3-23-2022

Sustainable resins for single-use technologies

Hans de Brouwer

CHEMISTRY THAT MATTERS™

TRUCIRCLE™ : CIRCULAR FUTURE FOR PLASTICS

MARSEILLE, 23RD MARCH 2022

Dr. Hans de Brouwer
Chief Scientist, Polymers Application Development & Industry Solutions

SABIC AT A GLANCE

1976
Company established

32,000
Employees around the world

50
Countries of operations

212th
Largest public company in the world*

Top 2
Chemical Brand Value**

4.017
US$ bn
Estimated Brand Value**

79
US$ bn
Total assets

17.8
US$ mn
Net income

31
US$ bn
Annual revenue

≈ 150
New products each year

9,946
Global patent filings

68
World-class plants worldwide

*Forbes 2020 **Brand Finance, 2021

OUR BUSINESS AND INDUSTRIES THAT WE SERVE

PETROCHEMICALS

Glycols, Olefins, Oxygenates and Aromatics

Chemical Inter. & Industrial Gases

Polyolefins

SABIC® PP, HDPE, LL/LDPE, SUPEER™ COHERE™ grades

Engineering Thermoplastics (ETP)

LEXAN™ resins & SABIC® PC
CYCOLOY™, XENOY™, VALOX™, GELOY™ resins
PMMA, POM

PVC , PET, Polystyrene, PU

Synthetic Rubbers

Sheet & Film

SPECIALTIES

Specialty Engineered Thermoplastics (ULTEM™ resins NORYL™ resins, LEXAN™ copolymers and EXTEM™ resins)

Specialty Compounds (LNP™ compounds)

Thermosets and Additives

AGRI-NUTRIENTS

METALS

PACKAGING

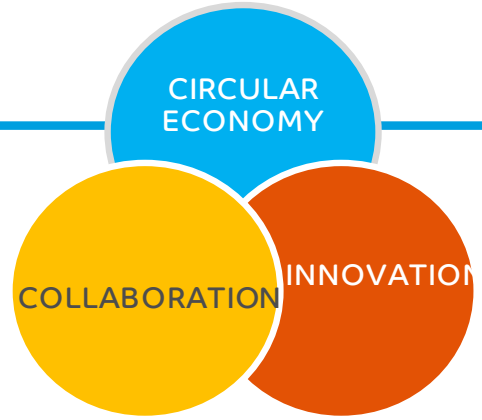
AUTOMOTIVE

BUILDING & CONSTRUCTION

ELECTRICAL & ELECTRONICS

CLEAN ENERGY

HEALTHCARE & HYGIENE



SABIC'S HEALTHCARE MATERIALS

SABIC'S BROAD MATERIALS PORTFOLIO FOR THE HEALTHCARE INDUSTRY

LEXAN™ HP (PC) resin
- Excellent processability
- Transparency
- Excellent impact resistance

CYCOLOY™ HC (PC/ABS) resin
- Excellent processability
- Colorability and aesthetics
- Good impact resistance

CYCOLAC™ HMG (ABS) resin
- Cost effective offering good mechanical properties
- Colorability and aesthetics

Manufactured by SABIC

	AMORPHOUS	CRYSTALLINE
HIGH PERFORMANCE	PEI, PES, PPSU	LCP, PEEK, PPS
ENGINEERING THERMOPLASTICS	PSU, PC, PC/PBT, PC/PET, PC/ABS, PC/ASA, ABS, ASA	PPA, PBT, POM, PA
COMMODITY	PS, PVC	PP, HDPE, PET, LDPE

PCG PET resins
- Thin wall
- processability

VALOX™ HX (PBT) resin
- Good dielectric strength
- Excellent chemical resistance

XYLEX™ HX (PC/PET) resin
- Good processability
- Good chemical resistance
- Transparency

