




# Innovation in chemical recycling

Finding cutting-edge technologies  
to transform plastic waste

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# EU Green Deal

- The European Green Deal comprises a set of policy initiatives by the European Commission with the aim of making Europe climate neutral in 2050 including increasing the EU's greenhouse gas emission reductions target for 2030 to at least 50%.
  - It includes a review of the regulatory framework of existing legislation and introduces new legislations addressing **circular economy, building renovation, biodiversity, farming and innovation.**
  - Policy areas
    - Clean Energy
    - Sustainable Industry
    - Building and Renovation
    - Farm to Fork
    - Eliminating pollution
    - Sustainable mobility
    - Biodiversity
- 
- Circular economy
  - **Toxic free environment**
  - ....

# Chemicals Strategy for Sustainability (CSS)

To ensure a toxic-free environment, the EC presented a Chemicals Strategy for Sustainability:

- All stakeholders including industry work together to combine better health and environmental protection.
- Better use of EU's agencies and scientific bodies to move towards “one substance – one assessment”
- Reflect most recent scientific evidence on the risk of:
  - Endocrine disruptors
  - Hazardous chemicals
  - Cocktail effects
  - Persistence

# Chemicals Strategy for Sustainability (CSS)

- Chemicals are everywhere in our daily life

## Main aims

“This strategy is an opportunity to reconcile the societal value of chemicals with human health and planetary boundaries as well as to support the EU industry in producing safe and sustainable chemicals. It is also an opportunity to respond to the legitimate aspirations of EU citizens for a high level of protection from hazardous chemicals and to promote the EU industry as a global frontrunner in the production and use of safe and sustainable chemicals.”

- CSS is focused on hazard-based policies enabling bans of substances due to their hazardous properties  
→ Aiming for a “Toxic free environment”

Intention is to motivate industry to innovate  
**“safe and sustainable by design”**



# CSS Charts a Long-term Vision for EU's Chemicals Policy

## Safe and sustainable products and production

**1.** Innovation of safe and sustainable EU chemicals

**2.** Stronger EU legal frameworks to address environment and health concerns

**3.** Simplification and consolidation of the legal framework

**4.** A comprehensive knowledge base on chemicals

**5.** Setting the example for a global sound management of chemicals

# CSS – Key Issues

- Re-opening REACH legislation and considering mixture/cocktail effects and endocrine disruptors
- New hazard classes and criteria to be introduced in CLP (environmental characteristics, especially regarding ground water, endocrine disruptors)
- New criteria to define “Substance of Very High Concern” (SVHC)
- More chemicals will be subject to regulatory scrutiny
- Increased enforcement resources
- Withdrawal of existing REACH registrations will be implemented

# The Challenge

- Political ideas and subsequent regulatory developments arrive more or less “out of the blue”
  - EU Green Deal (December 2019)
  - EU CSS (October 2020)
- Societal demand may create market opportunities
- Innovation needs to catch-up with the new developments, but
  - Innovation can hardly be ordered
  - Innovation needs time
  - Innovation needs collaboration within the value chain
  - Innovation has to meet economics

# Sustainability – A Key Success Factor



- Be a leader in the area of sustainability and increase the role of sustainability in our business decisions.
- Decouple our CO<sub>2</sub> emissions from organic growth through a **Carbon Management** program.
- Invest in cutting-edge technologies to speed up the transition to a **Circular Economy**.



# Plasticizer Portfolio of BASF in Europe (2021)

Offering a broad range of products covering different applications driven by **PERFORMANCE**, **CUSTOMER DEMAND** and **REGULATION**

## o-Phthalates

- Palatinol® N (DINP)
- Palatinol® 10-P (DPHP)

## Cyclohexane dicarboxylate

- Hexamoll®
- DINCH

## Adipates

- Plastomoll®
- DOA
- Plastomoll®
- DNA

## Polymeric Adipates

- Palamoll®
- 632
- 638
- 646
- 652
- 654
- 656

## Other types of plasticizers

- Terephthalates
- Trimellitates
- (Di)Benzoates
- Sebacates
- Phosphates
- ...
- ... **BIO / GREEN** ...



