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Circular Economy

We speed up the transition through a Circular Economy program

Our purpose:

We create chemistry for a sustainable future

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.

Photo: BASF Project ReciChain Brazil

1 million

tons of batteries of electric vehicles will reach their end of life in 2030[1]

only

18%

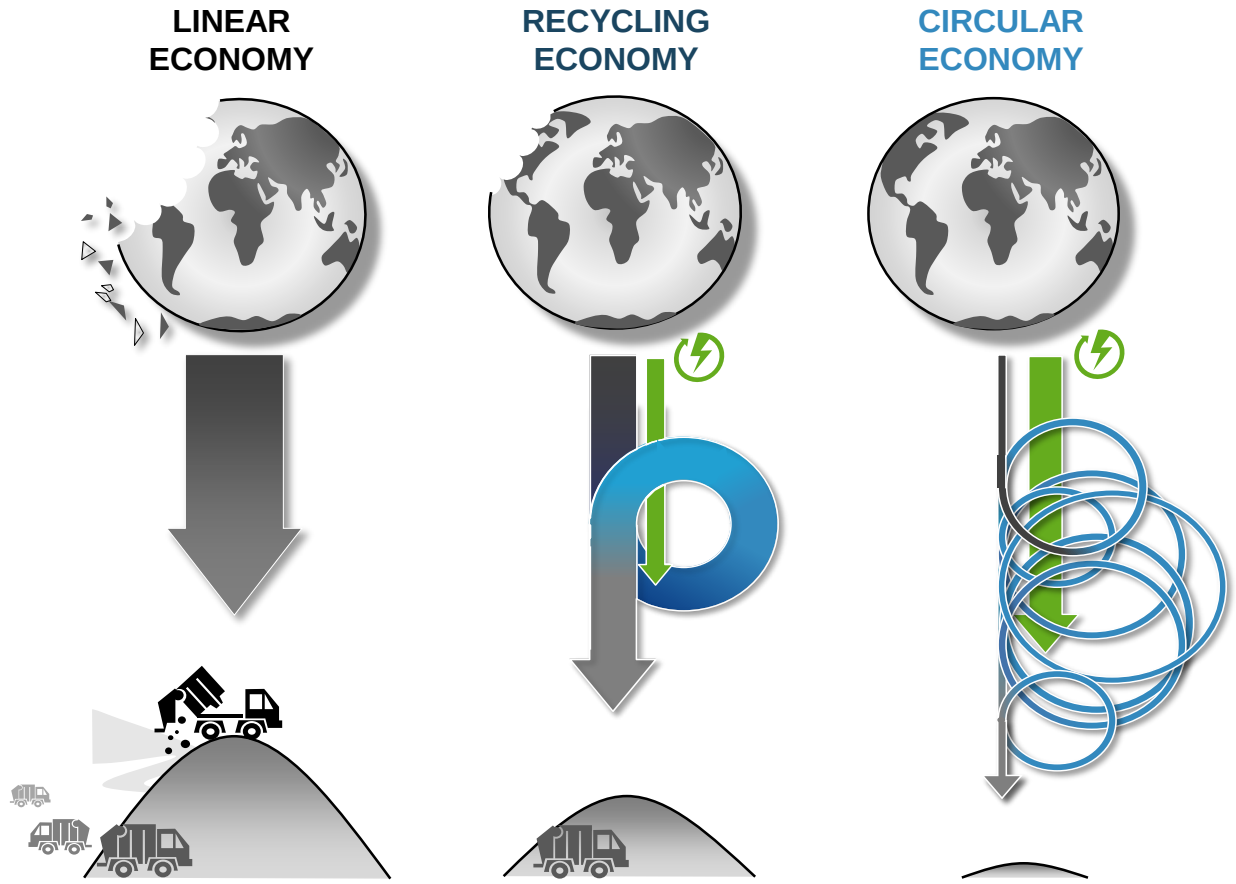
of global plastic waste is recycled[2]

