

From plastic waste to new resources, recycling as an opportunity for the chemical industry



BCCI Workshop
Green Deal for the Chemical Industry, Legislation

27 October 2021

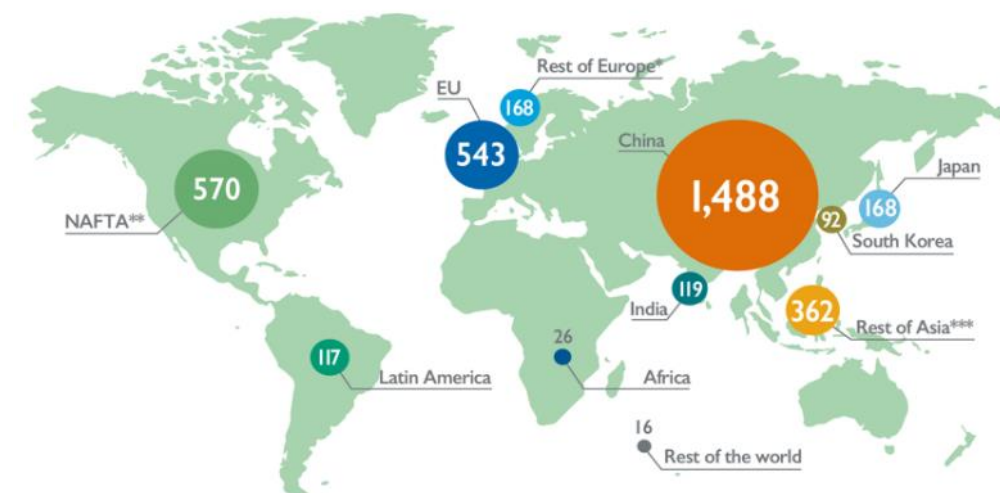
Henk Pool, Innovation Manager

Cefic is the voice of the chemical industry in Europe

- Based in Brussels since 1972, Cefic has grown to become one of the **largest trade organisations** in Europe and in the world
- Representing large, medium and small chemical companies in Europe – **1.2 million jobs** – **16.9%** of world chemicals production
- One of the **most active networks** of the business community: companies + industry (sector) associations + national federations incl. 
- We **interact every day** on behalf of our members with international and EU institutions, non-governmental organisations, the international media and other stakeholders

Europe is the second largest chemicals producer in the world

World chemical sales (2019, €3,669 billion)



Source: Cefic; 2021 Facts & Figures



Creating a Circular Economy for Plastics

“Every year, Europeans generate 25 million tonnes of plastic waste, but less than 30% is collected for recycling” states the 2018 European Plastics Strategy

Plastic recycling today:

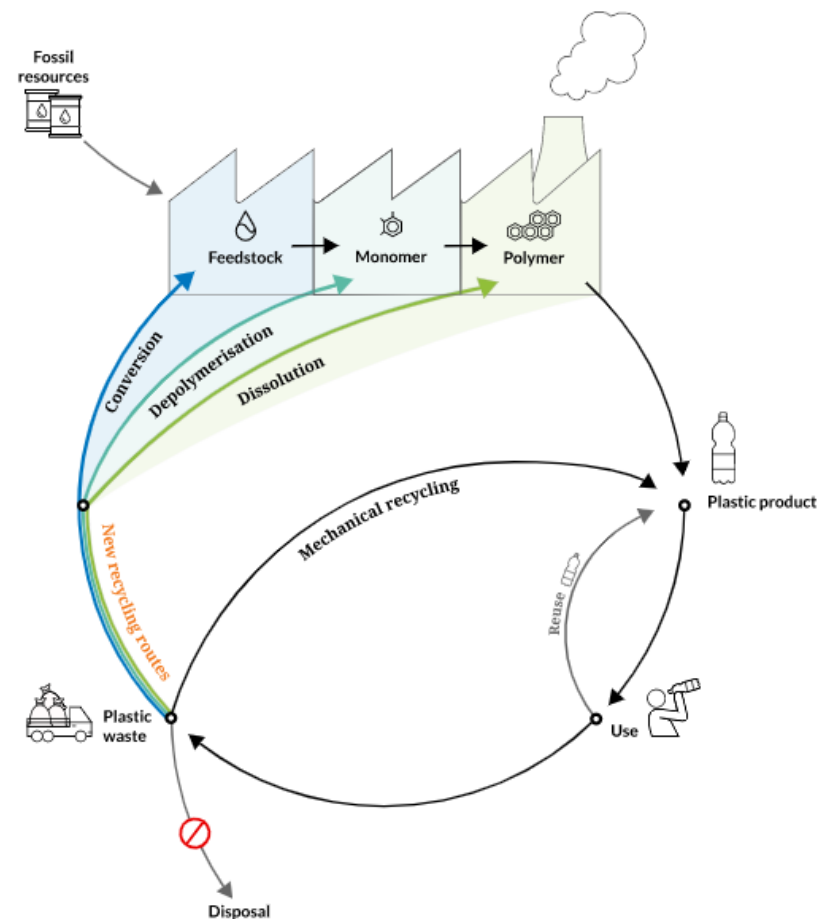
15% of the plastic waste today finds its way back to the market