# Biomass Balance Approach



Requires **no reformulation** – identical product performance



Saves fossil resources and **reduces greenhouse gas emissions**



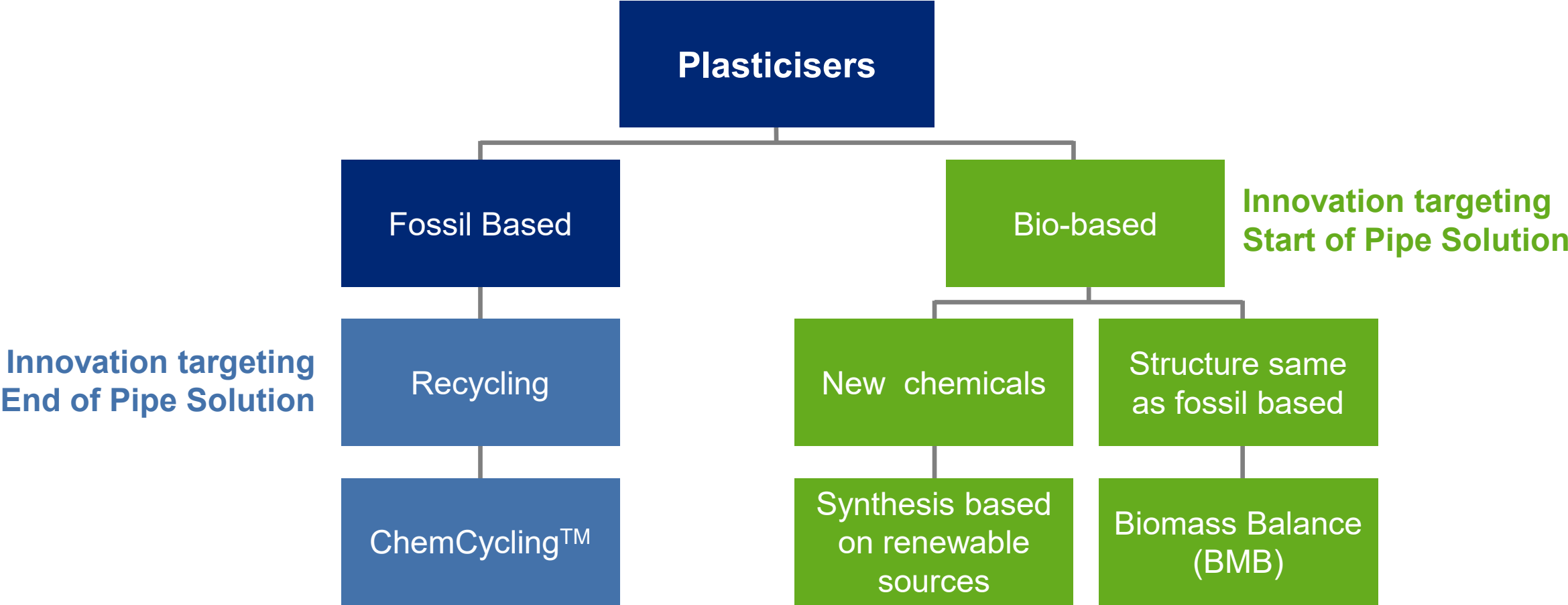
Drives the use of sustainable **renewable feedstock**

