

CHEMISTRY THAT MATTERS™

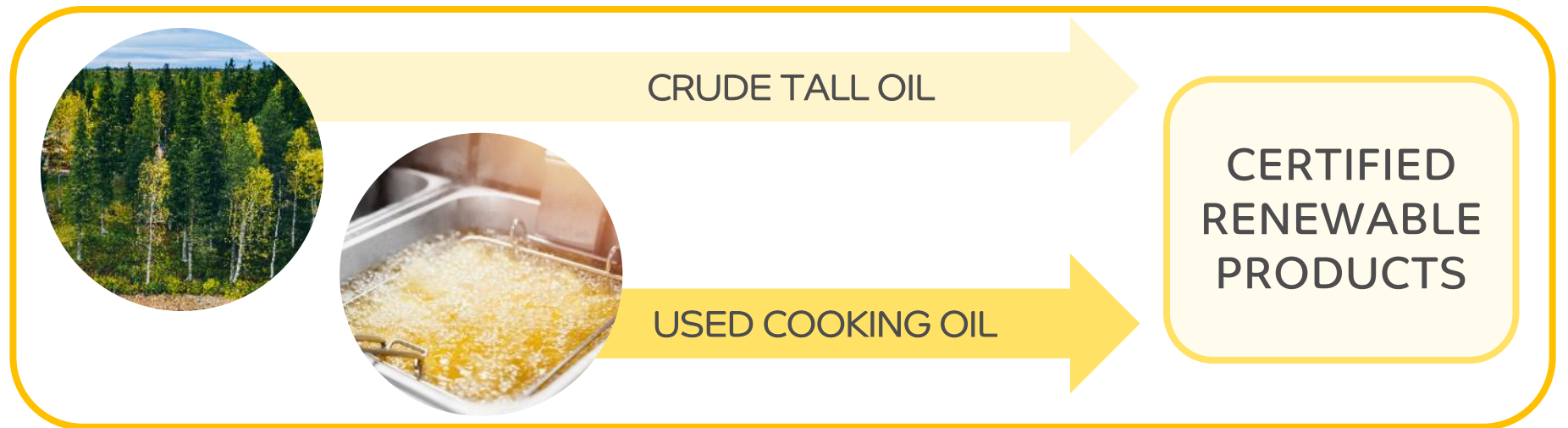
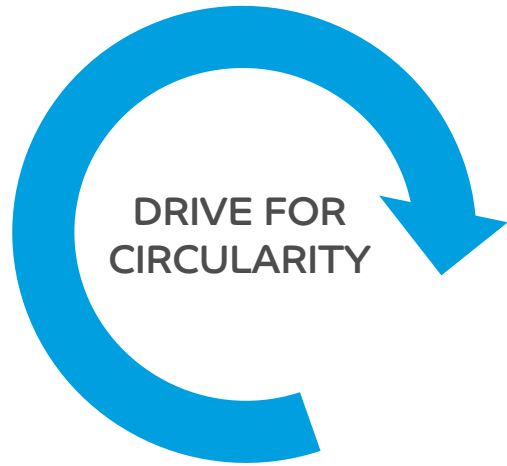


# SABIC TRUCIRCLE™ PROGRAM

TECHNOLOGIETAG “INNOVATIV und NACHHALTIG”  
OBERRIET, Switzerland  
September 08, 2022

Edwin Verhorst  
Lead Engineer, Petrochemicals EUROPE

# THINK OF ...



# WASTE AND OPPORTUNITY

## PUBLIC OPINION



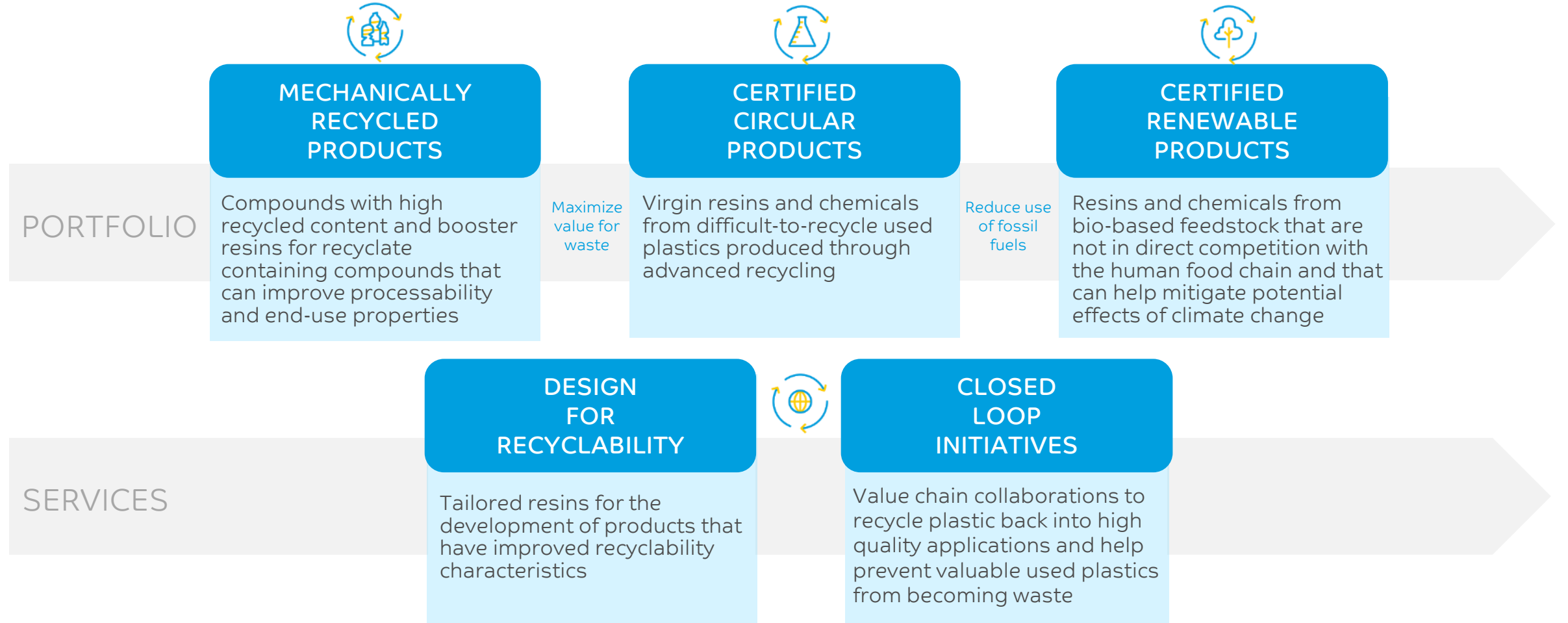
**NEGATIVE ATTENTION TO PLASTICS IN MEDIA. WASTE ISSUE** OVERSHADOWS ADVANTAGES OF PLASTIC PRODUCTS

## EXISTING BENEFITS



**BENEFITS INCLUDING LIGHTWEIGHT, STIFFNESS, IMPACT, DURABILITY, COST, SAFETY, APPEARANCE, ETC.**

# SABIC'S TRUCIRCLE™ PROGRAM – COMPLEMENTARY SOLUTIONS



WORKING SIDE BY SIDE WITH **PARTNERS ACROSS THE ENTIRE VALUE CHAIN** TO DEVELOP CIRCULAR SOLUTIONS AND FULFILL **SABIC'S AMBITION** FOR A NEW PLASTIC ECOSYSTEM

# SABIC'S TRUCIRCLE™ PROGRAM – CASE STUDIES

PORTFOLIO



SERVICES



## CLOSING THE LOOP AND CREATING A CIRCULAR ECONOMY FOR PLASTICS

TRUCIRCLE™ PROGRAM

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# MECHANICALLY RECYCLED PRODUCTS

## MAIN CHALLENGES IN THE VALUE CHAIN



### KEY CHALLENGES FOR PCR\* COMPOUNDS:

- Feedstock availability
- Consistent raw material quality
- Odor & color consistency
- Process-ability
- Mechanical properties & performance of end product
- Product safety