8 million

tons of plastic waste ends up in the oceans per annum[3]

A Circular Economy aims to decouple growth from resource consumption and is regenerative by design

- **Rethink design** and use of resources and **keep** them in **use as long as possible**
- **Recover and recycle** products and materials
- **Avoid waste** and **pollution** and **protect natural systems**



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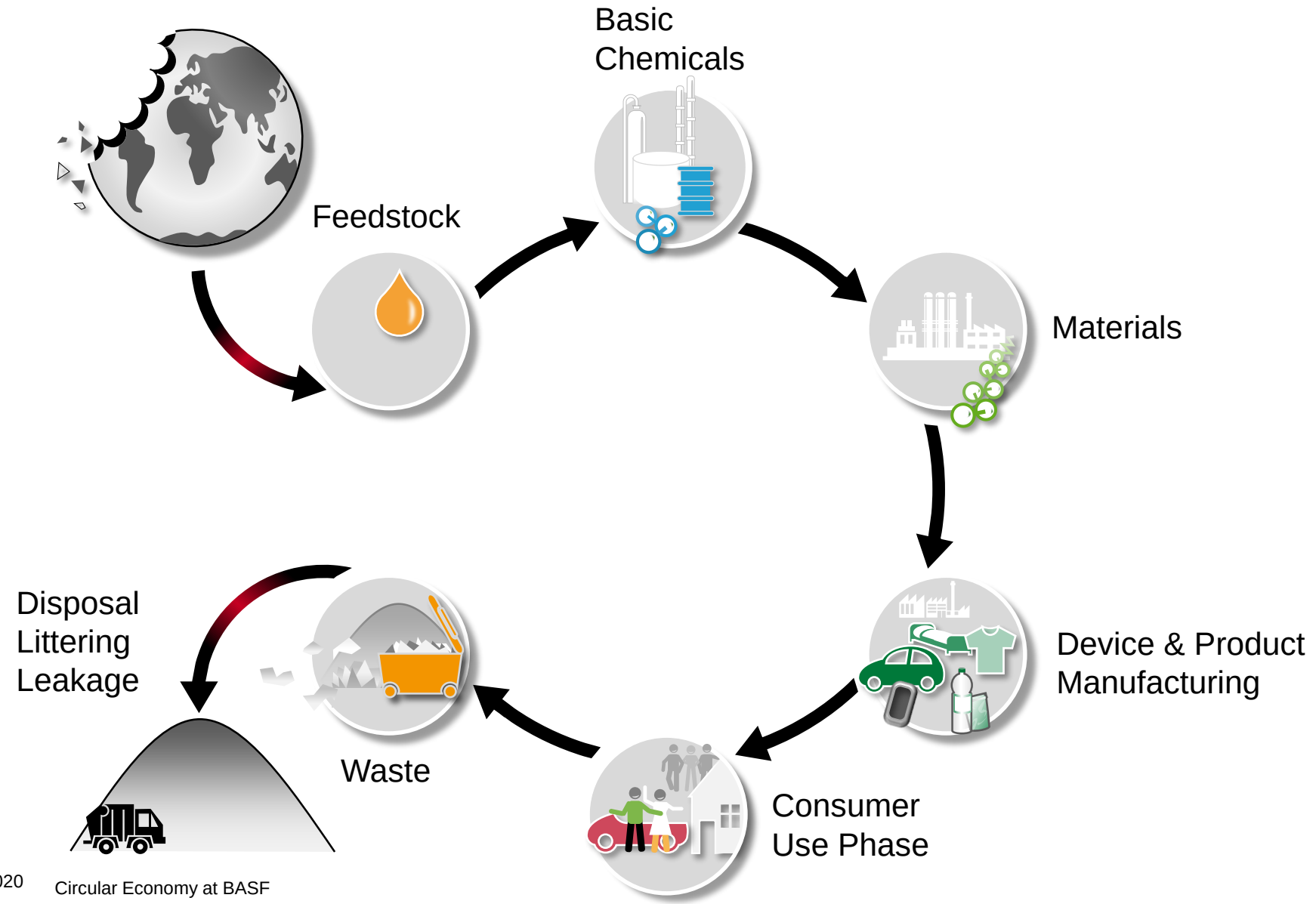
The linear economy: Take – make – dispose



