Gospodarka Obiegu Zamkniętego w BASF

Recykling chemiczny i równoważenie biomasą

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BASF Polska

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Agenda

1. Zrównoważony rozwój i gospodarka obiegu zamkniętego w BASF
2. Alternatywna baza surowcowa w ramach Programu GOZ
   - Recykling chemiczny – ChemCycling™
   - Równoważenie biomasą – Biomass Balance

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Heading towards a sustainable future

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Our purpose:

We create chemistry for a sustainable future

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What we want to achieve

We want to be a thought and action leader in the area of sustainability.

We want to increase the role of sustainability in our business decisions.

We want to show how we add value to society along the value chain.

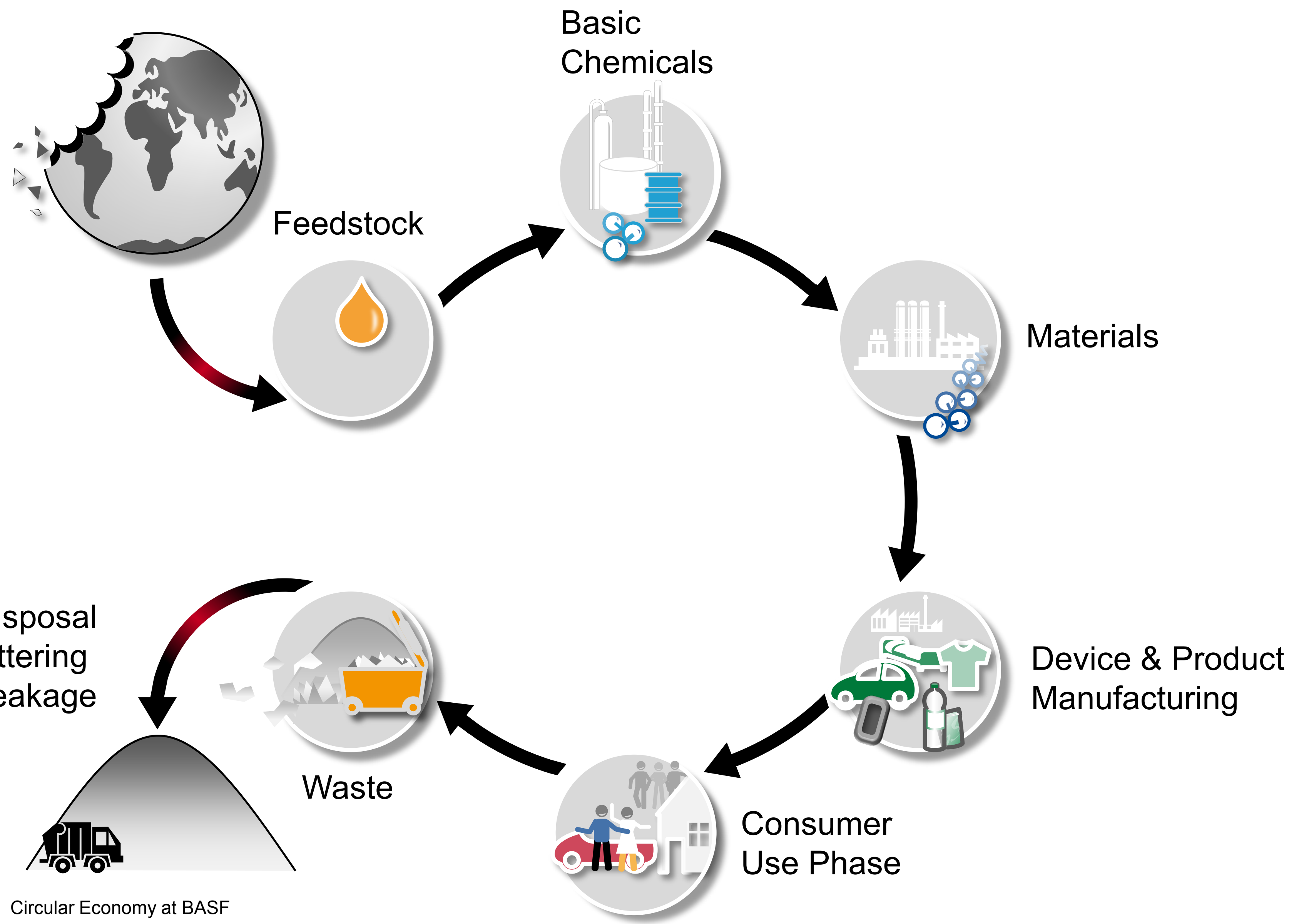
Key measures

Decouple our CO_2 emissions from organic growth through a Carbon Management program.