COLLECTION



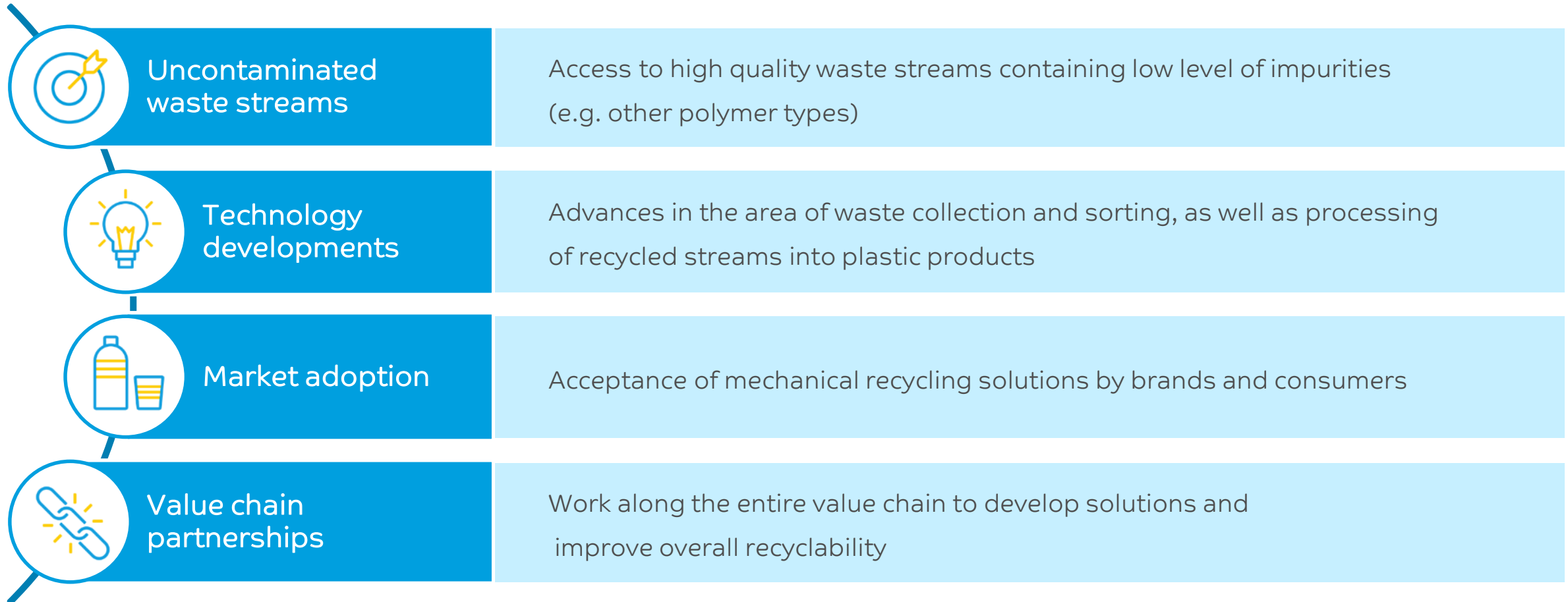
SORTING



RECYCLING

➤ Need for innovative technologies to develop sustainability solutions

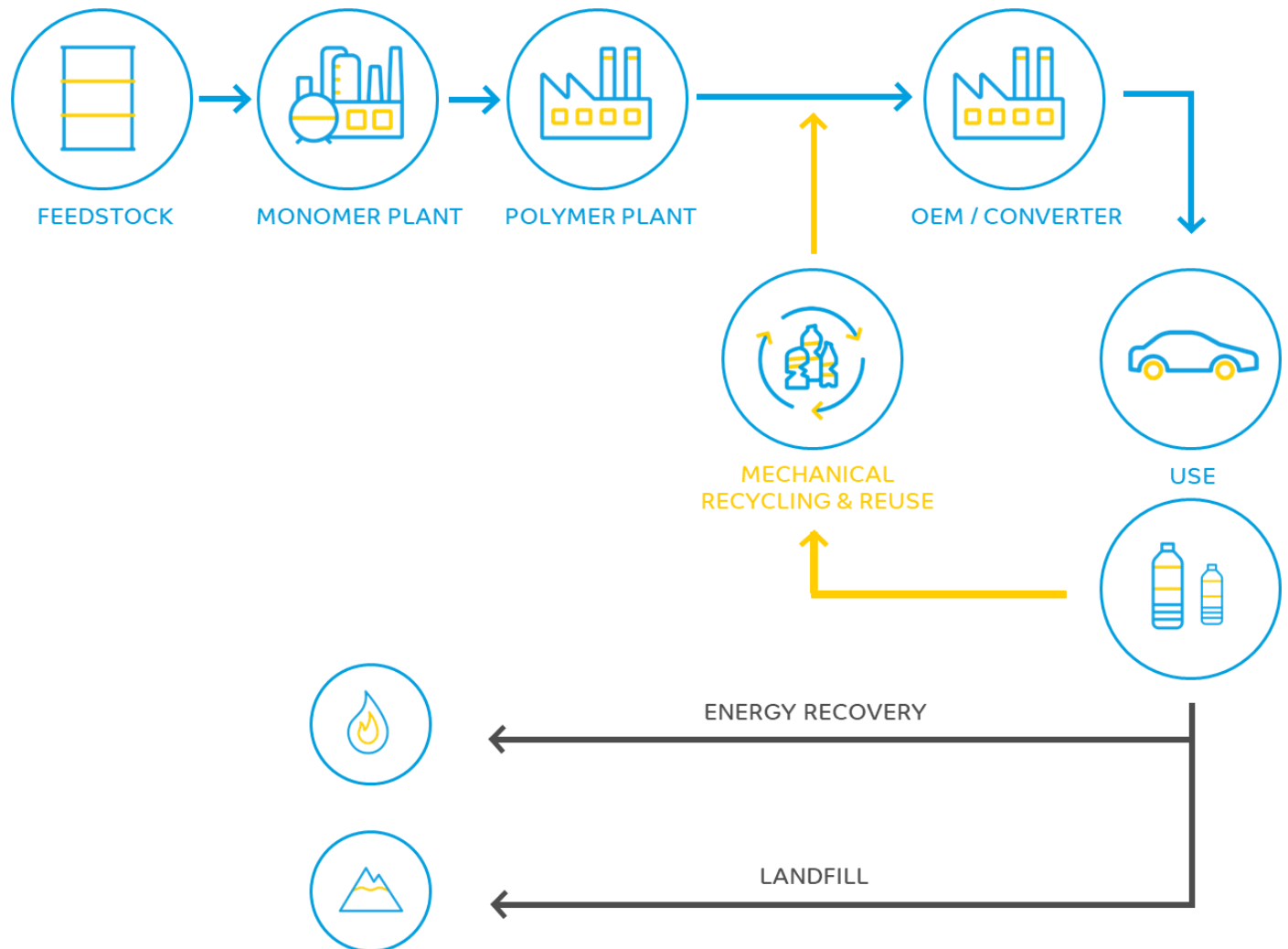
## KEY ENABLERS DRIVING PLASTIC MECHANICAL RECYCLING IMPLEMENTATION



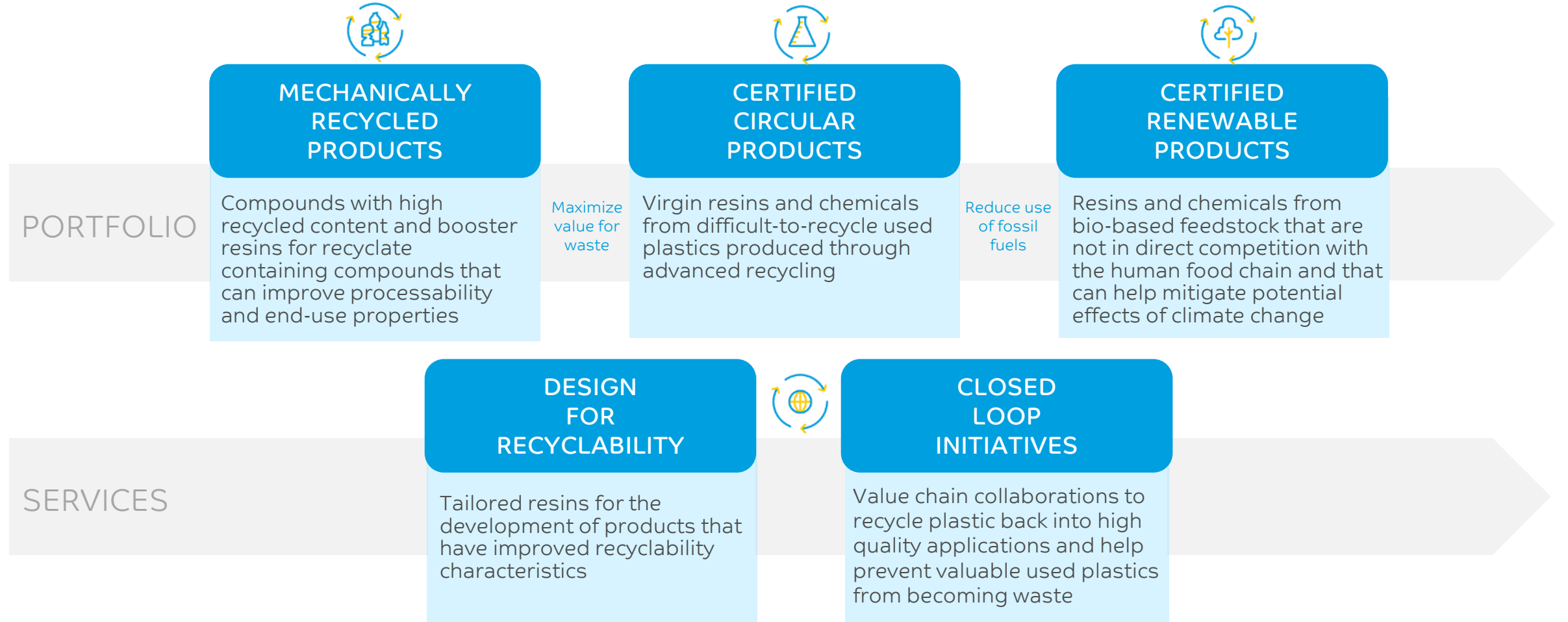
Let's **THINK AND WORK TOGETHER** to address main challenges on mechanical recycling