- Collection & Sorting + Mechanical Recycling

Plastics Recycling tomorrow:

85% currently incinerated or landfilled

- Complementing opportunity for Chemical Recycling
- Mixed + Contaminated Plastics



Recovery and Resilience Facility (NextGenerationEU)

Recovery and Resilience Facility:

- The RRF is an EU fund to alleviate the negative economic impacts of the COVID-19 crisis

Bulgaria 2030:

- Bulgaria share of grants amounts to €6.6 bn (equivalent to BGN 12.9 bn)
- Bulgaria's draft plan foresees BGN 100 million of support for circular economy

Waste management:

- 36% of municipal solid waste is currently recycled; target for 2030 is 55%

Source: Bulgaria Recovery and Resilience Plan



Mechanical & Dissolution Recycling of Plastic Waste

1. Mechanical Recycling

- Sorted plastic waste is **molten and granulated** into recycled plastic articles

2. Dissolution Recycling

- Sorted plastic waste is **dissolved to extract** the polymers and make new recycled plastics from them



CHEMICAL INNOVATIONS FOR Plastics in a Circular Economy

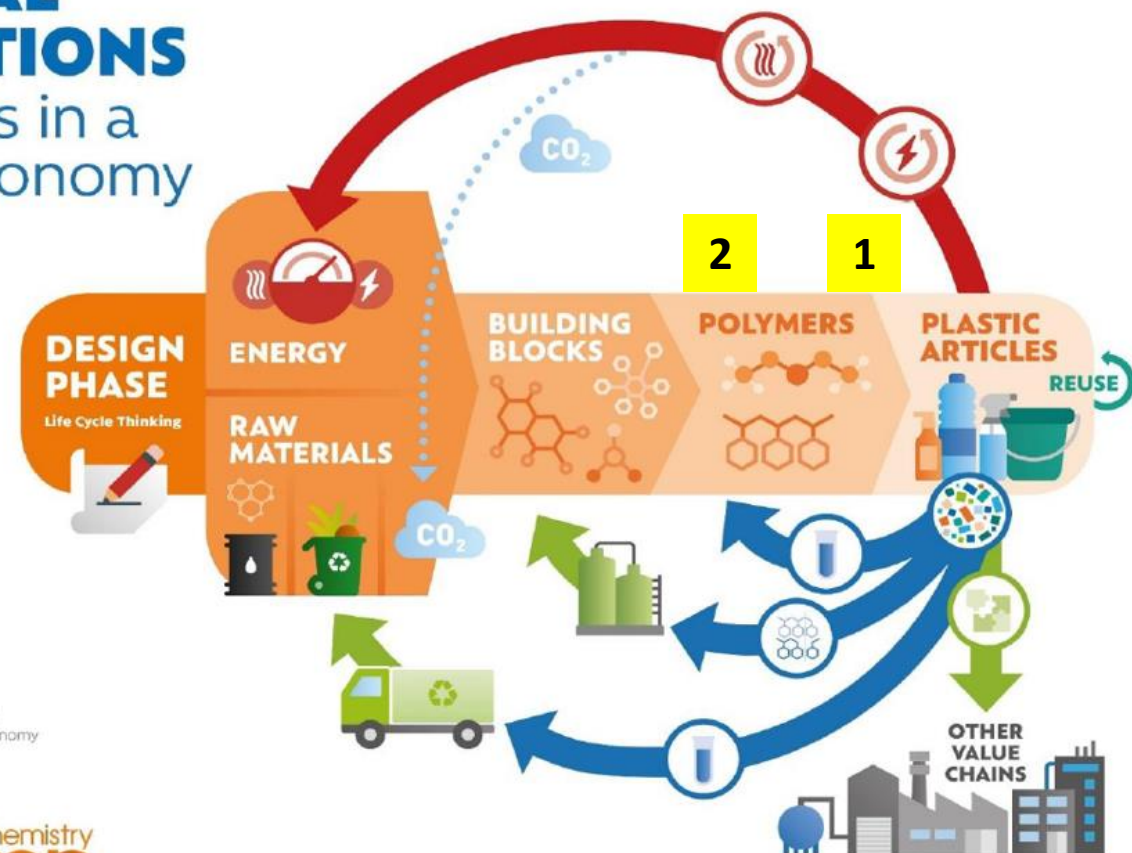
Production chain

Recycling technologies
Grinding, washing, compounding
Depolymerization, solvent extraction,
controlled bio-degradation

Secondary raw materials

CO₂ utilization
CO₂ as raw materials

Energy recovery
Heat, electricity



For more information about the Chemical industry's commitment to the circular economy please check our website www.cefic.org

Follow us on social media: @Cefic



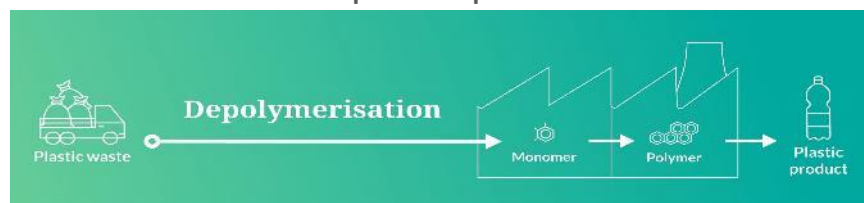
Material &
Secondary Raw Material



Chemical Recycling of Plastic Waste

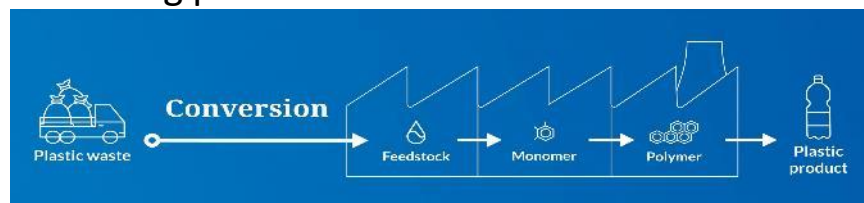
3. Depolymerisation

- Sorted plastic waste is **broken down** into **monomers** (basic building blocks) to feed them back into the plastic production



4. Conversion into Raw Materials

- Mixed plastic waste is **broken down** into oil- or gas-like **feedstock** (secondary raw material) that is then used to produce chemicals including plastic