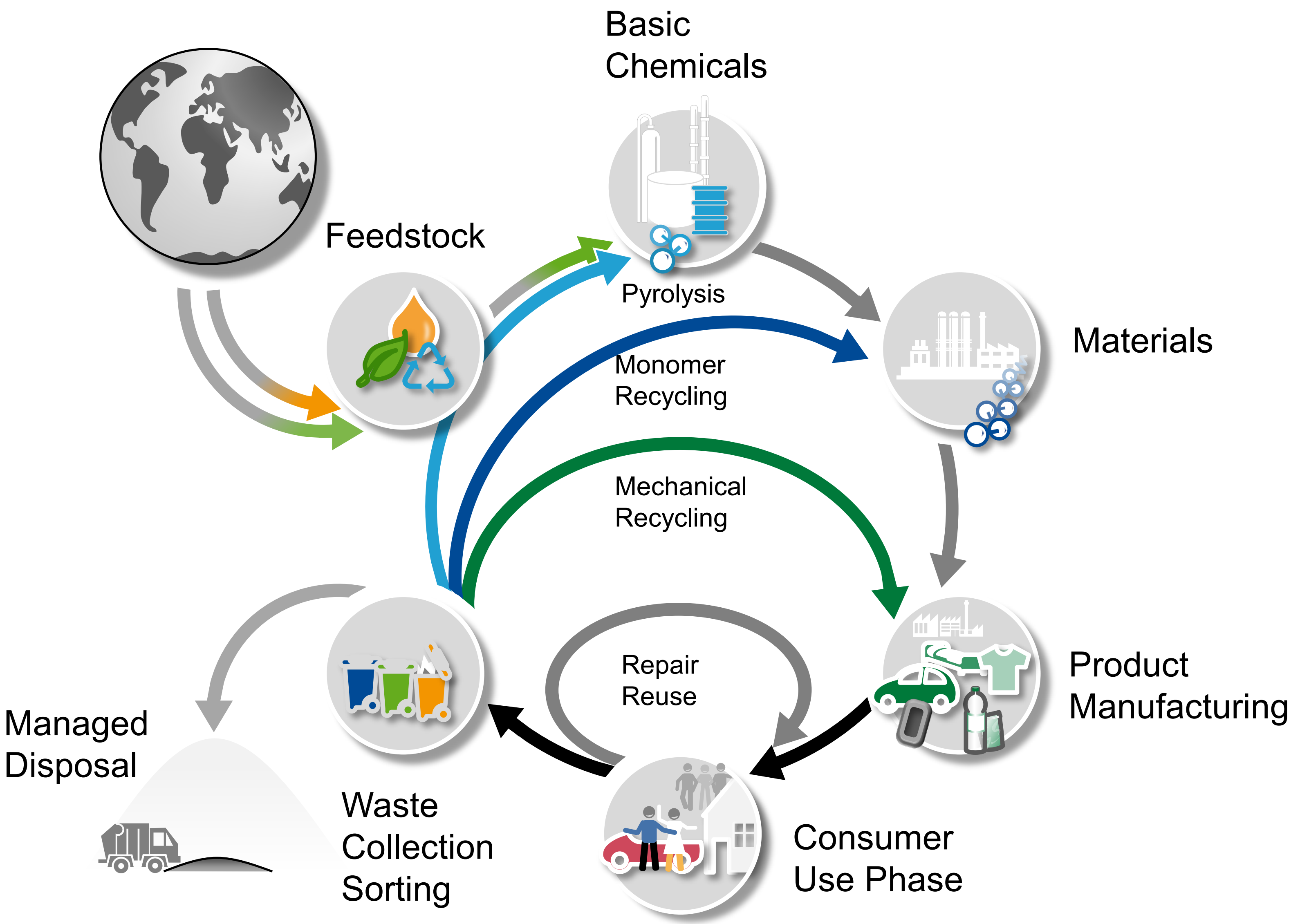
Speed up the transition to a circular economy through a Circular Economy program.

Further increase our sales from Accelerator products, which make a substantial sustainability contribution in the value chain.