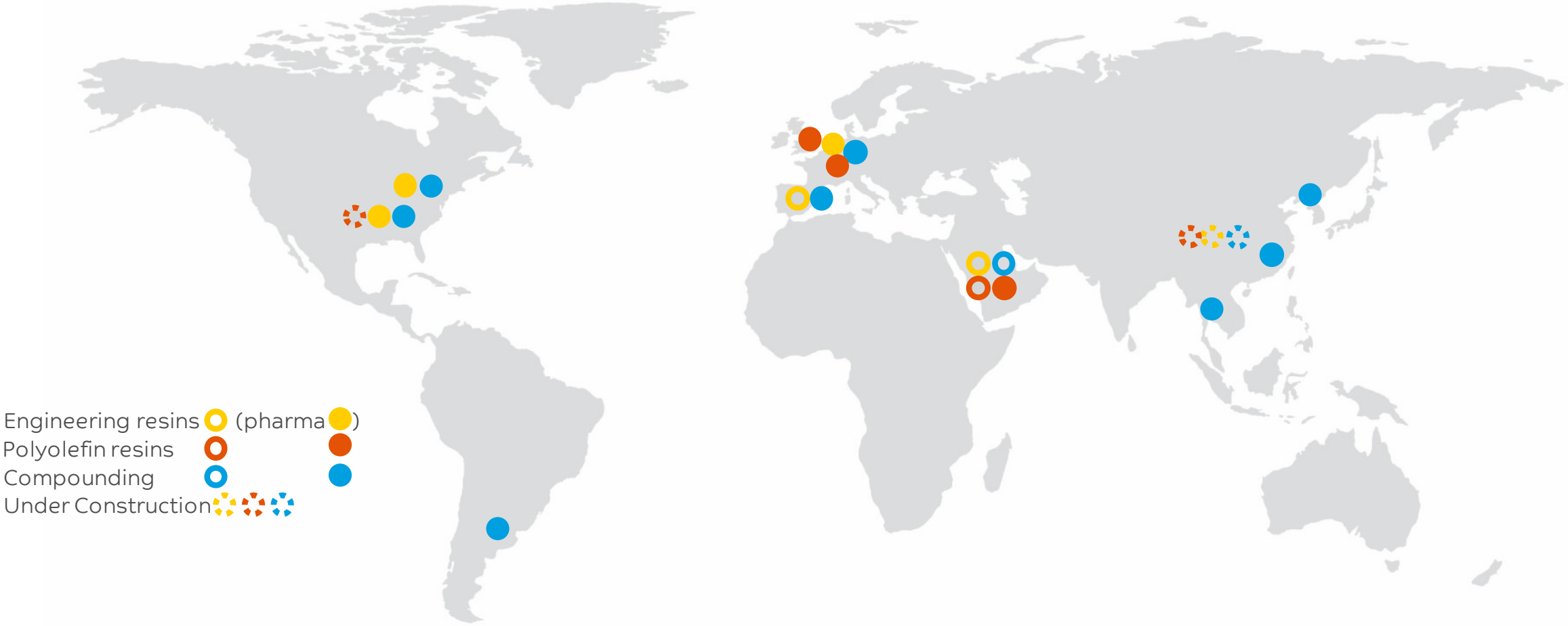
SABIC® PCG (PP and PE) grades
- Cost effectiveness
- Versatility
- Processability

SABIC'S HEALTHCARE PRODUCT POLICY

- Easily identifiable healthcare product nomenclature
  - CYCOLAC™ HM resins
  - CYCOLOY™ HC resins
  - LEXAN™ HP resins
  - VALOX™ HX resins
  - XENOY™ HX resins
  - XYLEX™ HX resins
  - SABIC® HDPE PCG resins
  - SABIC® LDPE PCG resins
  - SABIC® PP PCG resins
  - SABIC® PET PCG resins
- Biocompatibility assessed (according to ISO 10993 or USP Class VI)
- Food contact compliance according to FDA and/or EU Reg. No. 10/2011 for most healthcare grades
- FDA Drug Master File and/or Device Master File listing
  (letter of authorization provided as needed)
- SABIC healthcare products are subject to formula lock and stringent management of change process. SABIC healthcare products are manufactured under GMP rules (No.2023/2006 (Commission Regulation EC, 22 December 2006) or FDA 21CFR174.5).
- Long-term supply options available

SABIC does **not** support applications which remain implanted **beyond 29 days**

HEALTHCARE GRADE RESIN & COMPOUNDING ASSETS



DEVELOPING PHARMA CAPABILITY IN KSA, USA & PACIFIC

MEGA TRENDS AND KEY REQUIREMENTS

Mega Trends

Mobile Healthcare, Miniaturization & Design
- Smaller, lighter weight, part consolidation, advanced sensing technologies

Advancements in Biotechnology
- Advanced drug delivery solutions, efficient filters, components for single-use systems (SUS) used in bioprocessing

Disposable vs. Reusable Devices
- increase patient safety & ease of use. Different sterilization methods

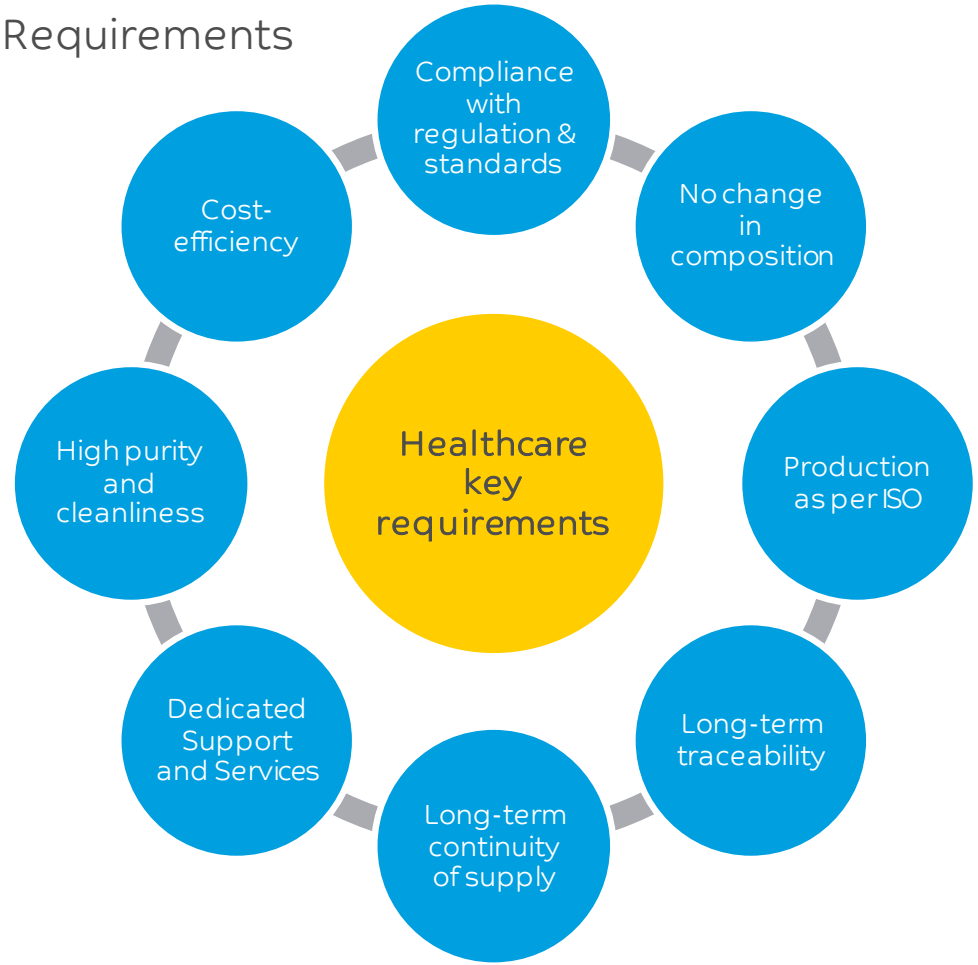
Sustainability
- Increased demand for greener alternatives, circular economy, closed loop, local supply

