conventional power plants
- BASF process to produce Caprolactam without N₂O emissions

Relative to the packed food the packing has limited impact on the overall PCF but packing companies and brands have their targets

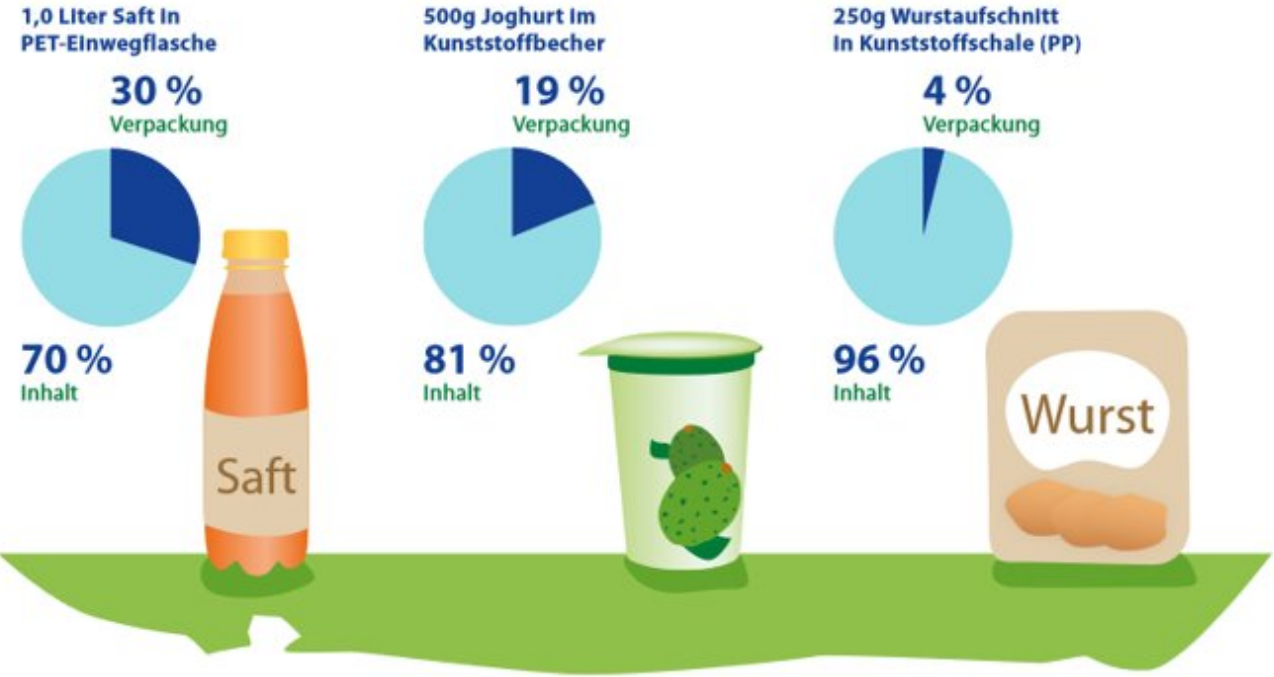


Abbildung 10: Anteil der Verpackung am CO₂-Fußabdruck ausgewählter Lebensmittel (AGVU 2010, basierend auf IFEU 2008)



Constantia Flexibles commits to reduce absolute Scope 1, 2 and 3 GHG emissions **24% by 2030** and 49% by 2050 from a 2015 base-year.