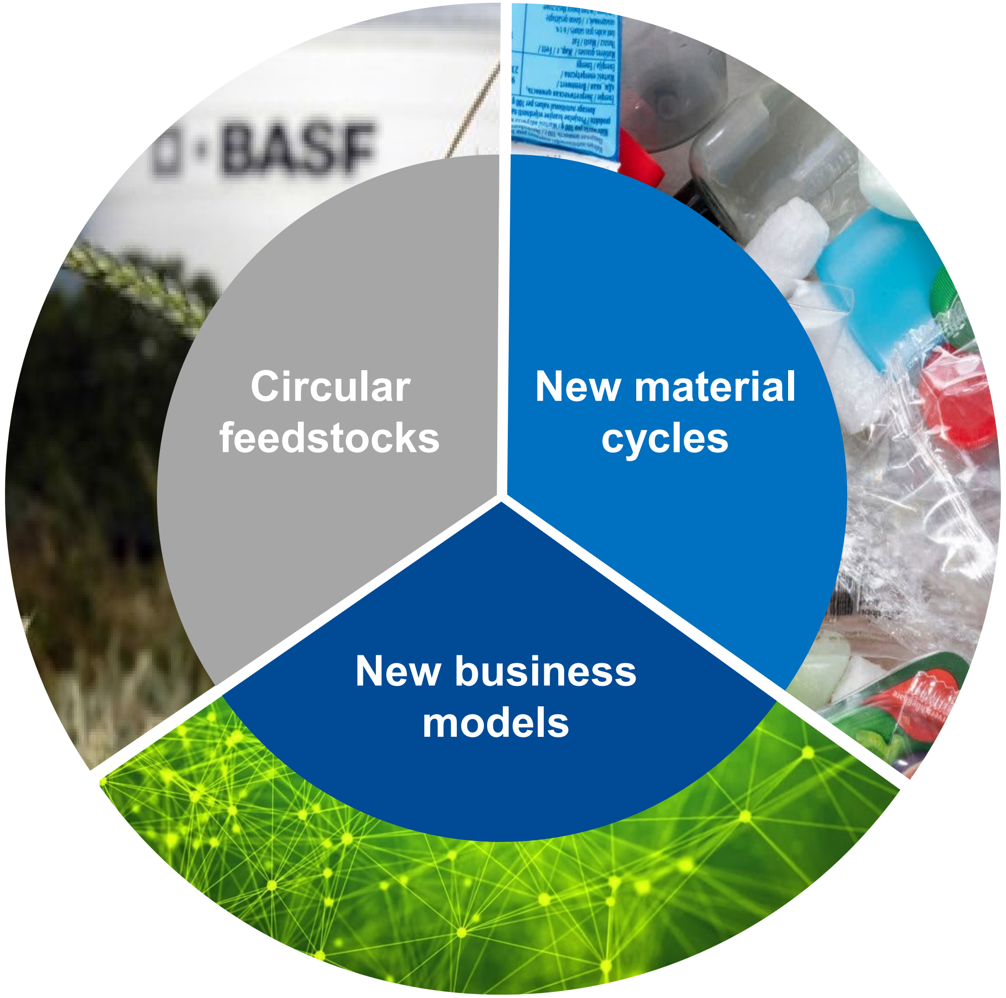
The linear economy: Take – make – dispose



The circular economy: Reduce – reuse – recycle



We have three areas of focus: circular feedstocks, new material cycles and new business models



Circular feedstocks
We will increase the volume of renewable and recycled feedstocks from sustainable sources, also via the certified mass balance approach.

New material cycles
We design materials for circularity, develop solutions which improve or enable recycling and establish product-specific recycling loops.

New business models
We enter new markets, create smart digital solutions and offer new services which allow a decoupling of growth from resource consumption.

By using alternative raw materials, we can manufacture the same products in a more sustainable way

Renewable feedstock

Biomass Balance portfolio

Derived from biomass waste of agricultural production, crop or food processing, or residues

Dedicated bio-based portfolio

Sustainably sourced resources, e.g. RSPO certified

Recycled feedstock

e.g. ChemCycling™

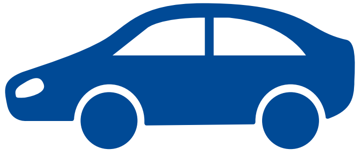
Derived from post-consumer plastic waste or tires

Plastics, plastic waste & end-of-life options

Plastics play an important role in a sustainable and resource-efficient economy

Packaging
Plastics ensure food safety and reduce food waste

Building & Construction
Plastics ensure energy savings and long product life span