Increased awareness of infection risk
- Reducing healthcare associated infections (HCAI's), more aggressive disinfectants used

Cost Competitiveness
- Government budget cuts, and expanding access to care

Regulations
- Stricter regulations, Extractable & Leachable (E&L)

Key Requirements



Healthcare market is highly regulated market with strong entry barriers and long validation time that requires dedicated support and focused supply and services with long term reliability

CHALLENGES & SABIC'S COMMITMENT TO SUSTAINABILITY

THE COMMON CHALLENGE

EXISTING BENEFITS

PROTECTION- LIGHTWEIGHT - STIFFNESS - IMPACT - DURABILITY - COST - SAFETY - APPEARANCE

ISSUES TO BE SOLVED

ADRESSING LEGISLATION

LINKING UN SDG'S TO SABIC'S TOP SUSTAINABILITY PRIORITIES

Resource Efficiency

SABIC's ambitious goals are to reduce Material Loss intensity 50% and Water Intensity 25% by 2025 since 2010.

Innovation & Sust. Solutions

Sustainability is the guiding light for SABIC's product and process innovation – to support the development of effective solutions to some of the world's greatest challenges.

Climate Change & Energy

SABIC's ambitious goals are to reduce GHG and energy intensity 25% by 2025, from 2010 levels.

Circular Economy

Circular economy inspires SABIC to adapt our processes to the use of renewable and recycled feedstock, and to create durable, recyclable product design solutions for our customers.

Environment, Health, Safety

SABIC is committed to our core EHSS values, with a supportive culture and focus on continuous performance improvement.

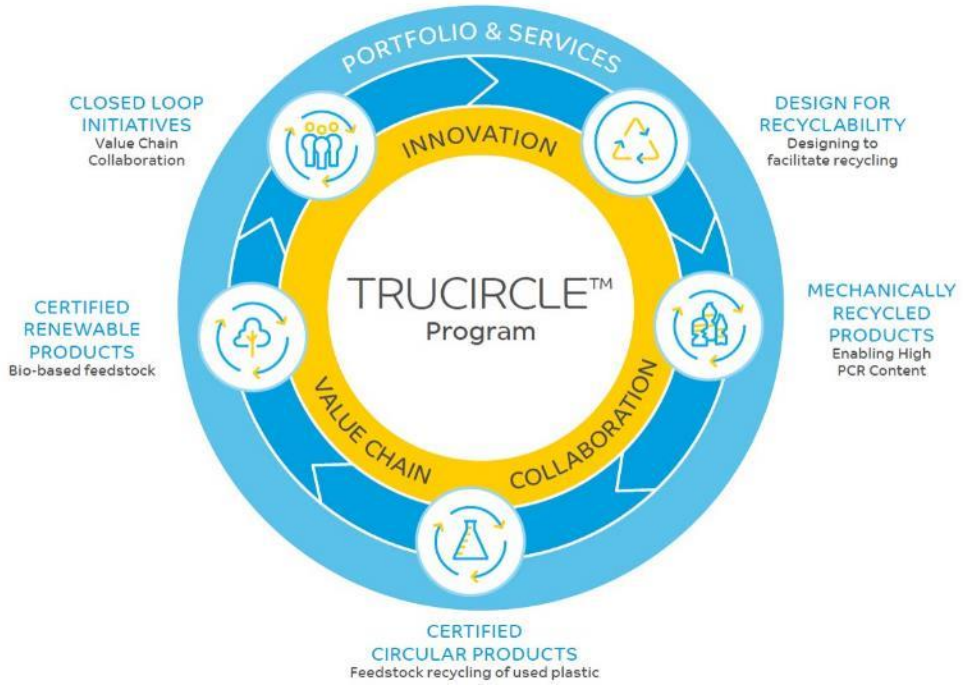
Governance & Integrity

Integrity is a core value and helps to maintain stakeholder trust. SABIC's Code of Ethics provides guidance to meet stakeholder expectations.