# MECHANICAL RECYCLING CONCEPT



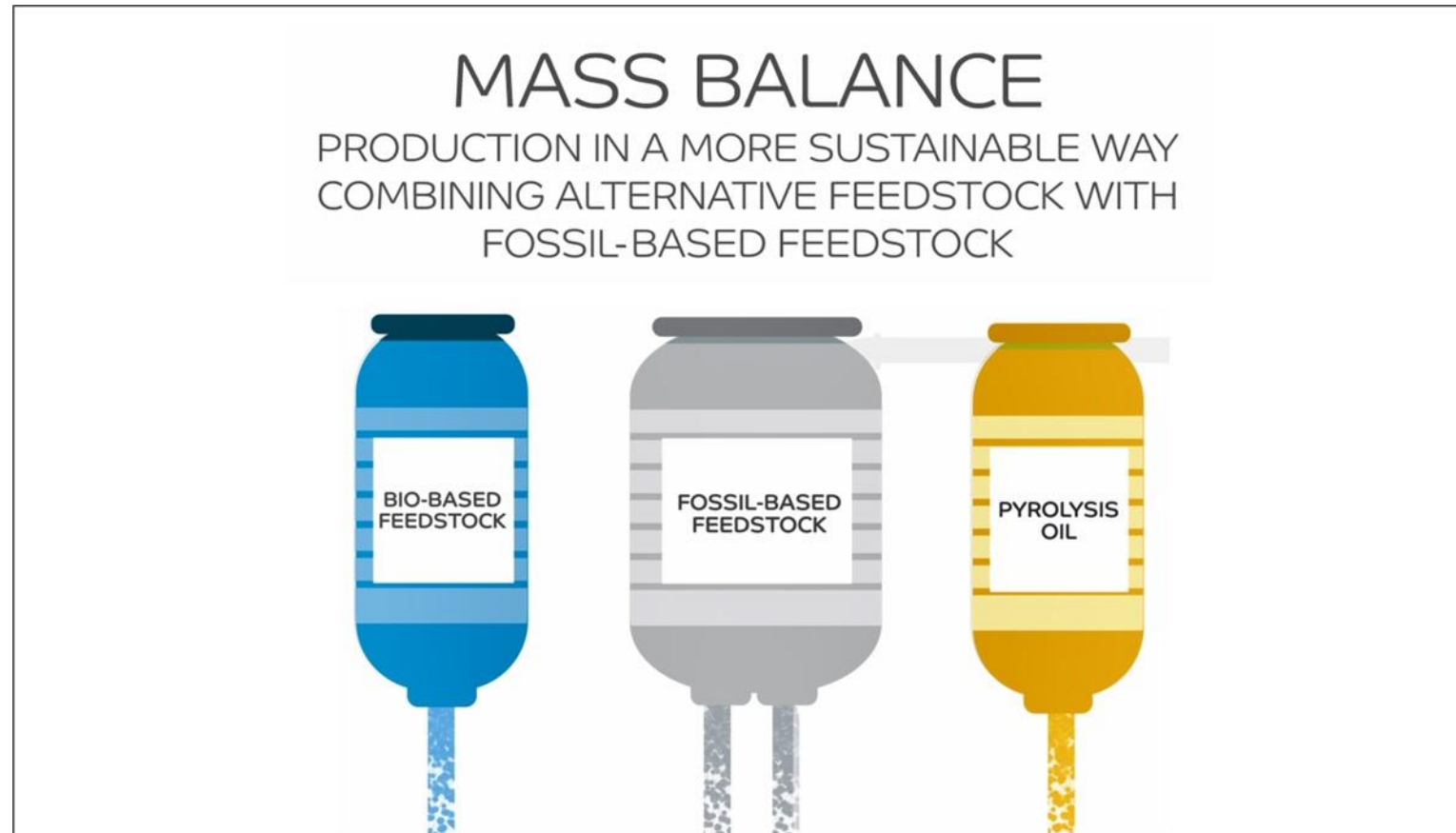
# SABIC'S TRUCIRCLE™ PROGRAM – COMPLEMENTARY SOLUTIONS



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# MASS BALANCE CONCEPT

## ACCEPTANCE OF THE MASS BALANCE CONCEPT IS A VITAL STEP



MASS BALANCE IS A SYSTEM WHERE THERE IS A CERTIFIED BALANCE BETWEEN THE AMOUNT OF 'INPUT MATERIAL' INTO A PROCESS AND THE AMOUNT OF 'OUTPUT MATERIAL' FROM THE PROCESS

# SABIC'S CERTIFIED RENEWABLE POLYCARBONATE



➤ All players in the value chain have to be ISCC Plus certified

## WHY MASS BALANCE APPROACH ?



Picture: Naphtha Cracker 4 (Geleen, the Netherlands)