## Start of pipe approach

Available for most of our products



# Raw Material Basis for Plasticisers



# Biomass Balance Approach – Replacement of Fossil Resources in Production Processes

## Feedstock

Fossil



Renewable

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

## BASF Verbund



Utilization of existing Production Verbund for all production steps

## Products

Conventional product



Biomass Balance product

Allocation of renewable feedstock to selected products

# Need for Certification and Standardization

## Feedstock

Fossil



Renewable

## BASF Production Verbund



## Products



Conventional



Allocated

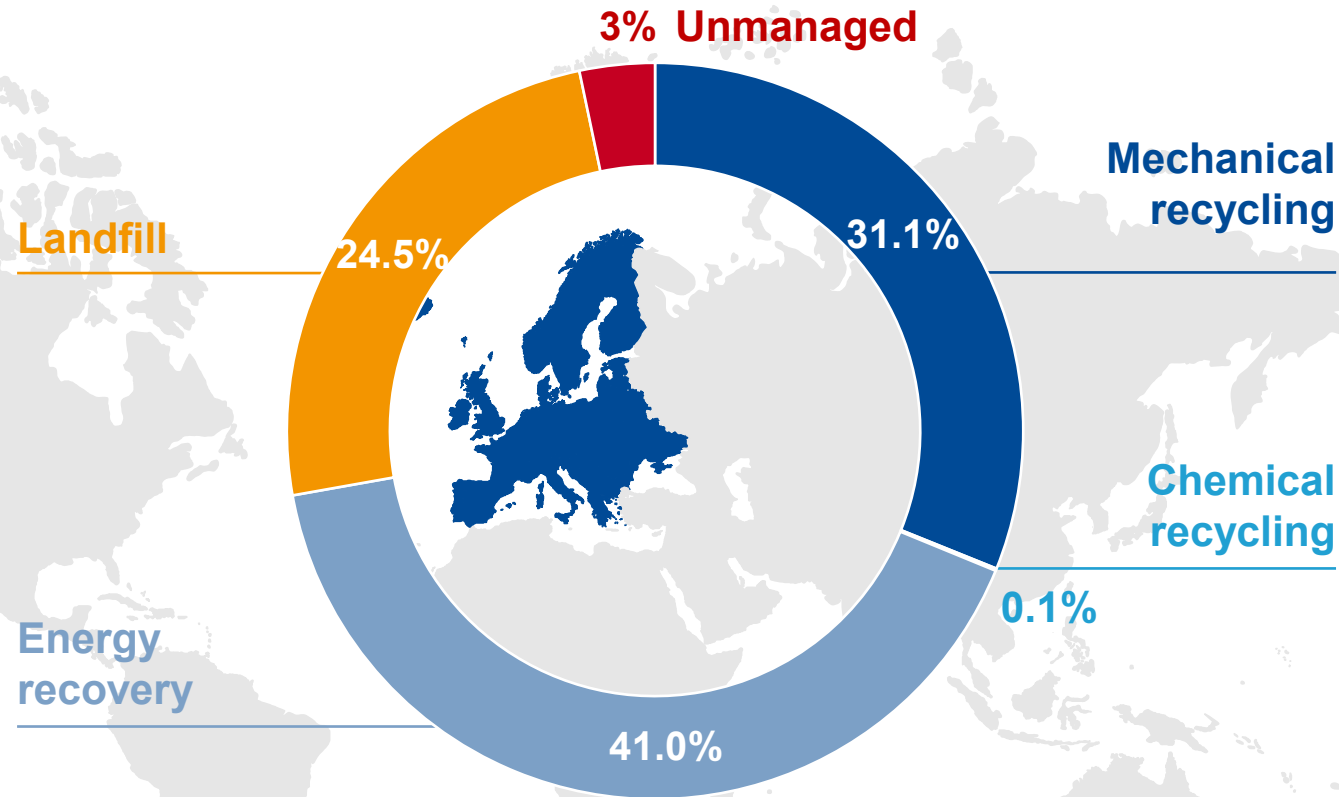
REDcert² ensures the correct allocation of renewable resources in BASF's value chain.