* Baseline is year 2010 / Retain intensity targets 2010-2025 based on external Sales

SDG: Sustainable Development Goals

LINKING UN SDG'S TO SABIC'S TOP SUSTAINABILITY PRIORITIES



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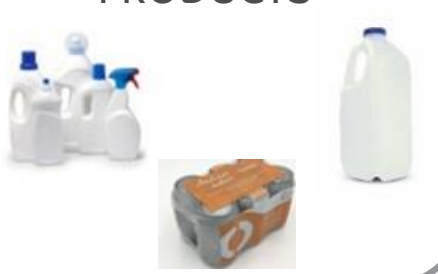
SABIC'S TRUCIRCLE™ PROGRAM – COMPLEMENTARY SOLUTIONS

PORTFOLIO

SERVICES

MECHANICALLY RECYCLED PRODUCTS



CERTIFIED CIRCULAR PRODUCTS

CERTIFIED RENEWABLE PRODUCTS

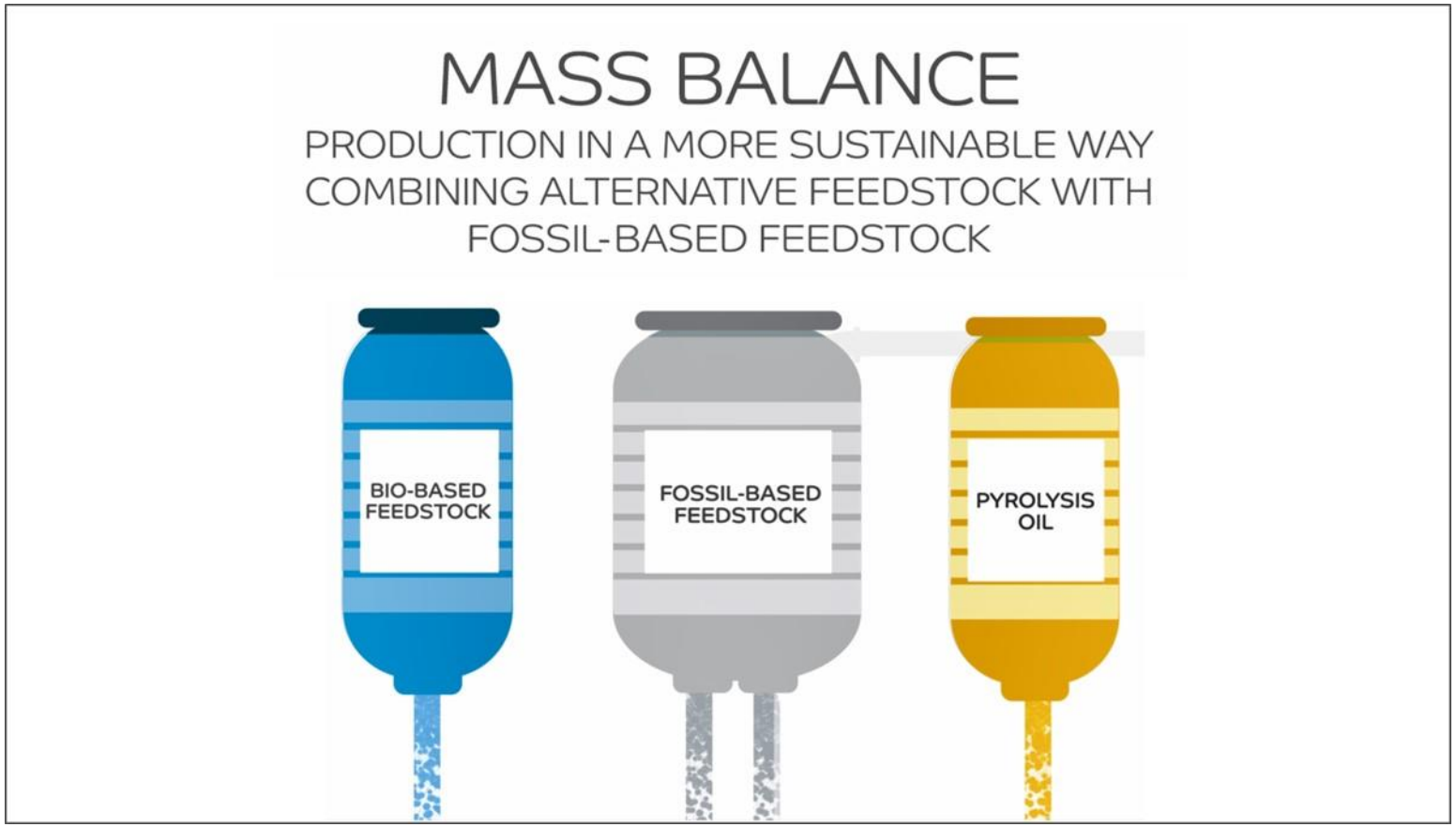
DESIGN FOR RECYCLABILITY

CLOSED LOOP INITIATIVES

Closing the loop and creating a Circular Economy for plastics

CERTIFIED RENEWABLE PRODUCTS & ADVANCED CHEMICAL RECYCLING

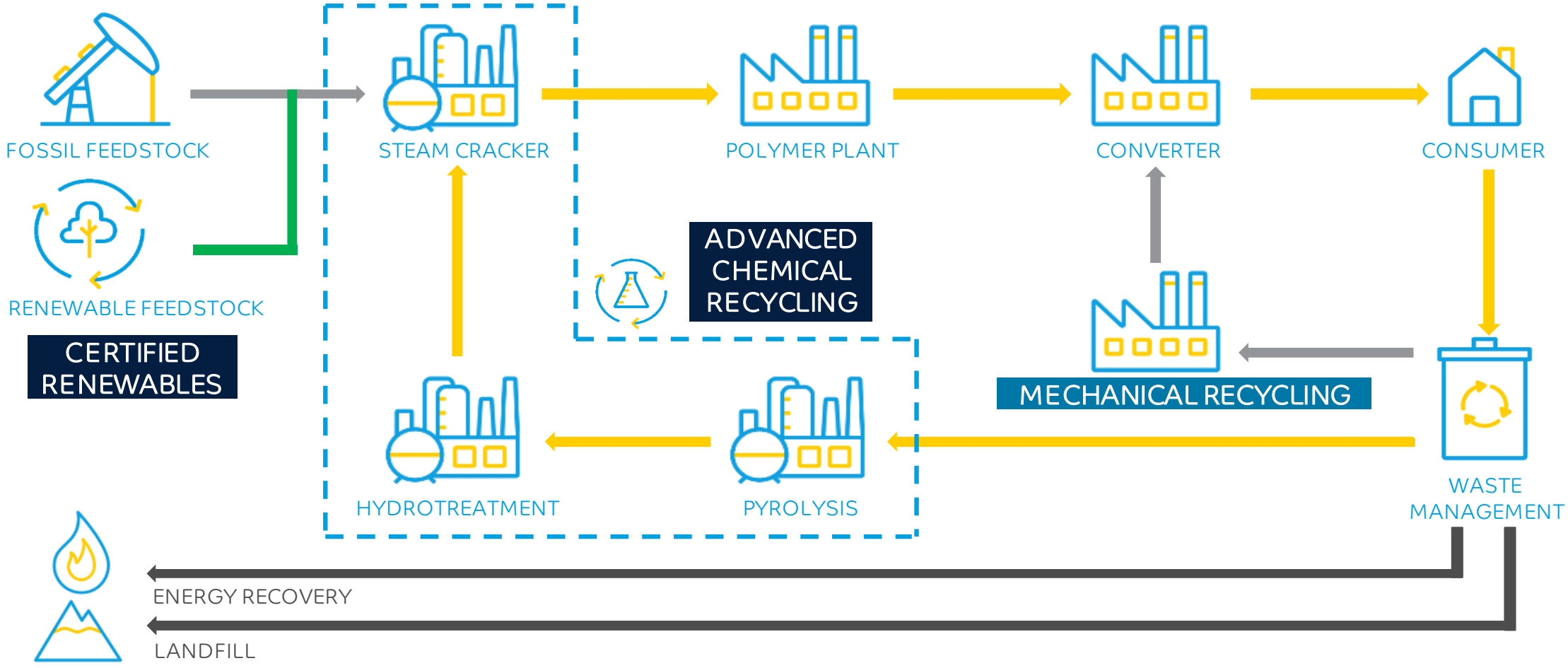
ACCEPTANCE OF THE MASS BALANCE CONCEPT IS A VITAL STEP



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

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

THE CONCEPT "FROM LINEAR TO CIRCULAR"