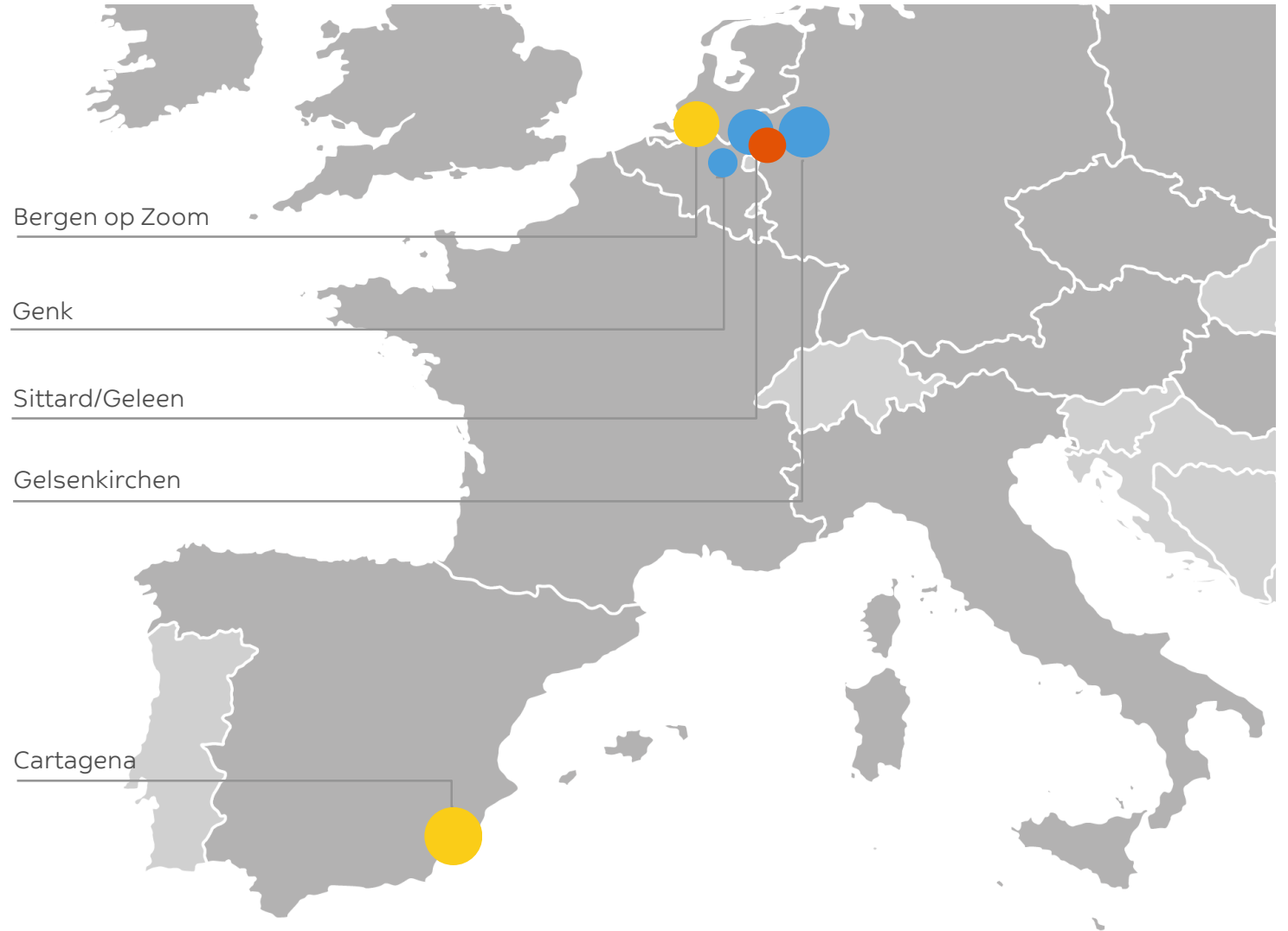


- A **CRUCIAL BRIDGE** between today's linear economy and the sustainable circular plastics economy of the future
- The **RELATIVELY SMALL VOLUMES** of alternative feedstock have to be **MIXED with conventional fossil-based feedstock**
- An innovative & **CRUCIAL INSTRUMENT** to stimulate the **FULL TRANSITION TO NEW FEEDSTOCK** in SABIC's current world-scale production units
- The **MASS BALANCE & CERTIFICATION CONCEPT** allows us to **USE EXISTING COMMERCIAL ASSETS** to convert our products
- **TRACEABILITY / VERIFICATION OF CORRECT MASS BALANCE HANDLING OF INFORMATION**; incoming alternative feedstock and outgoing product