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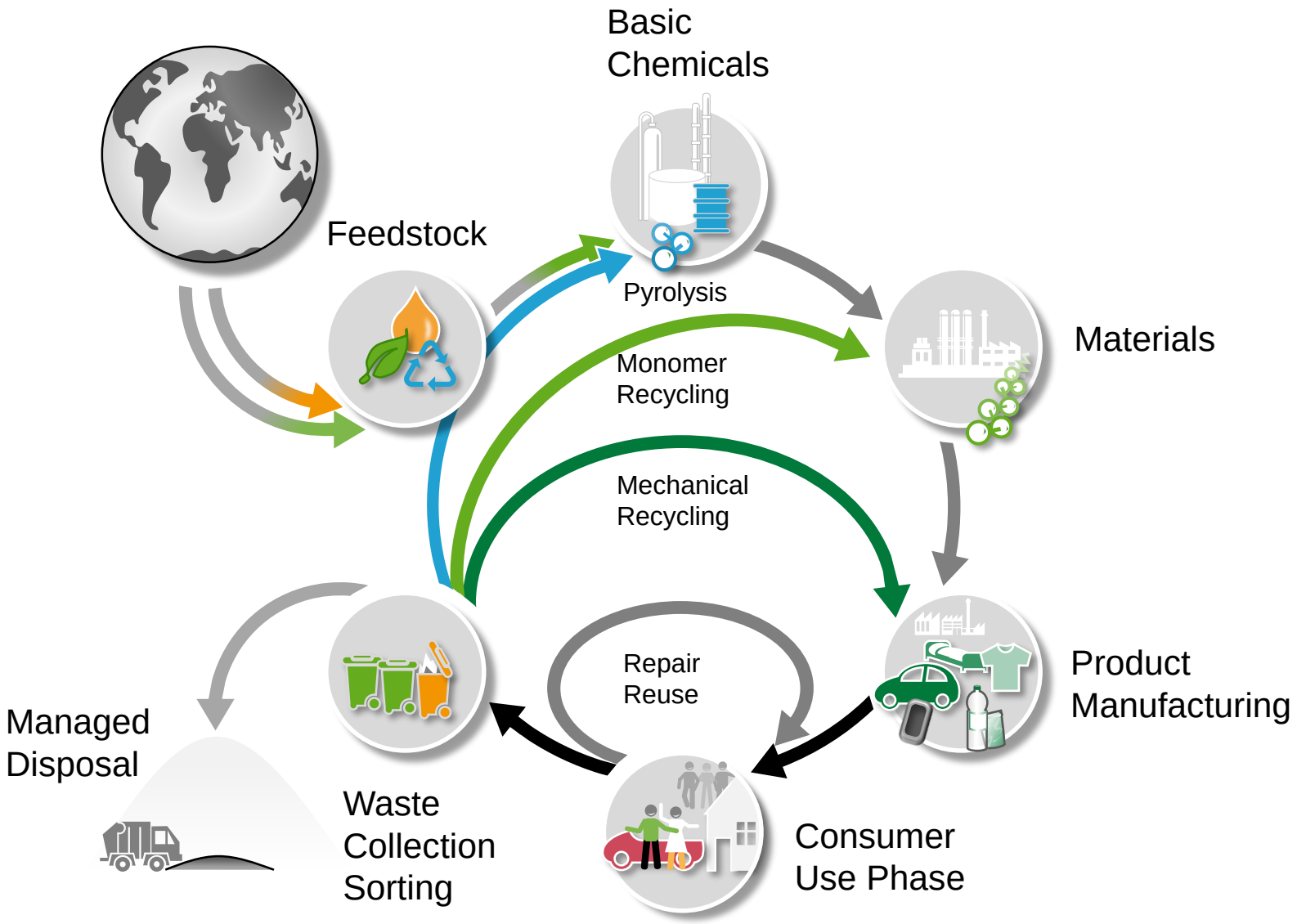
The circular economy: Reduce – reuse – recycle



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Circular Economy Program

How do we drive Circular Economy?