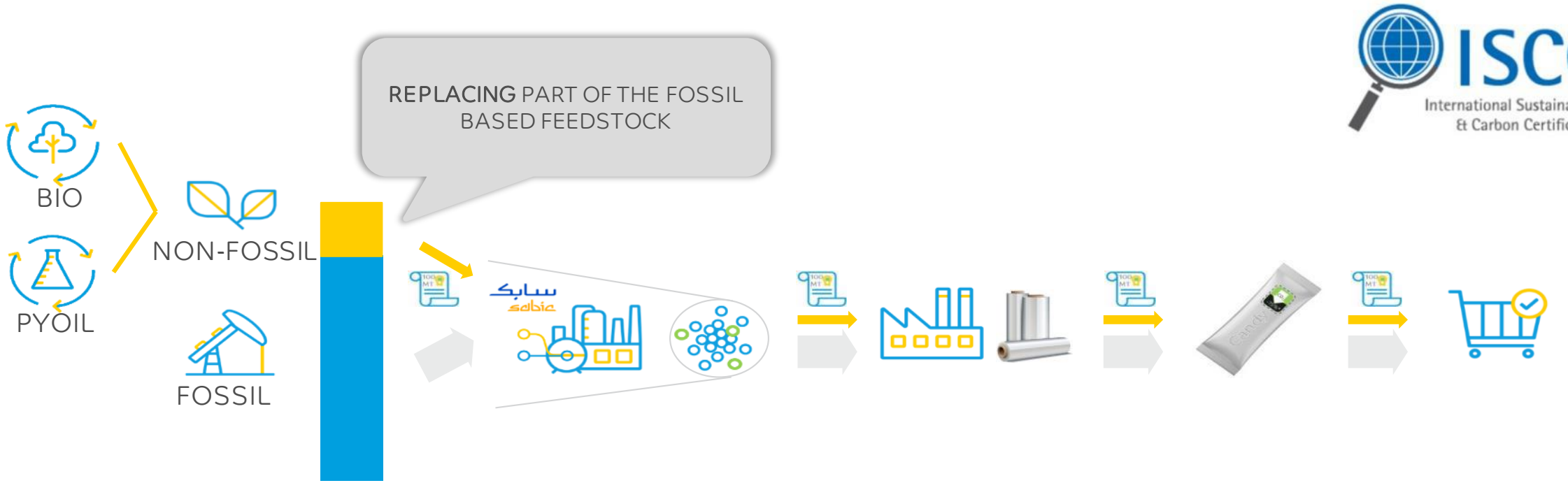


WHY MASS BALANCE APPROACH ?

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

TRACEABILITY OF CERTIFIED PC, PE & PP SOLUTIONS



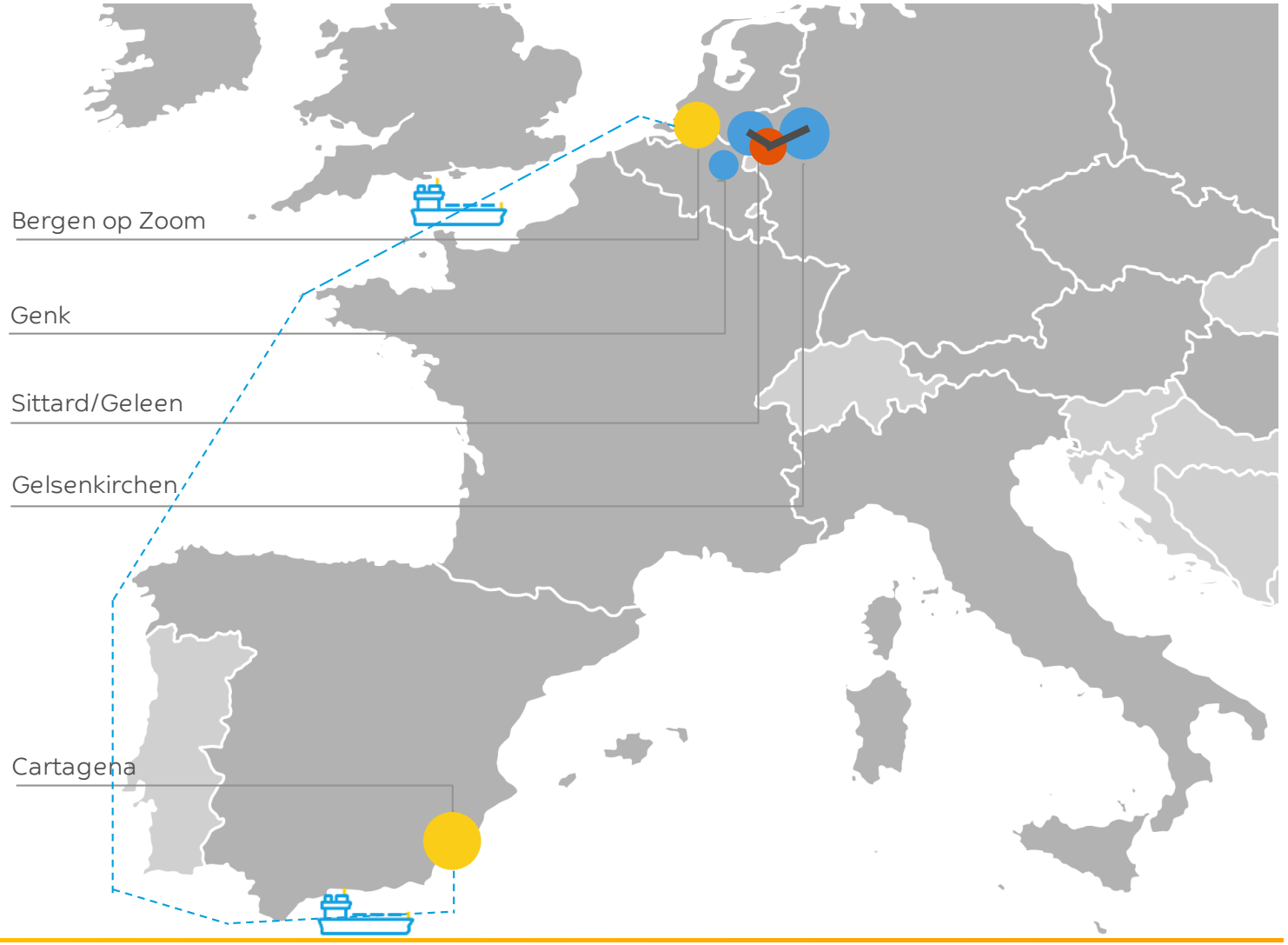
For Renewable and Chemical recycling: Certification by mass balance chain of custody