# EUROPEAN PRODUCTION PLANTS OF CERTIFIED PRODUCTS

## CERTIFIED PRODUCTION PLANTS

- PE / PP
- ETP
- Steam cracker



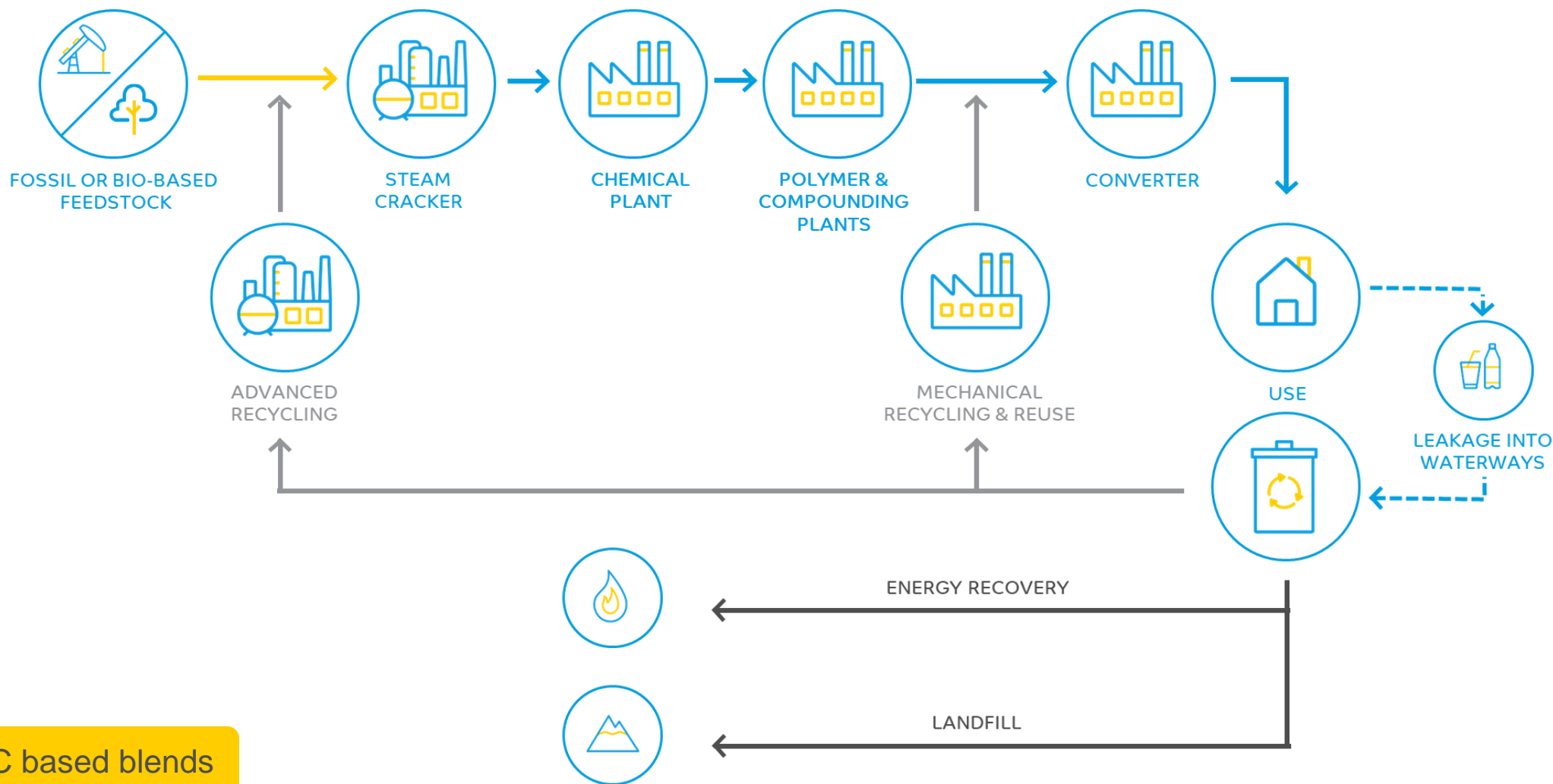
TRUCIRCLE™ PROGRAM

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# ADVANCED RECYCLING



# THE CONCEPT "FROM LINEAR TO CIRCULAR"



PC / PC based blends

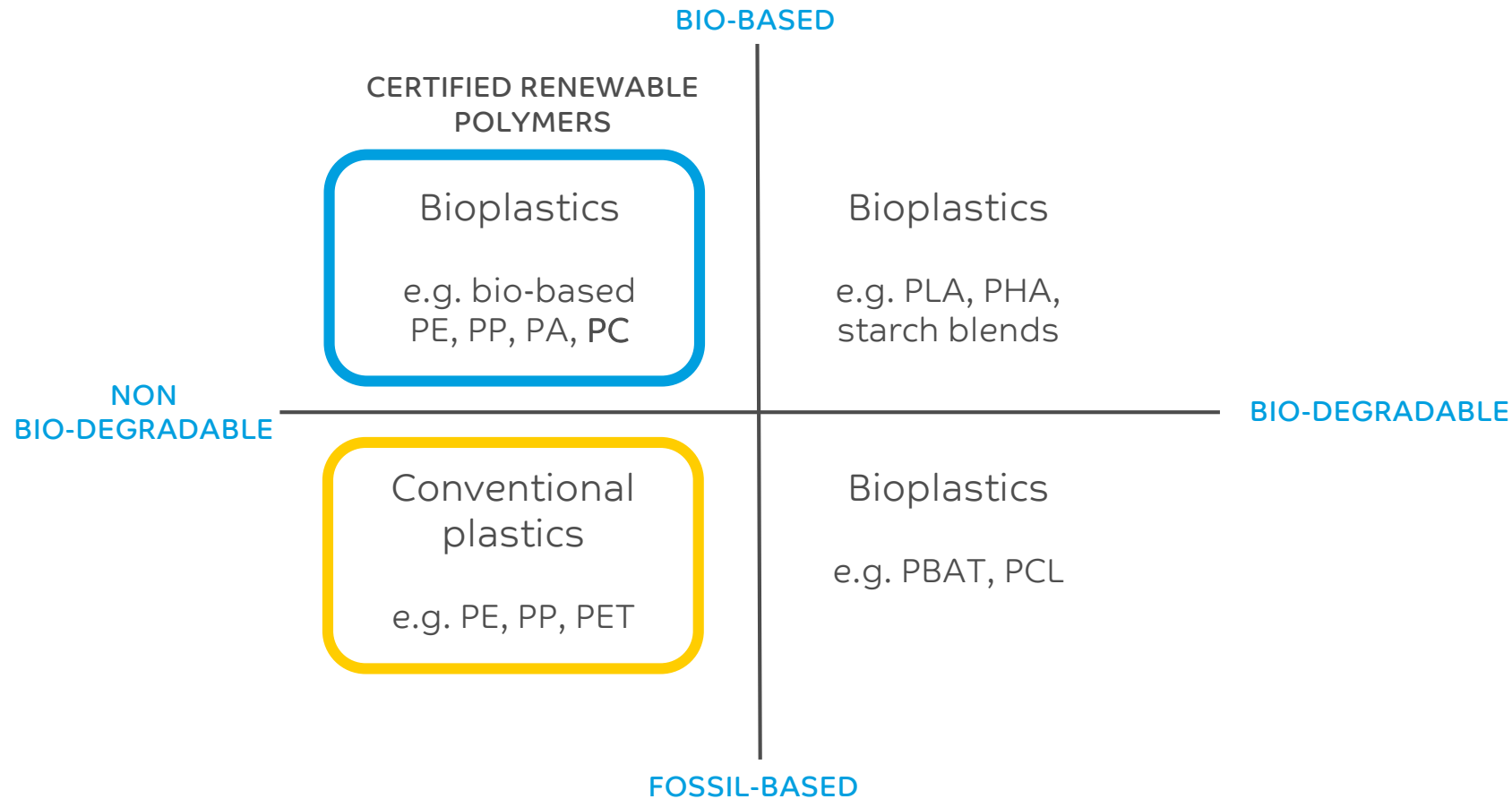
TRUCIRCLE™ PROGRAM

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# CERTIFIED RENEWABLE POLYMERS

## WHAT ARE BIOPLASTICS?

BIOPLASTICS = PLASTICS THAT ARE BIO-BASED, BIO-DEGRADABLE, OR BOTH



## SABIC'S CERTIFIED RENEWABLES

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- Non-fossil based feedstock
- Feedstock source has a lower carbon footprint compared to fossil alternative
- Second generation renewable feedstock not in competition with the human food or feed chain
- No direct/indirect change in land use
- Derived from waste or residue
  - Crude tall oil
  - Used cooking oil (UCO)
  - Residues from vegetable oil processing
- No compromise on product safety
- Identical product specifications to our current SABIC polymers (PE / PP), chemicals and LEXAN™ resin PC portfolio
- Externally certified chain of custody by ISCC Plus \*
- Can be recycled



\* through mass balance approach and physical connection/ISCC Plus certified value chains

## BIO-BASED FEEDSTOCK USED BY SABIC

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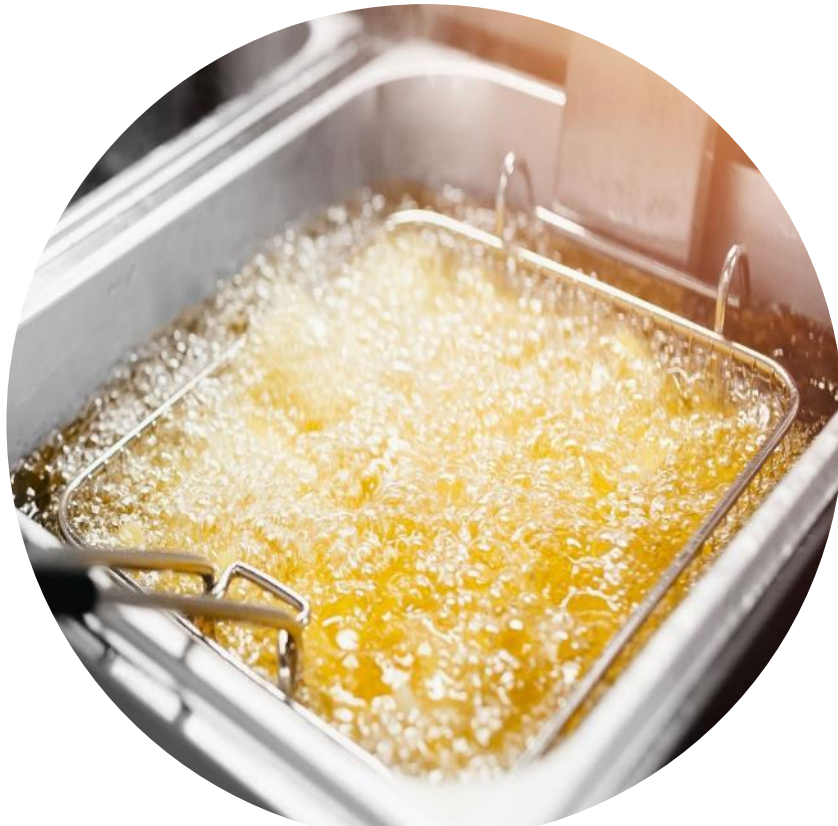
### Bio-based feedstock used by SABIC

#### CRUDE TALL OIL

- Derived from forestry residue
- Replacing fossil based feedstock (e.g. Naphtha)
- Second generation renewable feedstock not in competition with the human food or feed chain
- Animal free feedstock
- Palm oil free feedstock
- Lower carbon footprint compared to fossil alternative
- ISCC Plus certified value chains

## SELECTED ADDITIONAL BIO-BASED FEEDSTOCK

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### Bio-based feedstock used by SABIC

#### USED COOKING OIL (UCO)

- Oils and fats used for cooking or frying in the food processing industry (e.g. restaurants) or at consumer level (e.g. in households); no longer fit for human consumption
- Replacing fossil based feedstock (e.g. Naphtha)
- Second generation renewable feedstock not in competition with the human food or feed chain
- Lower carbon footprint compared to fossil alternative
- ISCC Plus certified value chains

## BENEFITS OF BIO-BASED FEEDSTOCK ALTERNATIVES

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### SUPPORTING CUSTOMERS IN ADDRESSING CORPORATE SUSTAINABILITY GOALS

#### SABIC'S CERTIFIED RENEWABLE POLYMERS



##### VERSATILE

No compromise on product properties  
Big window of applications, including Food & Beverage consumer packaging, E&E, Personal Care, Automotive, ...



##### DROP-IN SOLUTION

Identical product specifications to our current grade portfolio  
No modifications to production processes down-stream



##### CARBON FOOTPRINT REDUCTION

Up to 4 kg of CO<sub>2</sub> per kg of resin



## SABIC TO GROW RENEWABLE PRODUCTS BUSINESS



### Market launch 2014

- Processing of bio-based feedstock via direct blending
- SABIC first and leader in certified renewable products
- Promoting ISCC Plus mass balance concept



### Market development ongoing

- Renewable products introduced in various businesses and value chains
- Multiple renewable feedstock sources within portfolio
- LCA externally peer reviewed



### What's next?

- SABIC is committed to further expand growth in renewable solutions for all our customers



TRUCIRCLE™ SOLUTIONS

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# CERTIFIED RENEWABLE POLYCARBONATE