# Plastic Waste – a Global Challenge

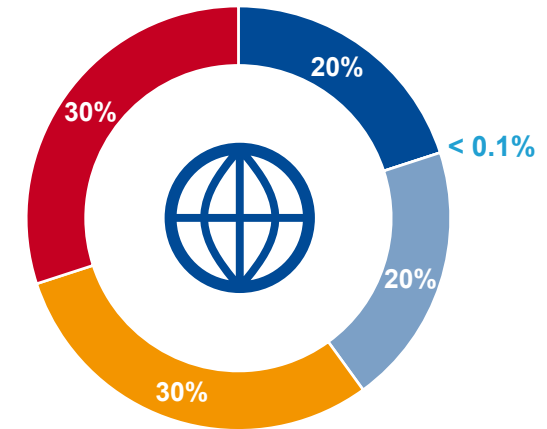


# Today's Recycling Landscape for Plastic Waste

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



Globally: 250 million metric tons

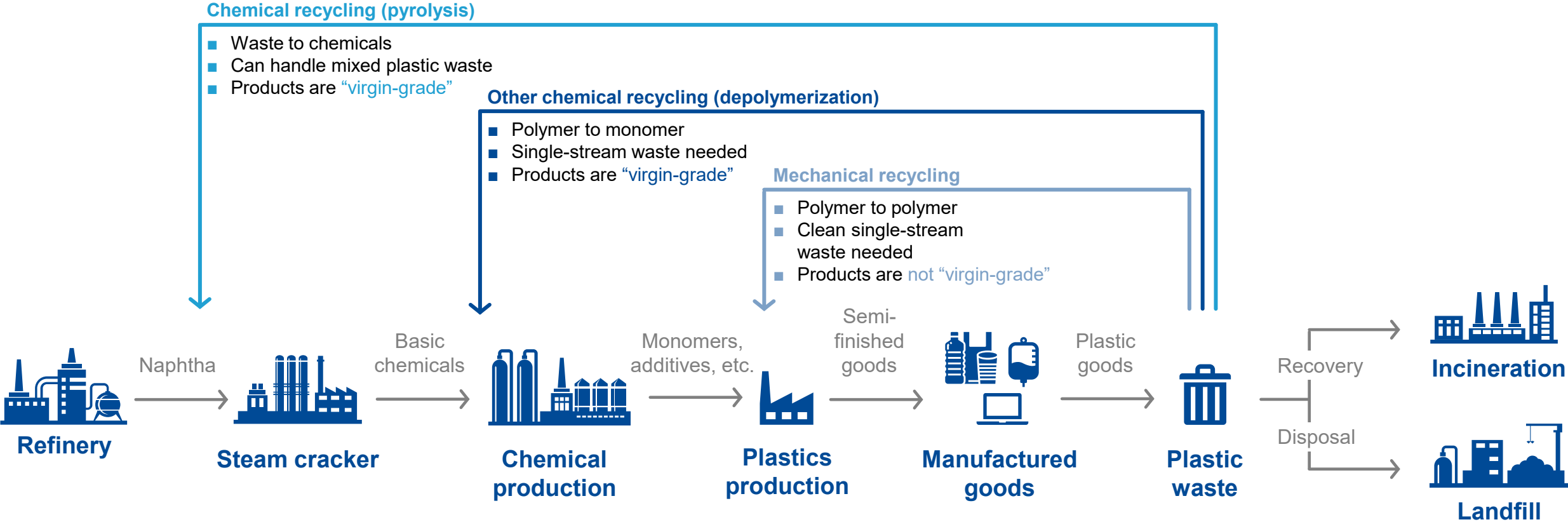


Only one third of all plastic waste is kept in the materials cycle in EU28+2.