We aim at **doubling** our **circular sales to reach €17 billion** by 2030.

We commit to use **250,000 metric tons of recycled feedstock by 2025** globally.

We run a **Circular Economy Program** to accelerate the transition.

We aim to achieve our circular sales target based on two portfolio concepts

We aim at **doubling** our **circular sales to reach €17 billion** by 2030.

Close the loops

Products which enable the closing of the recycling loop and/or are based on recycled or renewable feedstocks

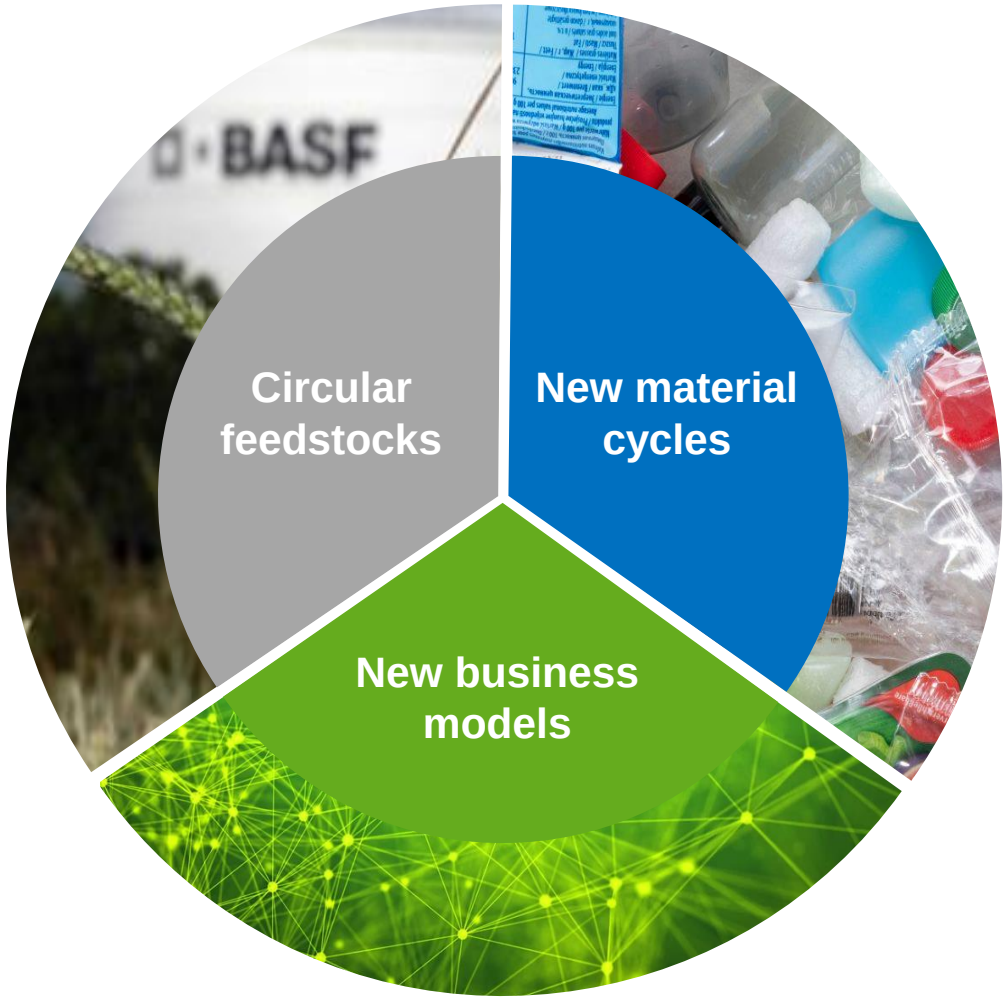
- Renewable-based feedstocks
- Recycled-based feedstocks
- Enable recyclability and/or biodegradability

Extend the loops

Products that perform best with less, and thus help to decouple growth from material consumption

- Save resources and reduce waste along the value chain
- Higher durability to enable product sharing and reduce maintenance

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.