Automotive
Plastics ensure weight reduction, fuel-efficiency and safety

Plastic waste is a major global challenge

We must address end-of-life challenges to make full use of plastics' benefits

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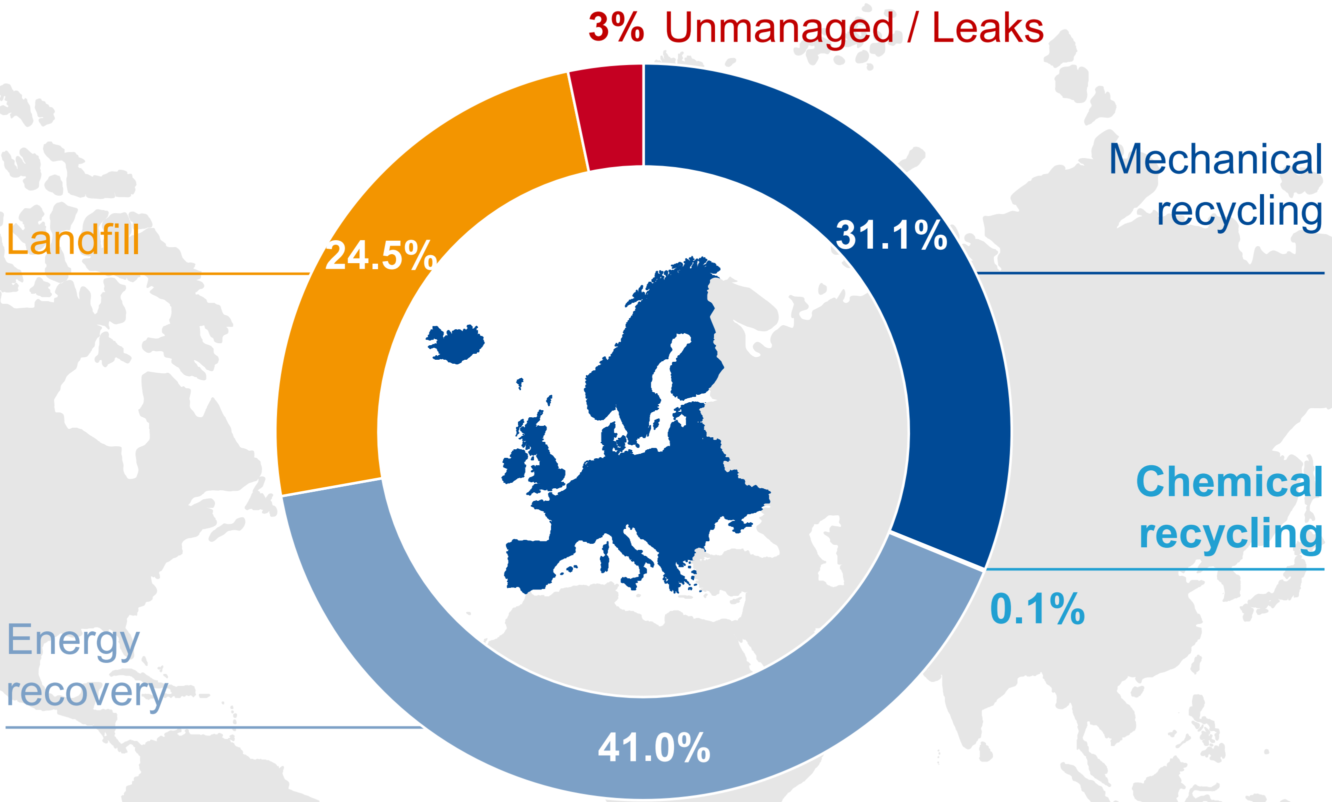
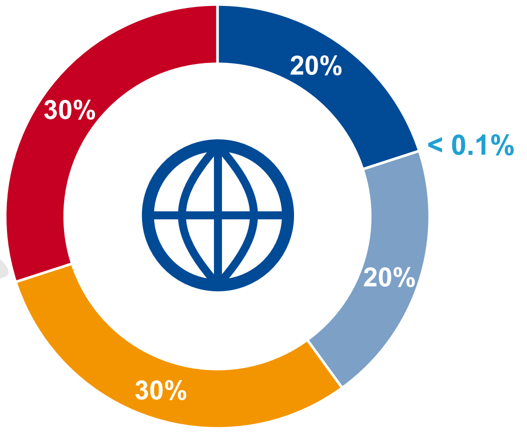
Today's recycling landscape for plastic waste