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

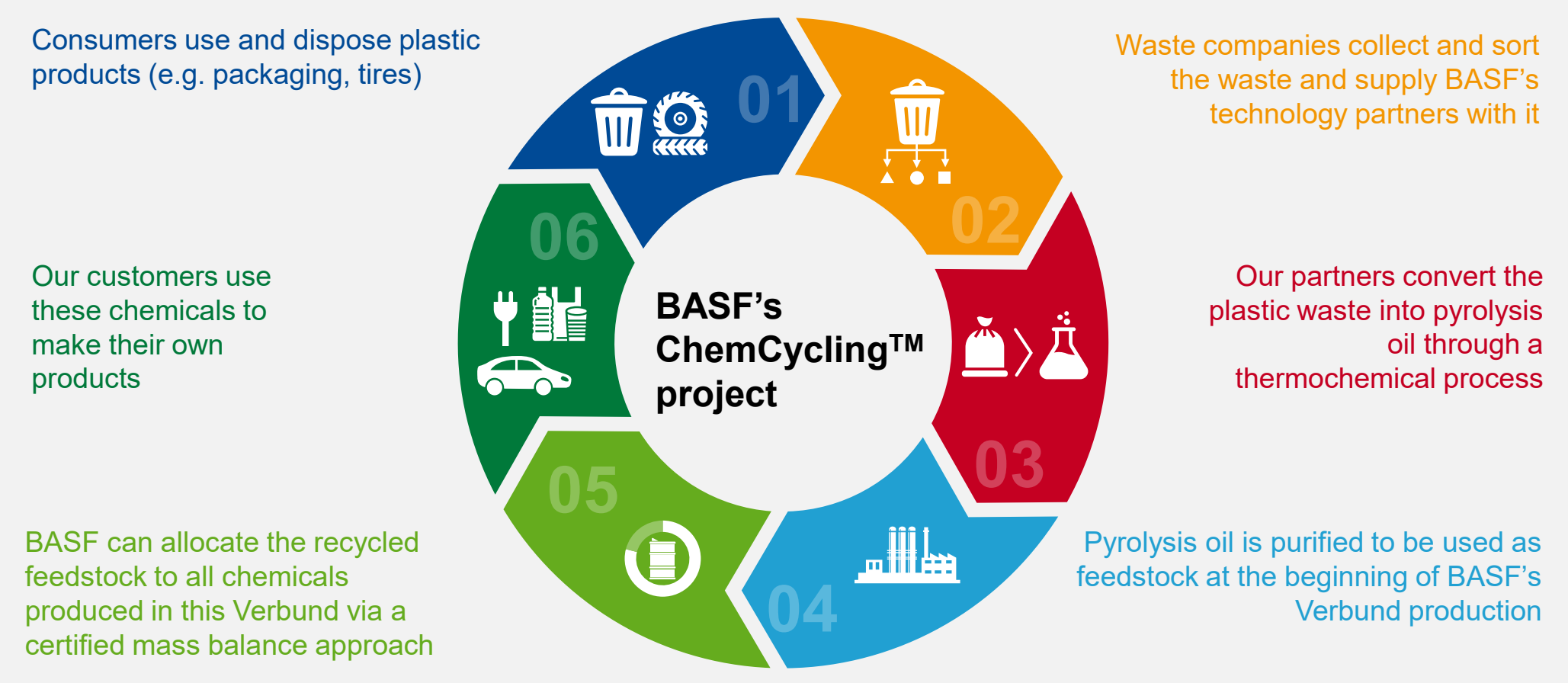
Different loops are necessary for a successful transition towards circularity





# ChemCycling™ Project

## Breaking new ground in plastic waste recycling



# ChemCycling™ is a complementary approach to existing recycling methods

- We focus on plastic waste that is not recycled mechanically for technological, economic or ecological reasons
- Examples include:
  - Uncleaned plastics
  - Plastics with special material compositions, e.g., from automotive
  - Mixed waste fractions, consisting of various plastic types, which are not sorted further due to economic reason
  - Used tires

Overall recycling rates of plastic waste can be increased, and a more circular economy established



# Our solution: Certification and standardization

## Feedstock

Fossil



Recycled

## BASF Production Verbund



## Products



Conventional



Allocated

REDcert² ensures the correct allocation of recycled resources in BASF's value chain.

# Summary

We are well prepared for the tasks ahead

We support our customers to meet their demand for sustainable products

- The BASF plasticiser portfolio meets EU Green Deal and CSS requirements

Major advantages of the smart innovations by ChemCycling™ or BMB products are:

- Established plasticisers are available to customers as Ccycled™ or BMB variants
  - Chemically these variants are the same as the virgin products
    - Registrations in different chemical inventories still apply
    - Approvals for specific applications are still valid
  - No need to adapt production processes at customers



**CSS Ready**



We create chemistry