EUROPEAN PRODUCTION PLANTS OF CERTIFIED PRODUCTS

CERTIFIED PRODUCTION PLANTS

that are physically connected
to renewable and/or circular feedstock

- PE / PP
- ETP
- Steam cracker



VALUE OFFER FOR SABIC'S CERTIFIED RENEWABLE POLYMERS

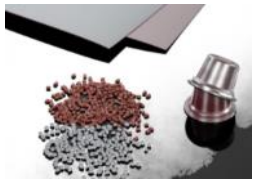
- NON-FOSSIL BASED
- Feedstock source has a lower carbon footprint compared to fossil alternative
- 2nd GENERATION RENEWABLE FEEDSTOCK, not in direct competition with the human food chain
- DERIVED FROM WASTE RESIDUE
  - Crude tall oil from wood industry
  - Used cooking oil (UCO)
  - Residues from vegetable oil processing

- No compromise on product safety
- **Identical product specifications** to our current SABIC PE, PP and LEXAN™ resin PC portfolio (first renewable PP, PC in the market)
- EXTERNALLY CERTIFIED VALUE CHAINS: ISCC Plus*
- Can be recycled

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

CERTIFIED RENEWABLE POLYOLEFINS & POLYCARBONATE

SABIC® PP & PE resins



PP for coffee capsules food industry

delica

Enabling solutions with PP for cosmetics packaging

Beiersdorf NIVEA

PP expanding to healthcare packaging

EACH KG OF RENEWABLE PE/PP CAPTURES UP TO 4 KG OF CO_2 FROM THE ATMOSPHERE WITH FOSSIL DEPLETION REDUCTION POTENTIAL BY UP TO 80%

PE in several food industry applications (milk, juice..)

SIG

FrieslandCampina

Arla

SIG

LEXAN™ resin

61% CO_2 FOOTPRINT REDUCTION FOR EACH KG OF POLYCARBONATE

Collaboration in lighting industry

elkamet

Lenses of several eyewear end applications

POLYRAY

ADVANCED CHEMICAL RECYCLING

PREVENTING PLASTIC FROM BECOMING WASTE

- 2019 Circular certified SABIC® PP & PE resins
- 2021 Polycarbonate certified circular LEXAN™ resin

WORLD'S FIRST COMMERCIAL UNIT FOR THE ADVANCED RECYCLING OF USED PLASTIC

SABIC and Plastic Energy **started construction** of world's first commercial unit to significantly upscale production of **SABIC's certified circular polymers** derived from used plastic

SABIC pioneering on the journey towards creating a circular economy for plastics

BENEFITS OF ADVANCED RECYCLING

SUPPORTING CUSTOMERS IN ADDRESSING CORPORATE SUSTAINABILITY GOALS

SABIC'S CERTIFIED CIRCULAR POLYMERS

PURE AND CARING
NO COMPROMISE ON PRODUCT PACKAGING PROPERTIES
BIG WINDOW OF APPLICATIONS, INCLUDING F&B CONSUMER PACKAGING, E&E, PERSONAL CARE, AUTOMOTIVE, …

DROP-IN SOLUTION
IDENTICAL PRODUCT SPECIFICATIONS TO OUR CURRENT POLYOLFIN GRADE PORTFOLIO
PROCESS ON EXISTING EQUIPMENT WITHOUT MODIFICATIONS
DOWN GAUGING OPPORTUNITIES (COMPARED TO MECHANICAL RECYCLING)