Fate of 30 million metric tons of plastic waste generated in EU28+2 in 2018



Globally: 250 million metric tons

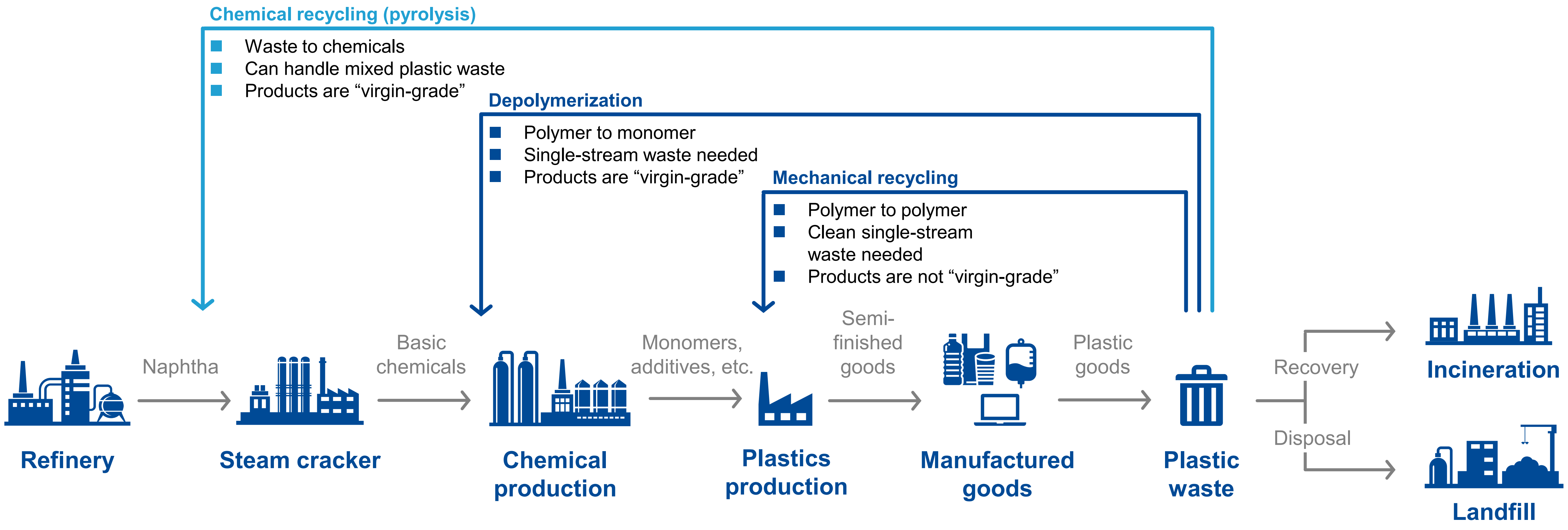


Only one third of all plastic waste is kept in the materials cycle in EU28+2.

Source: Conversio, "Circular Economy of Plastics 2018 EU28+2", September 2019 // Conversio, "Global Plastics Flow 2018", February 2020

The role of chemical recycling in a Circular Economy

Different loops are necessary for a successful transition towards circularity



ChemCycling™ is complementary to mechanical recycling.

Closing the loop for plastics with the ChemCycling™ project

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BASF's ChemCycling™ project

An innovative way to use recycled raw materials for demanding applications

Consumers use and dispose plastic products (e.g. packaging, tires)

Waste companies collect and sort the waste and supply BASF's technology partners with it

Our partners convert the plastic waste into pyrolysis oil through a thermochemical process

Pyrolysis oil is purified to be used as feedstock at the beginning of BASF's Verbund production

BASF can allocate the recycled feedstock to all chemicals produced in this Verbund via a certified mass balance approach

Our customers use these chemicals to make their own products

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BASF's cooperates with Quantafuel, Pyrum and New Energy

Partnerships are part of BASF's efforts to develop chemical recycling as a business

- Pyrolysis of **mixed plastic waste**
- Start-up of plant in September 2020
- BASF supports further development of Quantafuel's technology towards optimizing the output for the use as feedstock in chemical production

- Pyrolysis of **end-of-life tires**
- One production line in operation after 10+ years of optimization
- Ready for roll-out of technology, planning to build additional production lines with partners

- Pyrolysis of **end-of-life tires**
- One plant in operation after almost a decade of optimization
- Feasibility study underway that targets the adaption of New Energy's technology to the conversion of other plastic waste streams

Pyrolysis oil from end-of-life tires is additional raw material source next to oil from mixed plastic waste, the use of which is the long-term focus of the ChemCycling project