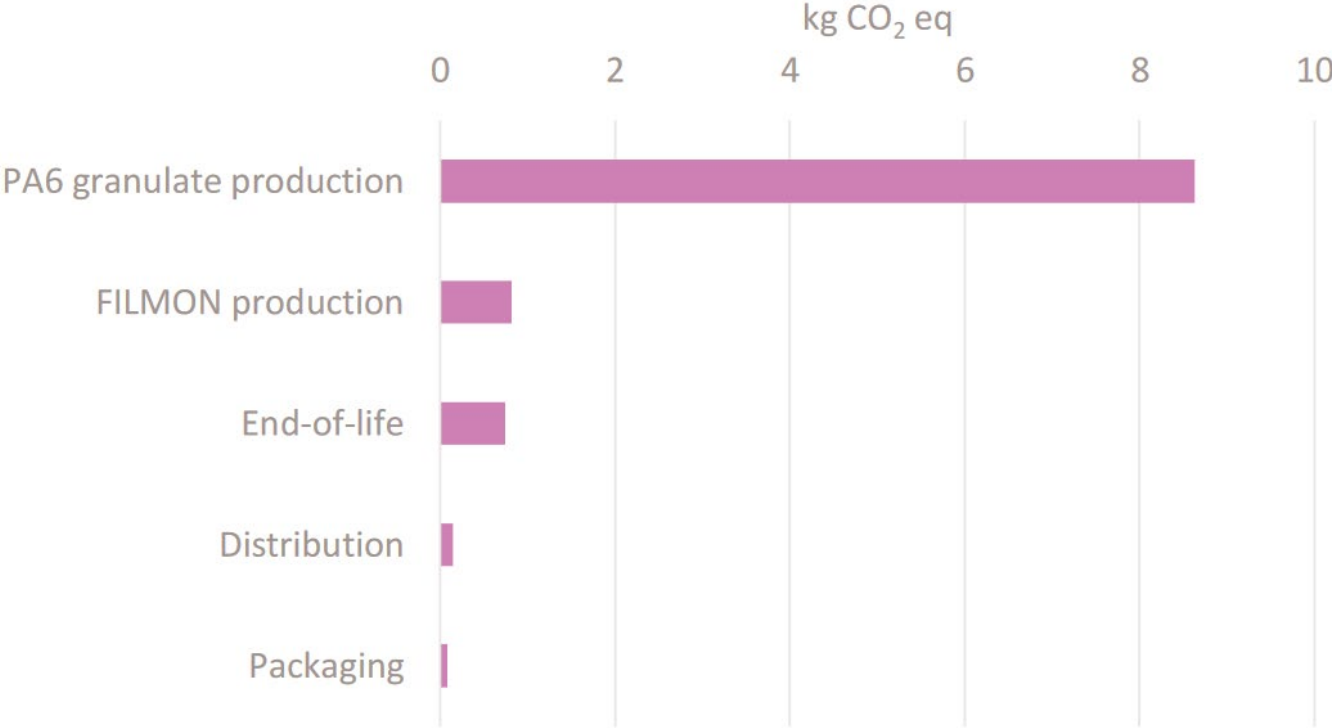
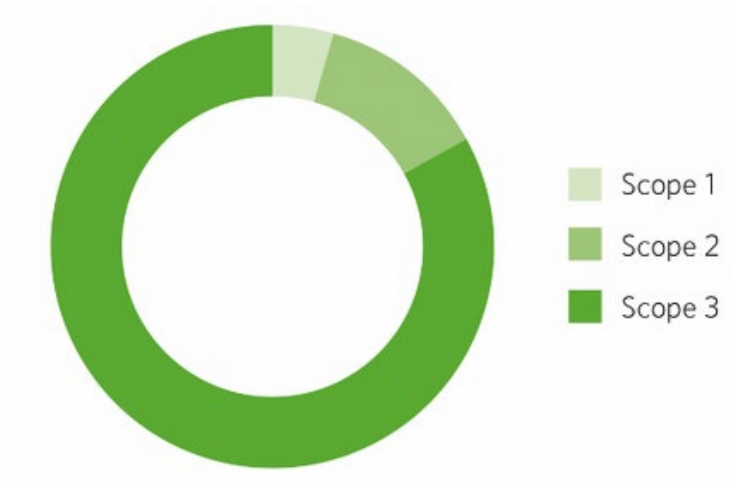
Major producer of dairy products in Europe

Reduce carbon footprint of packaging by **30% by 2030**

Source: <https://www.cflex.com/newsroom/constantia-sets-science-based-target-approved-by-the-sbti/>

The Scope 3 emissions (polymer contribution) is around 80% of a flexible packaging

Absolute GHG Emissions (tonnes CO2e)



Source: <https://www.amcor.com/sustainability-report/enviroaction>

Source: https://www.domofilm.com/wp-content/uploads/2020/03/CFP_carbon_footprint-disclosure-report-181212_Quantis.pdf

Summary

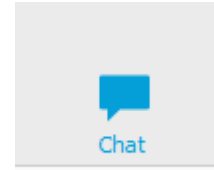
- BASF's Ultramid® B and C grades for film extrusion are on the lower side of Product Carbon Footprint
- BASF Verbund and backward integration enable BASF to offer sustainable alternatives to extrusion grades currently on the market
- Bio-Mass and Pyrolysis oil from post consumer feedstock can be used instead of fossil resources
- A circular economy for Polyamide Multi-Layer films is possible with the pyrolysis of mixed plastic waste - including food contact!
- Ultramid® sustainable extrusion polymers can help our customer to achieve their sustainability targets
- Country specific deduction of recycled or bio-based content from EPR* schemes

*Extended Producer Responsibility

Thank you for listening!

Questions

- But please, feel free to ask questions using the **chat**
- Please **raise your hand**, we will call you, unmute yourself and ask your question



A JOINED-UP APPROACH TO SUSTAINABLE PACKAGING

Our series of web seminars continues!

- March 22 *BASF calculates the CO₂ footprint of its products*
- March 23 *New Ultradur® grades for thermoforming and injection-molding applications with tailor-made property profiles*
- March 24 *Water-based ink technology: a more sustainable solution for flexible packaging*
- March 25 *Pharmaboxes made from Styropor® Ccycled™ go around the world*

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