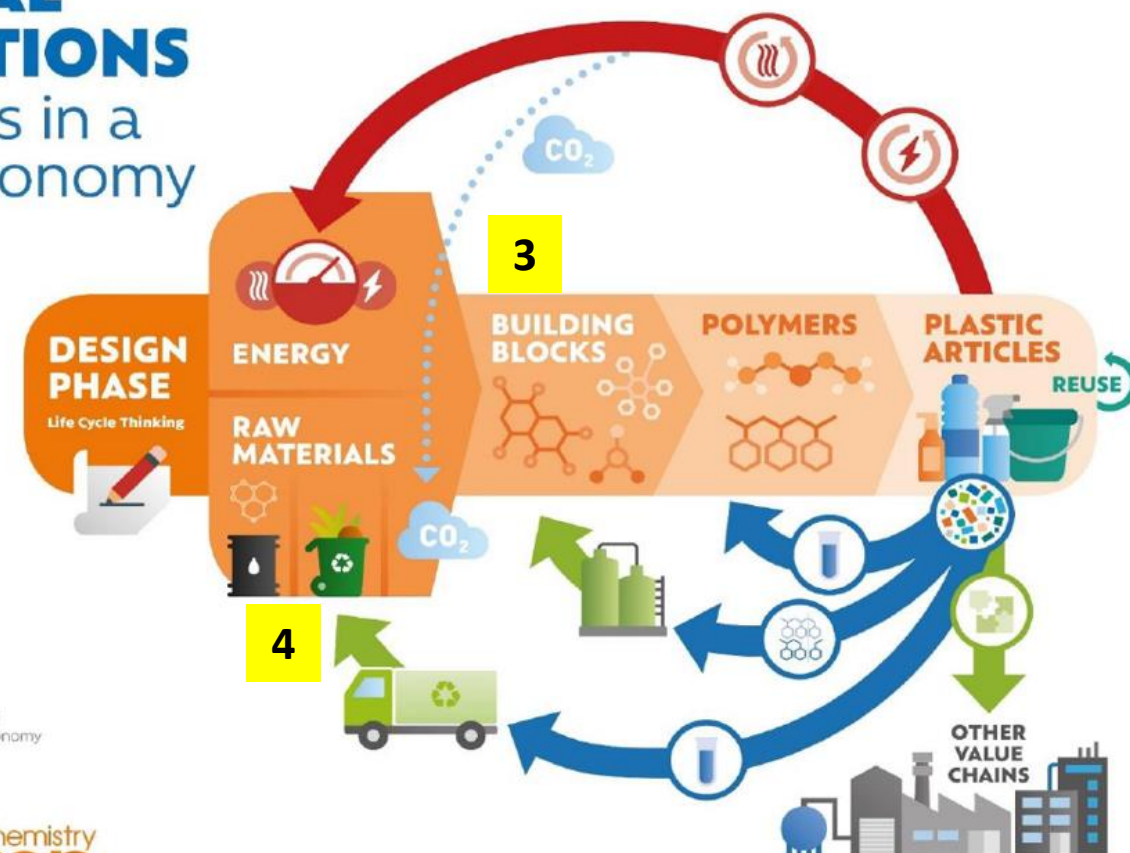


CHEMICAL INNOVATIONS FOR Plastics in a Circular Economy

- Production chain**
- Recycling technologies**
Grinding, washing, compounding
Depolymerization, solvent extraction,
controlled bio-degradation
- Secondary raw materials**
- CO₂ utilization**
CO₂ as raw materials
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Material &
Secondary Raw Material

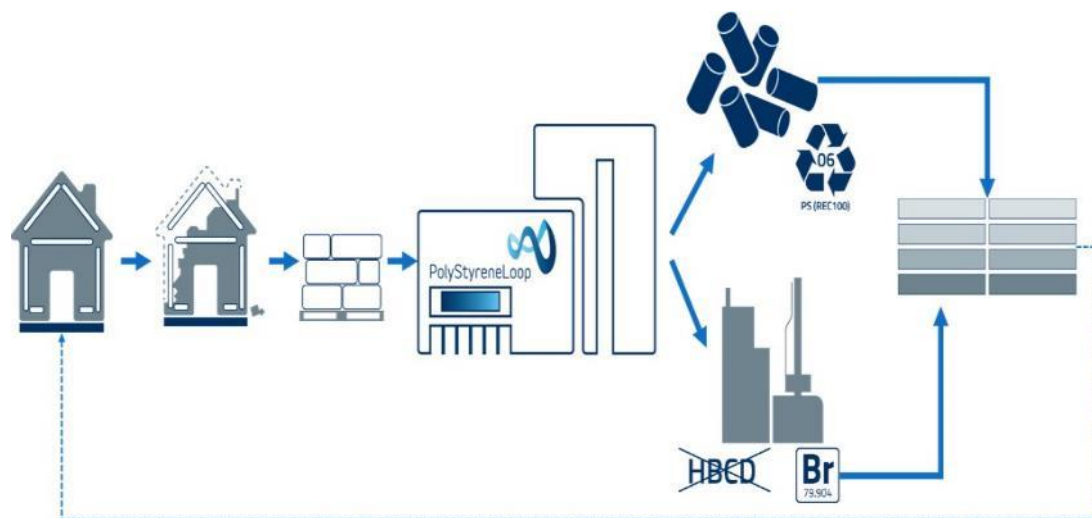


What is the chemical industry doing?