# SABIC'S CERTIFIED RENEWABLE POLYCARBONATE



➤ All players in the value chain have to be ISCC Plus certified

# CERTIFIED RENEWABLE POLYCARBONATE FROM BIO-BASED FEEDSTOCK

FOR ALL POLYCARBONATE (PC) & PC BASED BLENDS

## Bio-based feedstock used by SABIC SECOND GENERATION FEEDSTOCK

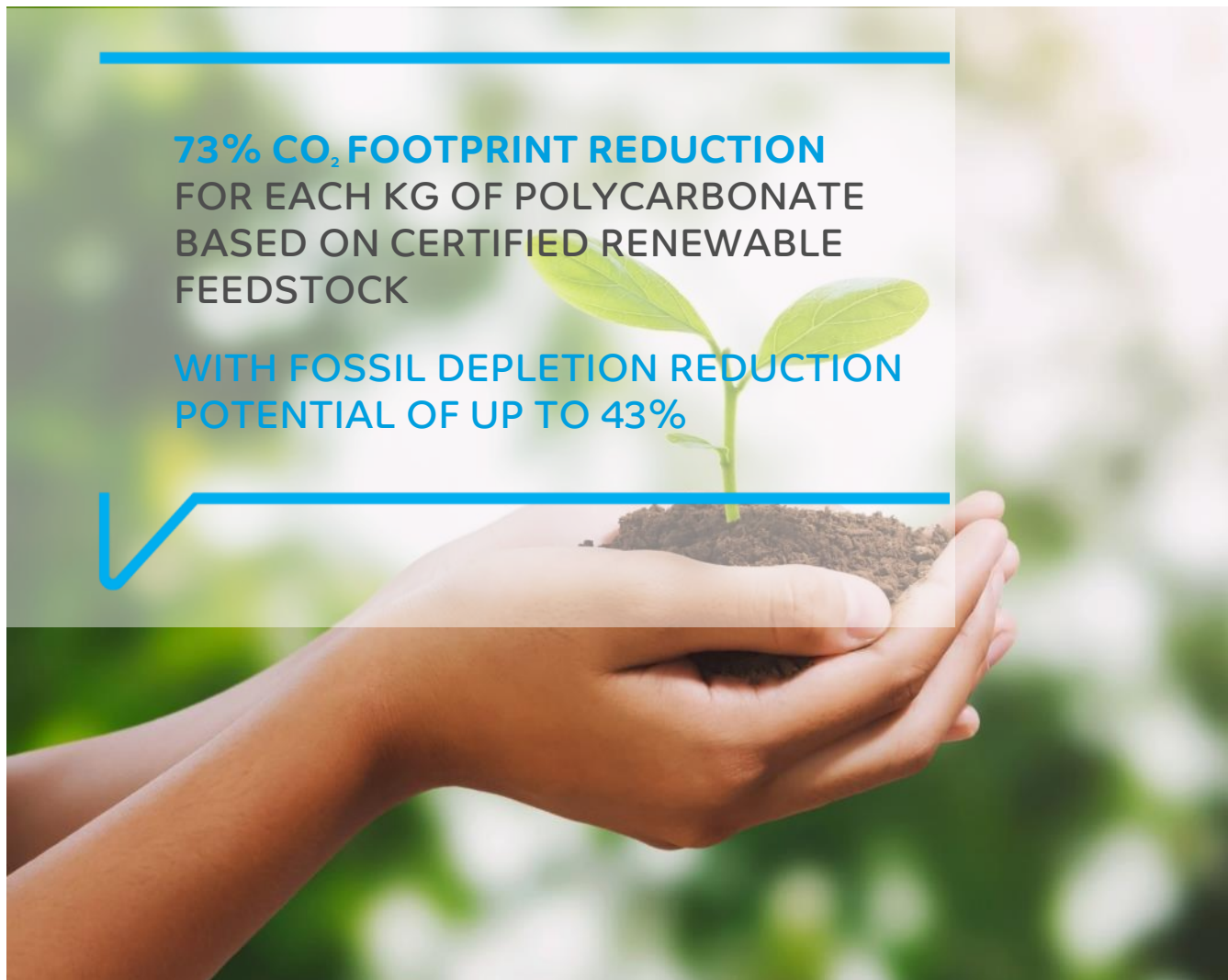
- Replacing fossil based feedstock
- Not in competition with the food or feed chain
- Derived from waste or residue streams
  - Crude tall oil (from the wood industry)
  - Used cooking oil (UCO)
  - Residues from vegetable oil processing
- Lower carbon footprint compared to fossil alternative
- ISCC Plus certified value chains



# SABIC'S POLYCARBONATE BASED ON CERTIFIED RENEWABLE FEEDSTOCK

**73% CO<sub>2</sub> FOOTPRINT REDUCTION**  
FOR EACH KG OF POLYCARBONATE  
BASED ON CERTIFIED RENEWABLE  
FEEDSTOCK

**WITH FOSSIL DEPLETION REDUCTION  
POTENTIAL OF UP TO 43%**



Collaboration in **lighting industry**



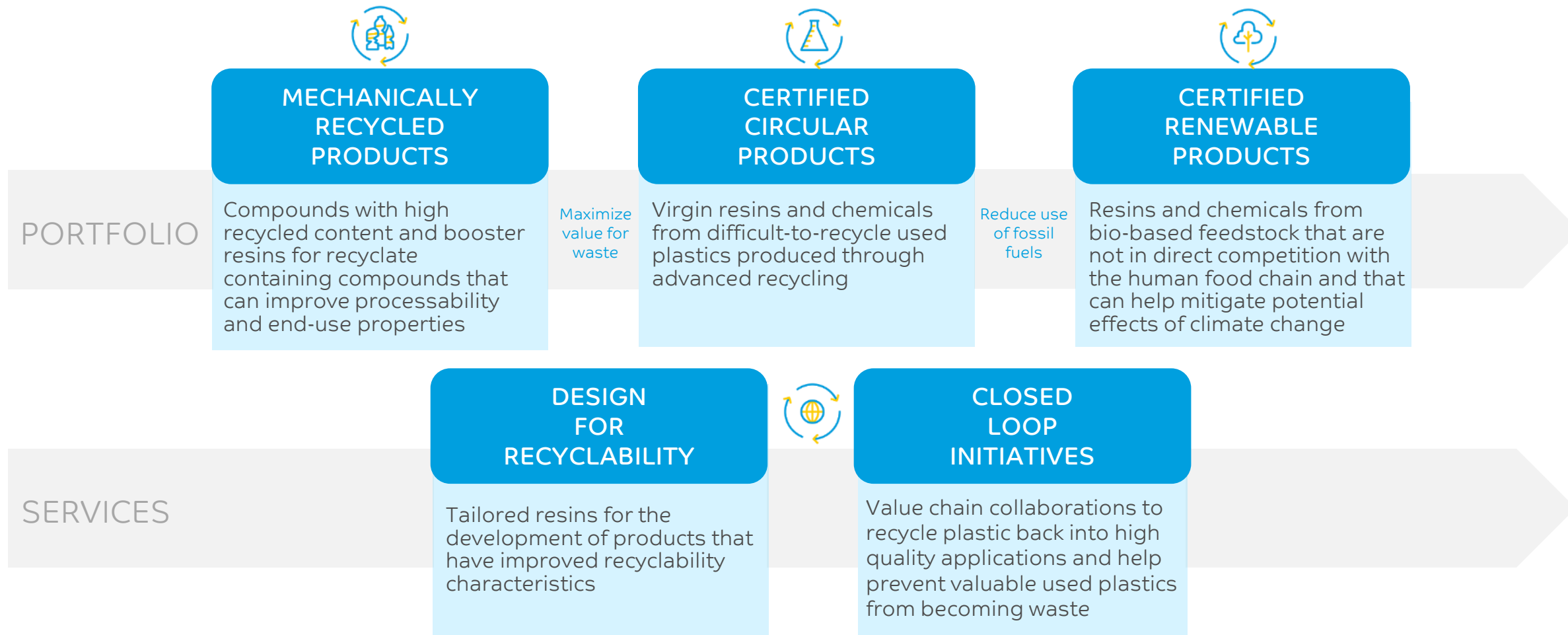
**elkamet**

Lenses of several **eyewear end applications**



**POLYRAY**

# SABIC'S TRUCIRCLE™ PROGRAM – COMPLEMENTARY SOLUTIONS



WORKING SIDE BY SIDE WITH **PARTNERS ACROSS THE ENTIRE VALUE CHAIN** TO DEVELOP CIRCULAR SOLUTIONS AND FULFILL **SABIC'S AMBITION** FOR A NEW PLASTIC ECOSYSTEM

# CLOSED LOOP INITIATIVES

## FROM LINEAR TO CIRCULAR

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### WHAT'S THE VALUE OF CLOSED LOOP INITIATIVES

- Full traceability from waste to PCR to end-product
- Economic valorization of waste
- Logistic optimization
- Influencing policies and legislation about sorting & collection