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Circular Feedstocks: ChemCycling™ Biomass Balance

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

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ChemCycling™ is a complementary approach to existing recycling methods

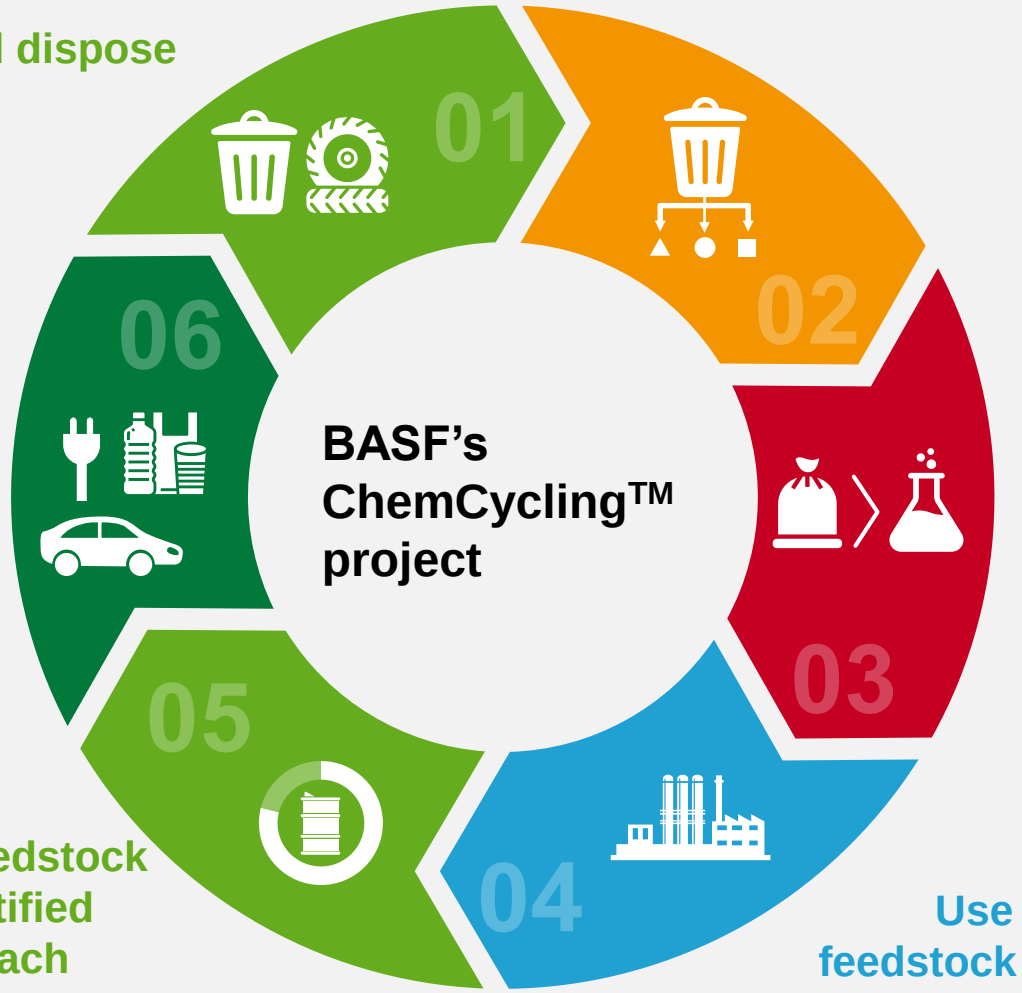
- We contribute to the recycling of **plastic waste for which no high value recycling processes are established** yet