Dissolution Recycling – Case study Example



PolyStyreneLoop Cooperative offers an efficient recycling system to Recover old Polystyrene Insulation Foam (EPS/XPS)



STEP 1: DEMOLITION AND PRETREATMENT

EPS and XPS is used as **insulation material** in building ensuring climate control and saving energy

- Demolition waste is collected separately at the demolition site and shipped to the recycling plant



PolyStyreneLoop Plant in Terneuzen, The Netherlands Further Details: < [link](#) >

STEP 2: SOLVENT-BASED SEPARATION OF PS AND HBCD

- Solvent is added; transforms the Polystyrene (PS) into a gel
- The PS gel is then separated from the process liquids
- The gel is transferred into **a granulated PS polymer**
- The HBCD is treated in the Bromine Recovery Unit (BRU)



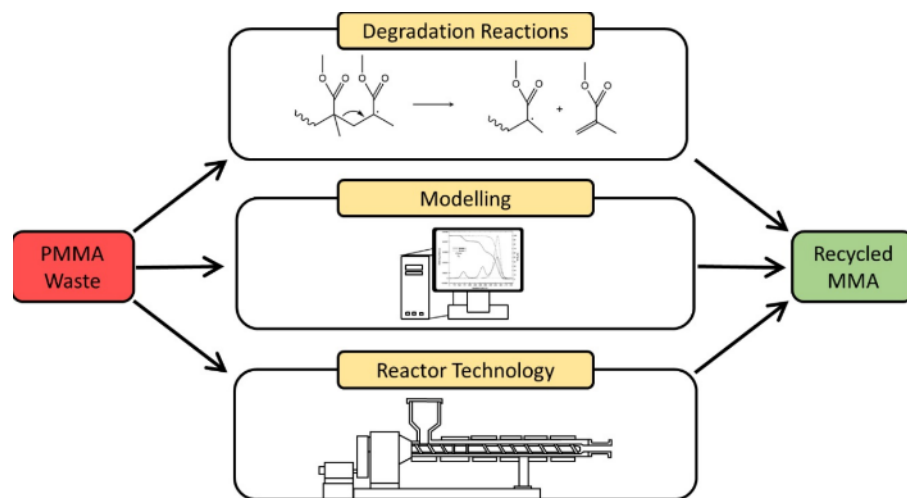
HBCD: Hexabromocyclododecane is a brominated flame retardant and prohibited substance in EU since 2016



What is the chemical industry doing?

Polymer to Monomer – Case study Example

MMAtwo, Second generation Methyl MethAcrylate (MMA) by ARKEMA



The MMAtwo project concerns the **thermal depolymerisation of PMMA** (PolyMethylMethAcrylate) to its monomer, and the reconversion into polymer applications



Extruder selected Further Details: < [link](http://www.MMAtwo.eu) >

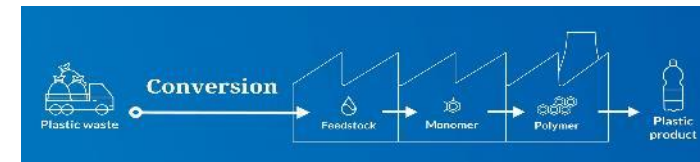
EXTRUDER TYPE OF EQUIPMENT @ THE CORE OF THE PLANT

- The MMAtwo project aims to secure the supply of commercial plant recycling units with at least 27,000 tons of feedstock of PMMA scraps and end-of-life products

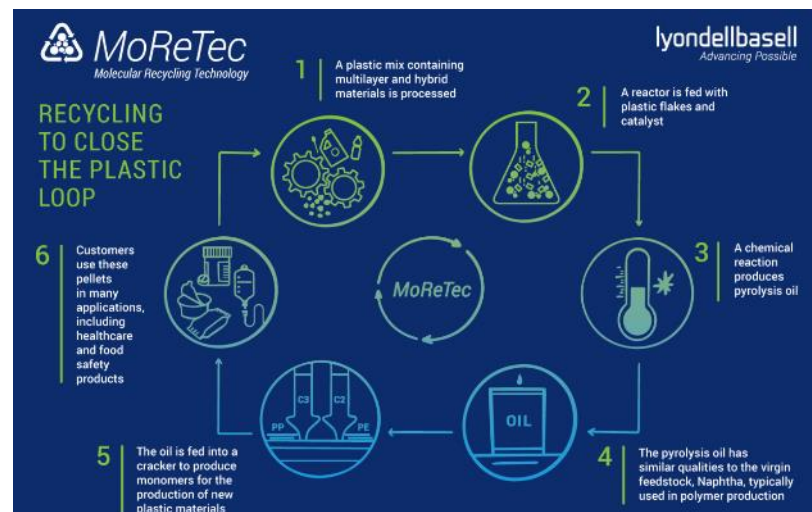


What is the chemical industry doing?