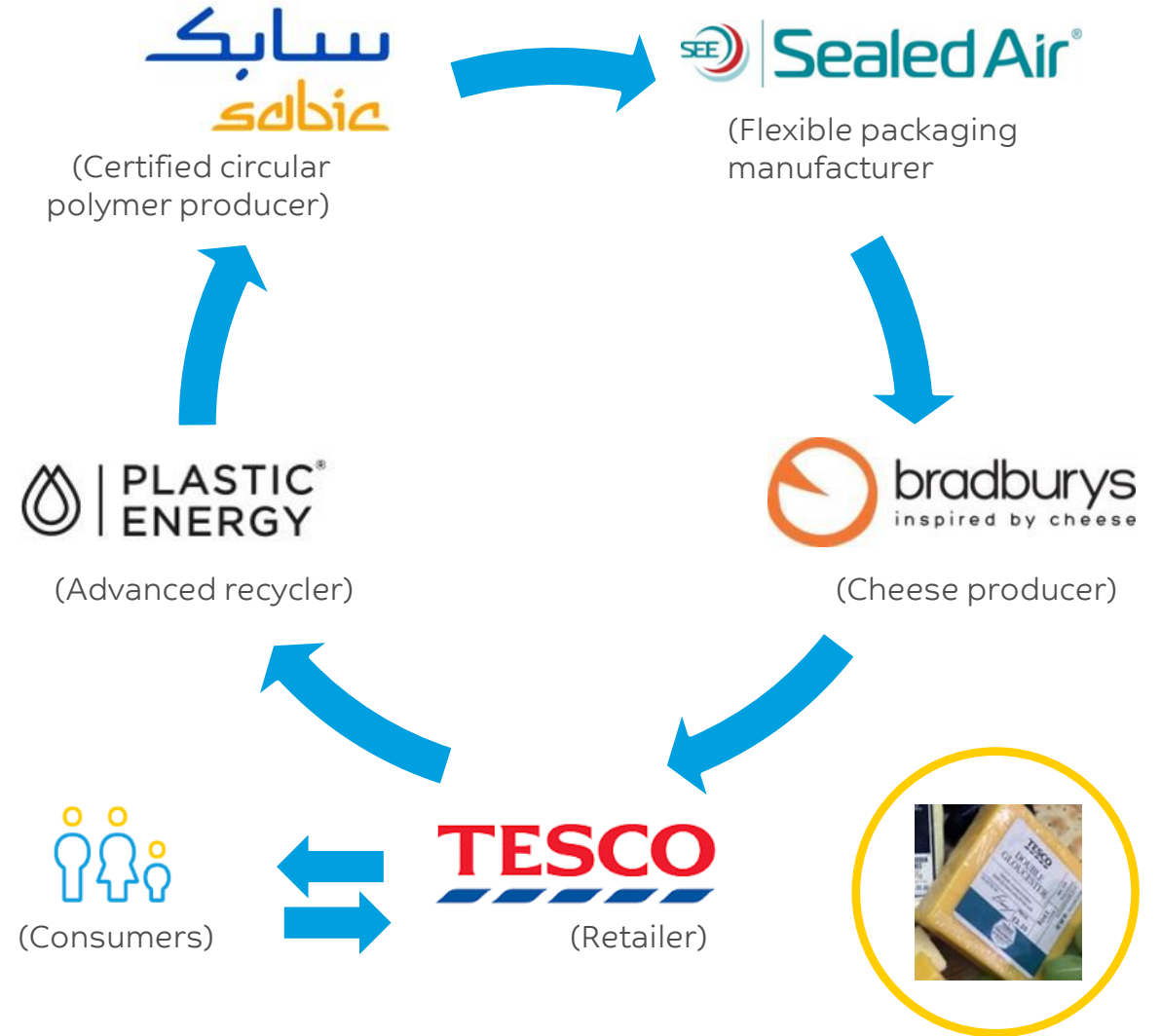


# SABIC COLLABORATION RESULTS IN INDUSTRY FIRST CLOSED LOOP PROJECT

## CIRCULARITY FOR PLASTICS is achievable through VALUE CHAIN COLLABORATION.

COLLABORATION PARTNERS of this closed loop recycling system:

- TESCO collected post-consumer flexible packing in ten stores in the UK
- PLASTIC ENERGY converted the packaging into pyrolysis oil
- SABIC used the alternative feedstock to produce certified circular polymers
- SEALED AIR produced the film for cheese producer BRADBURYS



“First produce in food-grade recycled flexible packaging hits Tesco shelves”

British Plastics and Rubber Magazine, 8 September 2020



# REFERENCES

# SABIC'S SUSTAINABILITY YOUTUBE CHANNEL

**\*NEW CELEBRATING THE 1-YEAR CONSTRUCTION MILESTONE ADVANCED RECYCLING UNIT**

<https://www.youtube.com/watch?v=vJv-xSTJDHw>

**WHAT IS OCEAN BOUND PLASTIC?**

<https://youtu.be/H6Fep47wpQg>

**SABIC'S TRUCIRCLE™ PORTFOLIO & SERVICES**

<https://youtu.be/hQzIE6UxuAE>

**HOW DOES CLOSED LOOP RECYCLING WORK?**

<https://www.youtube.com/watch?v=6H7DtAw1wHo&list=PLvrbA1nA2I8qR8MfoHAOWVRHCJvgEjtBF&index=11>

**SABIC'S POLYCARBONATE BASED ON CERTIFIED RENEWABLE FEEDSTOCK**

<https://youtu.be/2F8bAteNkP4>

**TRUCIRCLE™ SOLUTIONS PERSONAL AND PROFESSIONAL HYGIENE APPLICATIONS**

<https://www.youtube.com/watch?v=sH7h0kkWrwE>

**CLOSED LOOP COLLABORATION**

= animation to explain closed loop initiative with Tesco

<https://www.youtube.com/watch?v=5NVEMplvi5Y>

**SABIC TRUCIRCLE™ ANIMATION**

= short introduction to TRUCIRCLE™ initiatives

<https://www.youtube.com/watch?v=AlcCUCmGrmg>

**SABIC TF BOPE POLYMER**

<https://youtu.be/z5q3NxrBoeA>

**SABIC'S VIRGIN POLYMERS FROM MIXED PLASTIC WASTE**

= movie explaining certified circular polymers as a TRUCIRCLE™ solution

[https://www.youtube.com/watch?v=qf\\_4jxcP2sY](https://www.youtube.com/watch?v=qf_4jxcP2sY)

**SABIC – MASS BALANCE METHOD**

= animation movie explaining mass balance chain of custody

<https://www.youtube.com/watch?v=-imvDD6i6Lo>

**TRUCIRCLE™ - THE JOURNEY SO FAR**

<https://youtu.be/wYK5JW6gegs?list=PLvrbA1nA2I8oQYw0o-xq16Qou4cNLeU69>

**SABIC'S CERTIFIED CIRCULAR PRODUCTS THROUGH FEEDSTOCK RECYCLING**

= attractor film from booth at K-show

<https://www.youtube.com/watch?v=REamRj4xXP5>

**SABIC'S CERTIFIED CIRCULAR PRODUCTS FROM MIXED PLASTIC WASTE**

= 2D animation movie explaining advanced recycling

<https://www.youtube.com/watch?v=WbEh2NtLrb0>

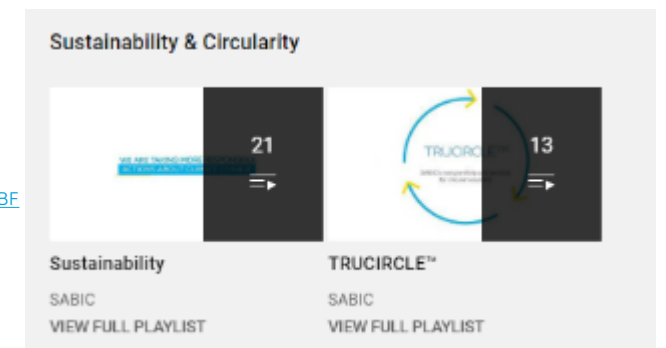
<https://www.youtube.com/c/SABIC/featured>

**TRUCIRCLE PLAYLIST**

**OR**

**SUSTAINABILITY & CIRCULARITY PLAYLIST**

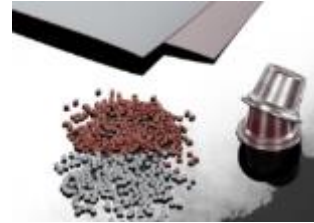
<https://www.youtube.com/playlist?list=PLvrbA1nA2I8qR8MfoHAOWVRHCJvgEjtBF>