- Examples of waste plastics which are difficult to recycle mechanically or which are incinerated include:
  - Plastics with adhering food residues
  - Multi-layer food packaging
  - Tires

With ChemCycling™ overall recycling rates of plastic waste will be increased

BASF's ChemCycling™ project

Breaking new ground in plastics waste recycling



01 Consumers use and dispose plastic products

02 Collect and sort plastic waste

03 Convert plastic waste into pyrolysis oil

04 Use purified pyrolysis oil as feedstock for Verbund production

05 Allocate recycled feedstock to chemicals via certified mass balance approach

06 Customers use chemicals for their own products

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ChemCycling™ is attractive in terms of CO_2 emissions

Conclusions of an external, critically-reviewed life-cycle assessment (LCA) for ChemCycling™:

- 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.**

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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 feed-stock 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

Renewable raw materials for BMB need to be sourced sustainably

Use certified renewable raw materials

- Waste/residues are preferred, e.g. from paper and wood industry, biogas
- Independent sustainability certification from recognized schemes, e.g., REDcert and ISCC

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

* Renewable Energy Directive of EU Commission

New Material Circles

Certified compostable plastics

Biodegradable and bio-based polymers

- **ecovio®** and **ecoflex®** brands
- Certified compostable polymers
- **ecovio®** is used for organic waste bags, fruit and vegetable bags, carrier bags with dual-use, packaging applications and agricultural films
- Improves the collection and recovery of food waste, helps avoid microplastics in soil
- **ecoflex®** is fossil-based and suited for the production of flexible film products in the packaging industry

Closing the Loop

Battery Recycling

- Using metals from recycled batteries to make new battery materials **offer significant CO_2 reduction** in the production of electric vehicles
- Fortum, BASF and Nornickel have signed a letter of intent to plan **a battery recycling cluster in Harjavalta, Finland**
- With this, BASF will be able to offer **a highly efficient “closed loop” in Europe,** covering all steps in the **recycling value chain**
- Recycling is also essential to **meet the growing demand of critical metals** in the electric vehicle sector

Putting the mattress waste problem to bed

- Every year in Europe, **30 million used mattresses are thrown away**
- BASF aims to **recover high quality polyols** from old mattresses
- How? With a **chemical recycling process** that breaks down the flexible polyurethane foams and enables a closed loop