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Examples for customers applications made with Ccycled™ products

Commercial product –

in the German market since summer 2020

> The innovative packaging based on recycled raw materials is a perfect match for our new Gutfried organic chicken meat sausage

Maximilian Tönnies, Managing Director
Zur Mühlen Gruppe

Prototyping

> Plastics are vital to car manufacturing and have proven benefits during their use phase, however, plastic waste remains a major global challenge. Solving this issue requires innovation and joined-up thinking between regulators, manufacturers and suppliers

Chris Brown Senior Sustainability
Manager, Jaguar Land Rover

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Benefits of ChemCycling™

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Benefits of ChemCycling™ – Overview

Why BASF is developing chemical recycling for use on industrial scale

Complementary approach to existing recycling methods, thus overall recycling rates of plastic waste will be increased

Contributing to a circular economy as plastic waste is turned into feedstock for the chemical industry

Virgin quality products for demanding applications can be manufactured, e.g. food packaging or automotive parts

Solution oriented end-of-life option for high-performance plastics, e.g. multi-layer packaging

Replacing fossil resources and **saving CO_2 emissions** against conventional plastics production

Supporting our customers in achieving their recycling targets

Life Cycle Assessment of ChemCycling™

Basic Life Cycle Assessment (LCA) ChemCycling™
Conformity to respective ISO 14040 series

Three separate studies

- **Waste perspective:** Comparison of pyrolysis and incineration of mixed plastic waste
- **Product perspective:** Comparison of plastics based on pyrolysis oil and conventional plastics from primary fossil resources (naphtha)
- **Plastics quality perspective:** Comparison of the life cycle of 1t of virgin plastics with three end-of-life options

Panel decision

- **"…the LCA study followed the guidance of and is consistent with the international standards for Life Cycle Assessment (ISO 14040:2006 and ISO 14044:2006)."**
- The background report **and review statement** is available at: www.basf.com

Commissioner / LCA practitioner

Dr. Christian Krüger

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Manfred Russ

sphera™ Advancing Operational Excellence™

Critical Review Panel

Prof. Adisa Azapagic
(Panel Chair)

ETHOS Research Environment · Technology · Society

Dr. Florian Antony

Öko-Institut e.V. Institut für angewandte Ökologie Institute for Applied Ecology

Simon Hann

eunomia

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Basic LCA ChemCycling™

General results

Chemical recycling is attractive in terms of CO_2 emissions – the most discussed LCA indicator

- Pyrolysis of mixed plastic waste emits **50 percent less CO_2 than incineration** of mixed plastic waste
- **CO_2 emissions** are **saved** when manufacturing **plastics based on pyrolysis oil** under a mass balance approach instead of naphtha.
- Manufacturing of plastics via either **chemical recycling (pyrolysis) or mechanical recycling** of mixed plastic waste results in **comparable CO_2 emissions.**

Remaining hurdles

Chemical recycling technology is ready for large scale industrial use

Challenges remain to make technology more broadly applicable and to meet demand

All major plastics producers have engaged in partnerships to overcome technical challenges

Challenge 1: Quality & Efficiency

- Quality of pyrolysis oil is crucial for use as feedstock in chemical production network
- Need for continuous improvement of pyrolysis & purification processes to
  1) increase overall efficiency
  2) to address a greater variety in quality of mixed plastic waste (purification)

Challenge 2: Volumes

- Today's capacities of pyrolysis by far not sufficient to meet the demand
- It is estimated that in the next twenty years several hundred chemical recycling plants will be required globally*

Partnering is Key

Example BASF & Quantafuel

- Quantafuel owns a unique integrated process of pyrolysis of mixed plastic waste & purification of the resulting oil
- Start-up of plant with a capacity of 16,000 tons in Q3 2020; optimization ongoing (according to plan)

QUANTAFUEL

Long-lasting commitment from big plastic producers to investment in chemical recycling capacities & technology is growing

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* Source: The PEW Charitable Trusts, Systemiq "Breaking the plastic wave", p. 32

ChemCycling™ project
Status quo

- First commercial applications and several prototypes realized with customers
- Investments into Quantafuel and Pyrum and collaboration agreement with New Energy to secure supply of pyrolysis oil
- Technological support for partners to gain speed in process development and plant start-ups
- Mass balance allocation and products themselves are certified by independent auditors
- Life Cycle Assessment (LCA) shows how CO_2 emissions can be saved with ChemCycling