TRULY RECYCLABLE
NO LIMITATIONS IN NUMBER OF RECYCLING STEPS

CLOSED LOOP INITIATIVES

SABIC COLLABORATION: INDUSTRY FIRST CLOSED LOOP PROJECT

bp&r BRITISH PLASTICS AND RUBBER MAGAZINE

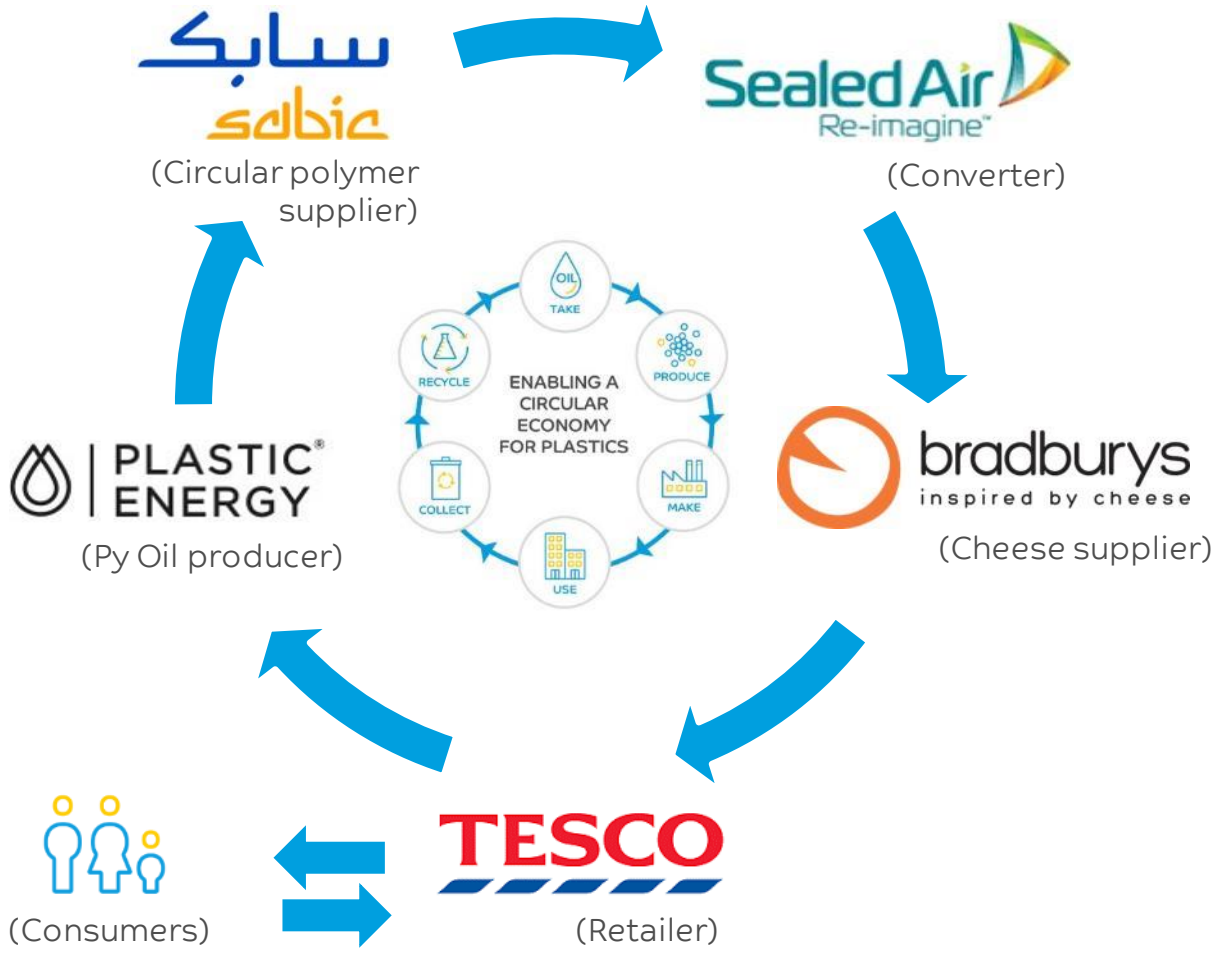
8 September 2020 10:47

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

by Leanne Taylor

RSS Print

A pioneering recycling project for soft and flexible plastics has resulted in the first food items on sale in a new packaging using these materials in Tesco this week.



Trial involving an entire supply chain

CIRCULARITY FOR PLASTICS is achievable through VALUE CHAIN COLLABORATION

CLOSED LOOP RECYCLING PILOT PROJECT FOR SINGLE USE FACEMASKS

- P&G collected post-consumer facemask in-house
- FRAUNHOFER converted masks into pyrolysis oil
- SABIC used the alternative feedstock to produce certified circular polymers
- P&G produced nonwovens for new masks

Validating loops for different industries and with variety of partners

ENABLING CIRCULAR BUSINESS MODELS

ENABLING NEW CIRCULAR BUSINESS MODELS

THINKING OUT OF THE LIGHTWEIGHT BOX

Development of a **returnable box** for converter of retail company

- Light weight for transportation: *15% vs exiting*
- Pallet and lid should have FR-properties: *UL-94 V0 @ 2mm*
- High impact and stiffness properties
- Processing: Low pressure Foam Injection molding

Developed new foam & lightweight PP compounds portfolio

TRACKING CIRCULARITY

SABIC Member of HolyGrail 2.0

Initiative to prove viability of digital watermark technologies for more accurate sorting of packaging and higher quality recycling

Pilot blockchain traceability project

Enabling the traceability of polyolefins and polycarbonate through the chemical and mechanical recycling loop

SUMMARY

MANY FIRSTS ... AND MORE TO COME

PROVEN SOLUTIONS

MASS BALANCE
chain of custody
for polymers

2014

2014

CERTIFIED RENEWABLE PE & PP
2nd generation bio-based feedstock

D4R WITH TF-BOPE
Mono-material solutions

2014

2019

2019

CERTIFIED CIRCULAR PE & PP
from chemically recycled feedstock

CERTIFIED RENEWABLE POLYCARBONATE
2nd generation renewable feedstock

2019

2019

CERTIFIED RENEWABLE CHEMICALS
new renewable value chains

CLOSED LOOP
with Tesco, Plastic Energy & Partners

2019

2020

CIRCULAR PRODUCTS
based on Ocean Bound Plastic

PCR COMPOUNDS
up to 70% mechanically recycled

2021

2021

2021

CERTIFIED RENEWABLE PRODUCTS
from 2nd gen used cooking oil

CERTIFIED CIRCULAR PC
from chemically recycled feedstock

2021

2021

TRUCIRCLE™ SOLUTIONS

Delivering on a Circular Future for Plastics by

INNOVATION & COLLABORATION

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