Petra®

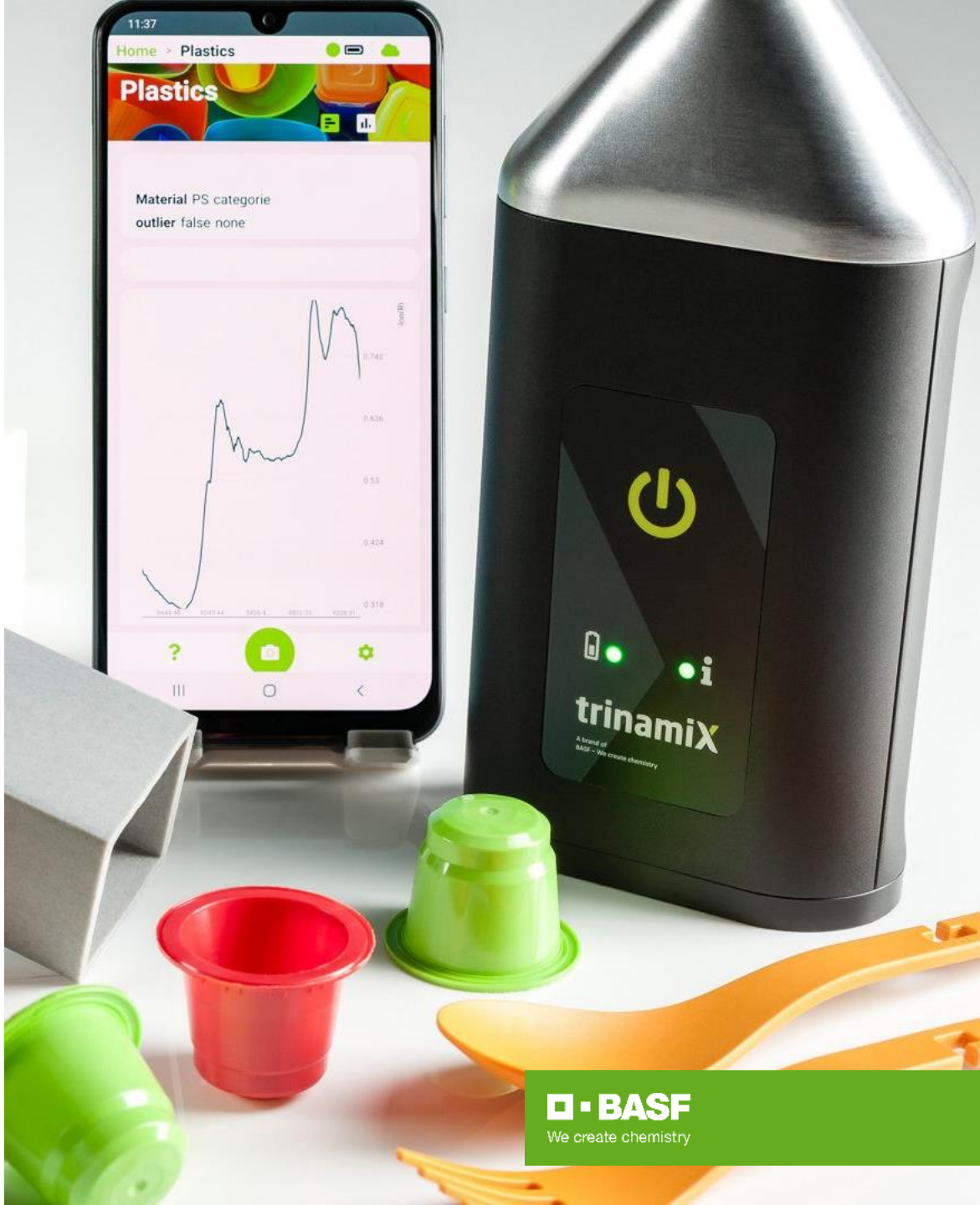
Recycling-based PET

- Petra® grades are based on 100% post-consumer PET bottles
- Performance advantages through high-temperature performance, chemical resistance, good electrical properties and ease of processing
- Applications:
  - Appliance electrical connectors
  - Power tool motor components / housings
  - Appliance handles

New Business Models

Infrared Spectroscopy

- trinamiX GmbH was founded in 2015 as a wholly owned subsidiary of BASF SE
- trinamiX has developed a mobile Near-Infrared (NIR) Spectroscopy Solution to identify plastics for easier sorting
- trinamiX technology can
  - precisely determine diverse compositions of different plastics
  - distinguish via the simple use of a portable handheld device that combines trinamiX data analysis with a mobile app
- Recycling and recyclability are improved, paying off for both the environment and businesses alike



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Smart Solutions in Development by BASF and Security Matters Limited