We are actively exploring chemical recycling's potential and are constantly working to improve this innovative recycling technology

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The biomass balance approach

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BASF’s Biomass Balance Approach

- Requires **no reformulation** – identical product performance
- **Available** easy and fast for nearly all our products
- **Saves fossil resources** and **reduces greenhouse gas** emissions
- Drives the use of sustainable **renewable feedstock**

The Biomass Balance Approach: Replacing fossil resources in the current Production Verbund

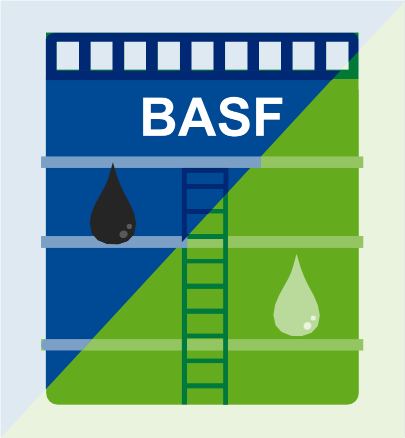
Feedstock

Fossil

Renewable

Use of renewable feedstock in very first steps of chemical production (e.g., steam cracker)

BASF Production Verbund



Utilization of existing Production Verbund for all production steps

Products

Conventional product

Biomass Balance product

Allocation of renewable feedstock to selected products

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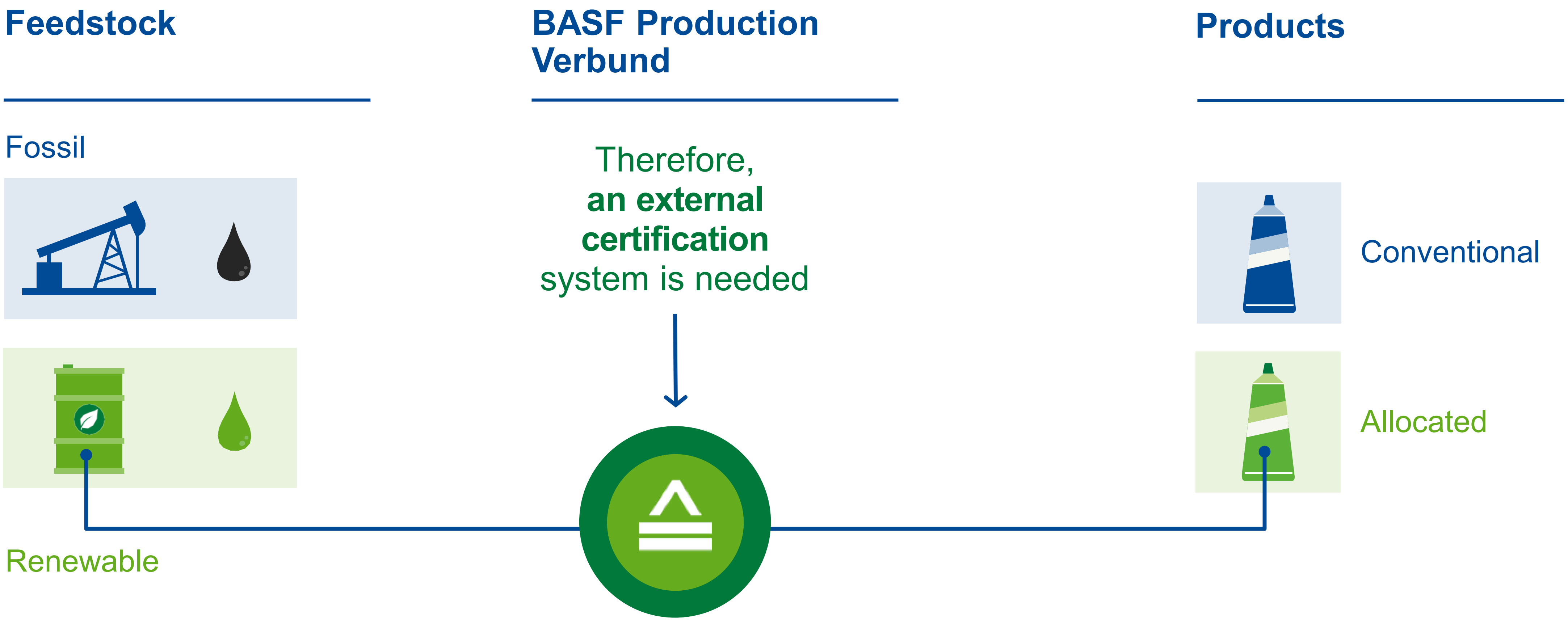
Challenge: Recycled materials cannot be directed to one specific product