Feedstock Recycling – Case study Example



Start-Up Of LyondellBasell's **MoReTec Plant** Underlines Ambitious Plastic Waste Targets



MoReTec Plant in Ferrara, Italy

Further Details: < [link](#) >

IN 6 STEPS FROM MIXED PLASTIC WASTE TO NEW PLASTICS

- Chemical reaction of plastic waste mix to Pyrolysis oil
- Pyrolysis oil replaces primary feedstock
- Production of monomers → new plastic materials

CIRCULENREVIVE POLYMERS

- CirculenRevive are polymers made using feedstock recycling
- Have a wide range of uses, including those which must meet strict regulatory requirements such as **food packaging** and **healthcare items**



Chemical Recycling: What is the chemical industry doing?

Partnerships: Technology Development & Business Case

20 Case studies from Cefic members @ the Cefic CR virtual exhibition



Certified circular products: a TRUCIRCLE™ solution

Conversion: turning it into raw materials - SABIC



Developing chemical recycling with value chain partners

Conversion: turning it into raw materials - Nestlé



Hoop®-chemical recycling towards infinitely recyclable plastic

Conversion: turning it into raw materials - Versalis



Enhancing the quality of pyrolysis oil

Conversion: turning it into raw materials - Clariant



Design for Recycling – Textile Flooring

Dissolution: extracting plastic - Clariant



Chemical recycling process for used mattresses

Conversion: turning it into raw materials - BASF



Fostering chemical recycling to become Fully Circular

Conversion: turning it into raw materials - Covestro



Working towards a circular economy for plastics

Conversion: turning it into raw materials - Borealis



New innovative process for recycling end-of-life PMMA wastes

Depolymerisation: breaking it down to basic building blocks - ARKEMA



Start-up of LyondellBasell's MoReTec plant underlines ambitious plastic waste targets

Conversion: turning it into raw materials - LyondellBasell



Styrolution ECO: Taking the “single” out of single use

Depolymerisation: breaking it down to basic building blocks - INEOS



RENUVA™ Mattress Recycling Program

Conversion: turning it into raw materials - DOW



A partnership to produce 100% circular plastic

Conversion: turning it into raw materials - DOW



Total and PureCycle Technologies Form a Strategic Partnership

Dissolution: extracting plastic - TOTAL



Plastic Waste to Feedstock

Conversion: turning it into raw materials - Shell



Repsol Reciclex® – Circular Resins

Conversion: turning it into raw materials - Repsol



ChemCycling

Conversion: turning it into raw materials - BASF

Visit Cefic virtual exhibition on Chemical Recycling to learn more: www.cefic.org



Chemical Recycling: Current Cefic view

Position Paper – March 2020

Cefic Position Paper Chemical Recycling



POSITION PAPER

March 2020

Introducing chemical recycling: Plastic waste becoming a resource

"Every year, Europeans generate 25 million tonnes of plastic waste, but less than 30% is collected for recycling" states the 2018 European Plastics Strategy.

The Green Deal is at the heart of the EU's ambitions of becoming climate neutral. To meet the ambitious European objectives, much more waste plastic needs to be recycled and a broader range of markets need to be served with plastic products containing recycled content. In this respect Cefic highlights the potential of chemical recycling of plastic waste. Transitioning from a linear economy to a sustainable circular economy using innovative technologies is a key opportunity for Europe and its industries.

Background

The recycling¹ rate for glass, paper and metal today in the EU is well over 70%. Combinations of different recycling processes, techniques and solutions are in place to achieve these recycling rates. Similarly, in the development of a circular economy for plastics a combination of complementary options will be required to achieve high recycling rates for plastics.

Chemical recycling can fill a void in the plastics recycling loop, conserve valuable resources, and contribute to the creation of low carbon circular economy. Chemical recycling **complements** other plastic recycling options like mechanical and dissolution recycling. It is capable of processing contaminated and/or mixed plastic waste which would otherwise end up in incineration (with or without energy recovery) or landfill. Chemical recycling technologies allow use of plastic waste as feedstock to produce new chemicals and plastics. The quality of the latter is equivalent to those produced from virgin resources, allowing use in high-quality applications such as food contact and food packaging. An added benefit is the potential of chemical recycling to capture and separate the so-called legacy chemicals and substances of very high concern (SVHC) that can be present in end-of-life plastic.