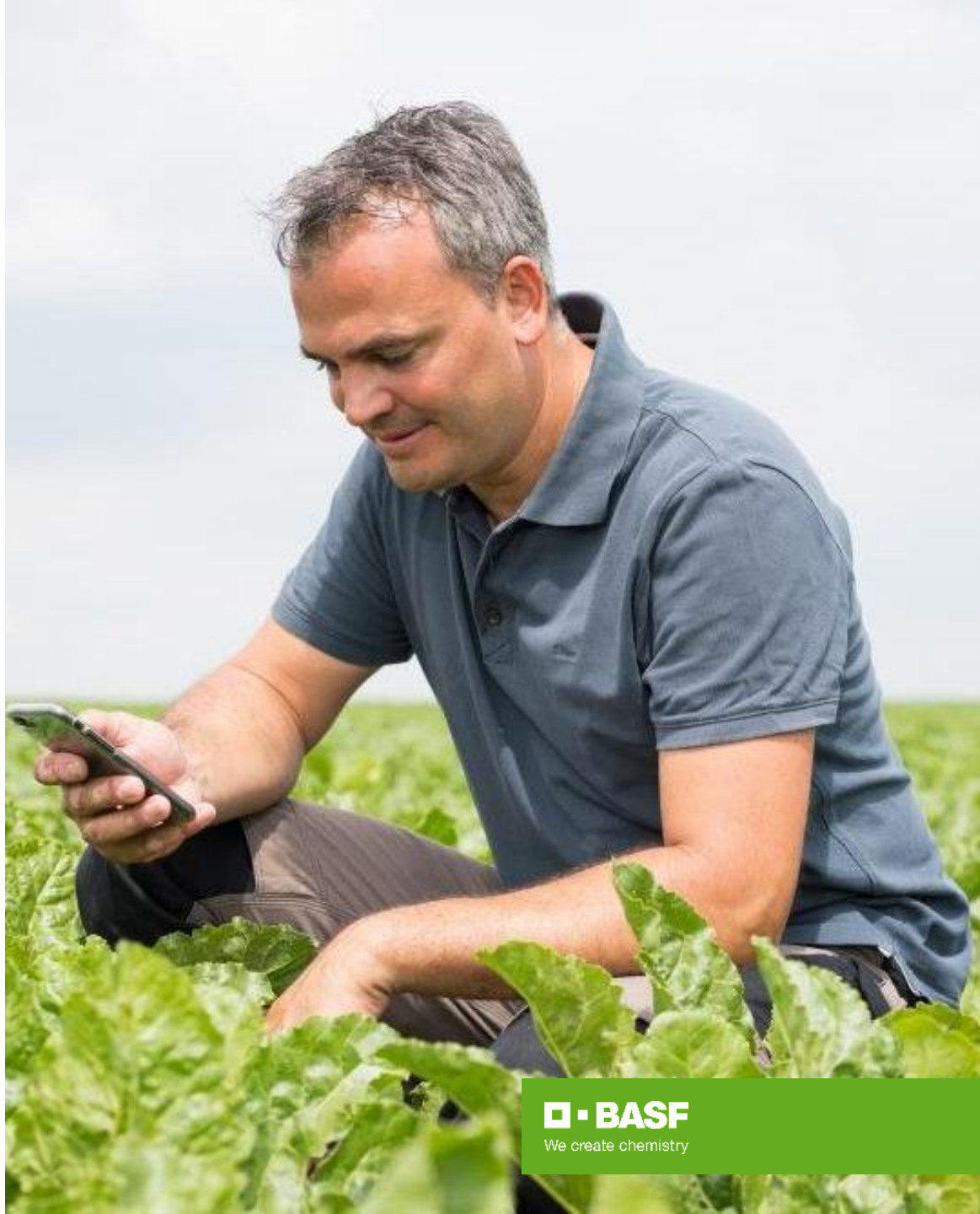
- BASF Plastic Additives supports customers in overcoming the challenges that come with increasing amounts of recycled plastics
- BASF and Security Matters Limited are jointly developing solutions for plastics traceability and circularity to tackle this global challenge
- Security Matters contributes its technology to enable physical and digital tracking of closed loop recycling and to authenticate sustainability claims

xarvio™ – the Future of Farming

- xarvio™ – Digital Farming Solutions offers digital products that deliver independent field-zonespecific agronomic advice enabling farmers to produce their crops most efficiently

- Using xarvio™ means to have a better oversight, less risk and more reliability for planning and managing fields and field zones
  - Use of a mobile app

- The scouting, field manager and healthy fields products are already being used by farmers in more than 100 countries worldwide



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