Our solution: Certification and standardization

Feedstock

BASF Production Verbund

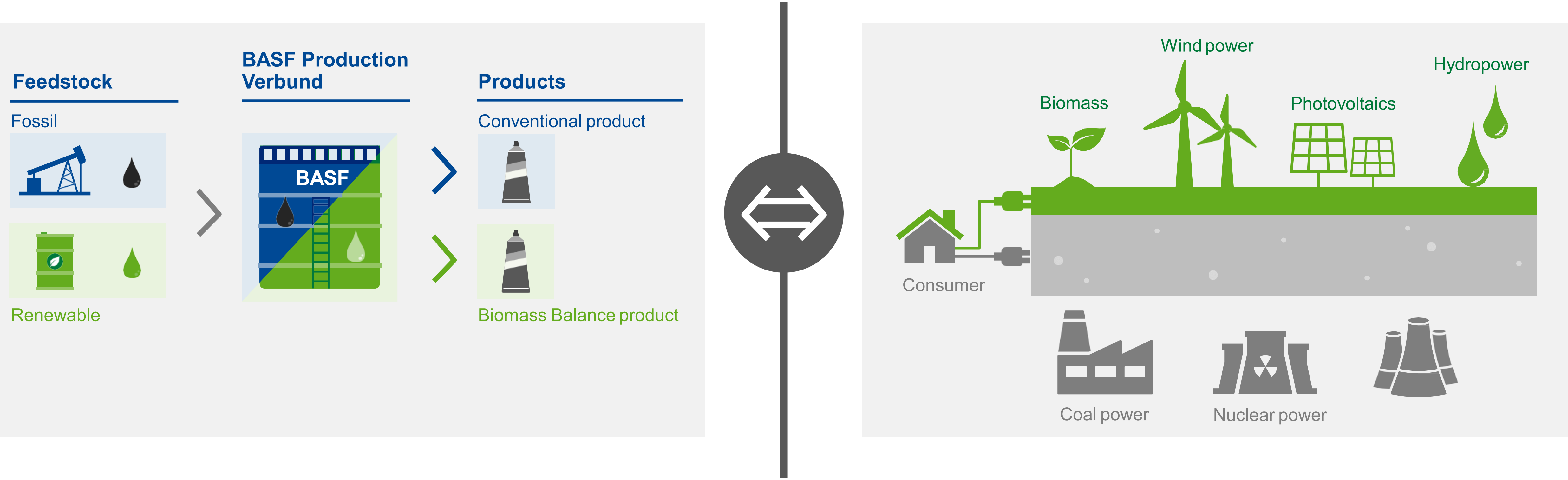
Products

RedCert² ensures the correct allocation of recycled resources in BASF's value chain.

Biomass Balance Approach can be compared to green electricity

Biomass Balance Approach

Green electricity



Renewable raw materials need to be sourced sustainably

Use certified renewable raw materials

- Waste/residues are preferred renewable raw materials
- Independent sustainability certification from recognized schemes, e.g., REDcert-EU and ISCC-EU

Apply standardized sustainability criteria

- Minimum sustainability criteria as in EU RED*
- Greenhouse gas emissions savings
- Responsible biomass production
- Protection of areas with high biodiversity and large carbon stocks

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* Renewable Energy Directive of EU Commission

Industries already benefit from our Biomass Balance products

HySorb® Biomass Balanced –
Sustainable superabsorber for baby diapers

R-M® automotive refinish products

EU-REDcert-Methanol

Glasurit® automotive refinish products

Ultramid® polyamide for textile application

Decorative effect paints with Acronal®

Flexible films for new packaging made of Ultramid®

Acronal® binders for interior paints

Styropor packaging solution

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BASF's mass balance approach for products based on renewable and recycled feedstock

Technical Approach / Tool	…for markets that seek….		
Biomass Balance – Renewable feedstocks used – Co-processing with primary fossil feedstock – Allocation to products via biomass balance (3rd party certified according to REDcert[2])	CO_2 emission reduction	Identical chemical and physical properties	Fossil resource savings
ChemCycling™ – Recycled feedstocks used – Co-processing with primary fossil feedstock – Allocation to products via mass balance (3rd party certified according to REDcert[2])	Waste reduction		

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Dziękuję za uwagę!

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