# TRUCIRCLE™ PARTNER PRESS RELEASES & CASE STUDIES 2021/2022 YTD

## CERTIFIED CIRCULAR PRODUCTS:

- [CONSTRUCTION STARTS ON ADVANCED RECYCLING UNIT](#)
- [BP COLLABORATION](#) - FOR CIRCULAR FEEDSTOCK
- [REN SABIC AND APTAR WIN BEAUTY SHORTLIST AWARD](#)
- [P&G / FRAUNHOFER](#) - CLOSED LOOP PROJECT FOR USED FACEMASKS
- [FROST & SULLIVAN GLOBAL COMPANY OF THE YEAR AWARD](#)
- [DSM DYNEEMA®](#) - CERTIFIED CIRCULAR ETHYLENE
- [CERTIFIED CIRCULAR PC](#) - ADVANCED RECYCLING ETP
- [ST JOHNS PACKAGING / KINGSMILL](#) - CERTIFIED CIRCULAR PE FOR BREAD BAGS
- [OBP VIA ADVANCED RECYCLING HHI COLLABORATION](#)
- [MARS PETCARE & HUHTAMAKI](#) - CERTIFIED PP FOR WET PET FOOD PACKAGING
- [ELLA'S KITCHEN](#) - BABY FOOD POUCHES
- [PESCANOVA - POLIVOUGA](#) - OBP CERTIFIED CIRCULAR FOR FISH PACKAGING



## CERTIFIED RENEWABLE PRODUCTS:

- [POLYRAY](#) - CERTIFIED RENEWABLE PC FOR EYEWEAR APPLICATIONS
- [NUDEC](#) - RENEWABLE PC FOR B&C
- [BEIERSDORF / NIVEA](#) - CERTIFIED RENEWABLE PP FOR COSMETICS PACKAGING (PP)
- [DELICA / ALMA](#) - CERTIFIED RENEWABLE PP FOR COFFEE CAPSULES
- [KRATON](#) - CERTIFIED RENEWABLE BUTADIENE
- [MATTEL](#) - CERTIFIED RENEWABLE PP FOR TOY PRODUCTS



## MECHANICALLY RECYCLED PRODUCTS

- [OBP PET /PC \(ETP\)](#) - FOR CONSUMER ELECTRONICS
- [MECHANICALLY RECYCLED RESINS FOR AUTOMOTIVE](#)
- [MICROSOFT](#) - OCEAN PLASTIC FOR MOUSE



# TRUCIRCLE™ PARTNER PRESS RELEASES & CASE STUDIES 2020

## CERTIFIED CIRCULAR PRODUCTS:

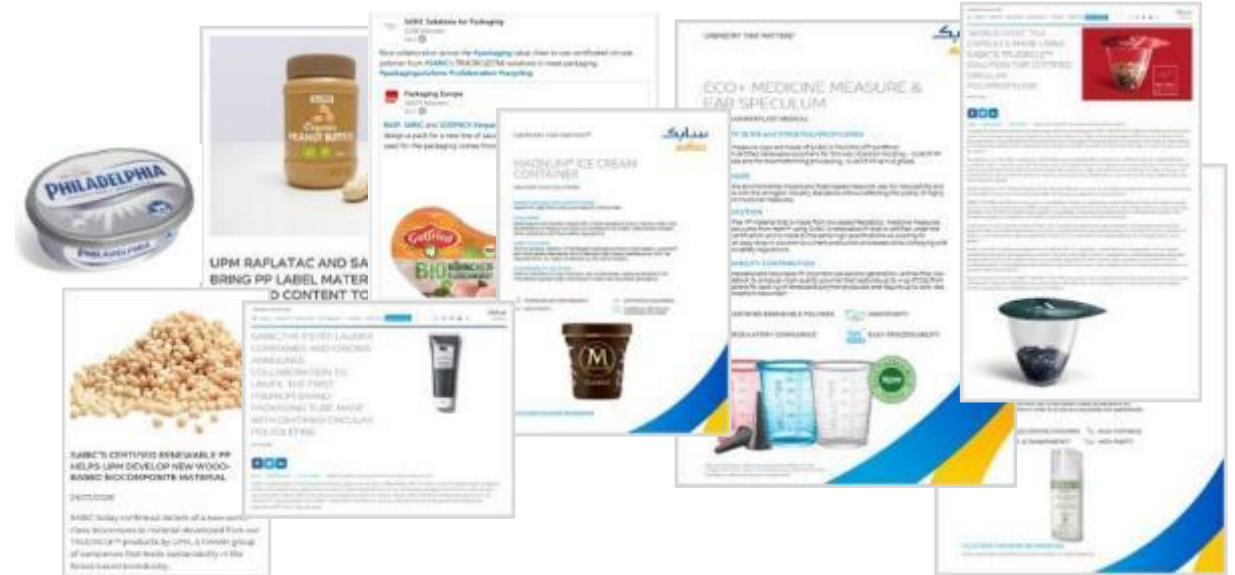
- [UNILEVER REN SKINCARE](#) - EVERCALM™ DAY CREM AIRLESS PACKAGING (PE)
- [APTAR](#) (CONVERTOR FOR UNILEVER) - REN SKINCARE PACKAGING (PE)
- [AVERY DENNISON](#) - LABELS (PP)
- [BERRY GLOBAL](#) - RECYCLABLE, COEXTRUDED PE STAND-UP POUCH
- [MAGNUM](#) - CIRCULARITY [WEBPAGE](#)
- [UPM-RAFLATAC](#) - PP PCR CLEAR AND WHITE LABEL PRODUCTS
- [BERRY, MONDELEZ](#) - PHILADELPHIA CREAM CHEESE TUBS (PP)
- [SÜDPACK/GUTFRIED/BASF](#) - PE BARRIER FILM MEAT PACKAGING
- [MAGNUM](#) - CIRCULAR PP TUBS: GLOBAL IMPLEMENTATION
- [AVOURY \(MELITTA\)](#) - PREMIUM TEA CAPSULES (PP)
- [TESCO](#) - INDUSTRY FIRST CLOSED LOOP PROJECT WITH SEALED AIR, PLASTIC ENERGY
- [FIBERTEX](#) – INDUSTRY FIRST NON-WOVEN (PP)
- [ESTÉE LAUDER](#) - FIRST PREMIUM PACKAGING TUBE
- [SCHWARZ GROUP / LIDL](#) - VEGETABLE BAGS (PE)
- [MARS / HUTAMAKI](#) – RETORT POUCH FOR PET FOOD (PP)
- [VYNOVA](#) – CERTIFIED-ATTRIBUTED PVC
- [DSM / VISCOFAN](#) - CHEMICAL & CIRCULAR PR FOR MEAT PACKAGING
- [UNILEVER KNORR](#) - BOUILLON POWDER CONTAINERS (PP)

## DESIGN FOR RECYCLABILITY:

- [BRÜCKNER](#) - COLLABORATION WITH MACHINE MANUFACTURER (BOPP/BOPE FILM)
- [SYNTEGON](#) - FROZEN FOOD PACKAGING (TF-BOPE FILM COLLABORATION)

## MECHANICALLY RECYCLED PRODUCTS

- [EXPANDED PCR ETP PORTFOLIO](#) - EXPANDED PORTFOLIO FOR CONSUMER ELECTRONICS



## CERTIFIED RENEWABLE PRODUCTS:

- [VYNOVA](#) – BIO-ATTRIBUTED PVC
- [UPM FORMI ECOACE](#) - WOOD BASED BIOCOMPOSITE (PP)
- [DSM](#) – BIO-BASED DYNEEMA®
- [HAMMARPLAST](#) - MEDICINE DOSAGE CUP & EAR SPECULUM - PP CASE STORY
- [ELKAMET](#) – FIRST PC BASED ON RENEWABLE FEEDSTOCK FOR LIGHTING
- [IRPLAST](#) - ADVANCED FOOD PACKAGING & LABELS (RENEWABLE & CIRCULAR BOPP)
- [ORKLA / IRPLAST](#) - POTATO CHIPS PACKAGING (PP)
- [BEIERSDORF NIVEA](#) - COSMETICS PACKAGING (PP)

## TRUCIRCLE™ AWARDS & RECOGNITIONS 2021/2022 YTD



SABIC was recognized by global consulting firm [Frost & Sullivan](#) for best practices in Circular Economy.



SABIC was a finalist in the Packaging Europe awards in the [Resource efficiency category](#),



SABIC won the [Rethink 2021 Sustainable Products Awards](#) in the producers category.



DSM Protective Materials recognized SABIC with their [Sustainability Supplier Award](#) 2021.



SABIC was recognized by the China Plastics Recycle Association with a [Golden Apple award](#)



SABIC was recognized by CEPIC in the [European Responsible Care® Awards 2021](#) for our TRUCIRCLE™ solutions in the *category Safe and Sustainable: from design phase to use phase.*



SABIC was named winner of the [Best Recycling/Circularity Initiative](#) award by IHS Chemical Week 2021 for our closed loop recycling project



SABIC'S innovative solutions [won 5 awards at the Edison Awards 2022](#). In the Plastic Upcycling category, SABIC won a silver award for its Microsoft Ocean Plastic Mouse.

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