Chemical recycling is not yet a widely deployed option for the recycling of plastic waste. Scale-up requires innovation, harmonised policies, recycling-chains and clear pathways to "valorise" plastic waste that is currently incinerated, landfilled or wasted. The involvement of the entire value chain in combination with a transnational policy framework are key in this respect.

To ensure the scale up and full deployment of chemical recycling, the industry is operating under the following guiding principles:

- Increase collaboration and work in partnerships to boost innovation and investments
 - Innovation and Research & Development (R&D) across innovation ecosystems and along the value chains creates the opportunity to address, amongst others operability, impurities – removal of additives / legacy chemicals / substances of very high concern (SVHCs) –

¹ Common recycling definition: Any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations. [EU Directive 2008/98/EC of 19 November 2008 on waste, Article 11\(17\)](#)

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EU Transparency Register n° 64879142223-90



Industry 's guiding principles to increase & develop:

- Collaboration and work in partnerships to boost **innovation and investments**
- Transparency and uniform standards for a chain of custody **mass balance approach**
- **Quality standards** for sorted/pre-treated plastic waste
- **Life Cycle Assessments (LCA)** to measure environmental impacts along the life cycle of products



Environmental impact: EU Commission view

- Answer by Commissioner Sinkevičius in ENVI committee meeting on **10 May 2021** on a question from MEP Pietro Fiocchi (ECR, IT) on opinion on chemical recycling.
 - The 'challenge of assessing chemical recycling and its environmental impact'.
 - He said there's **little independent information** available, as many projects are **still in the pilot phase**



If you would like to listen to the Commissioner's answer, go to 17:43:48 in this link:

https://multimedia.europarl.europa.eu/en/committee-on-environment-public-health-and-food-safety_20210510-1645-COMMITTEE-ENVI_vd



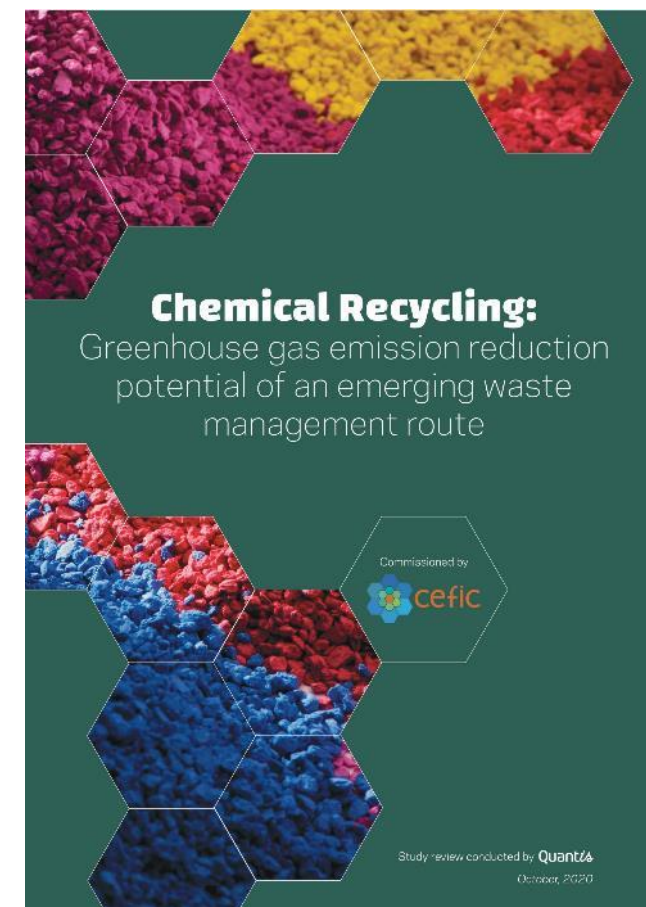
Environmental impact: Cefic views

Cefic-Quantis study published 1 December 2020

Chemical Recycling reduces CO₂ emissions of plastics' manufacturing

- Study analysing 4 published studies:

Material Economics	2019 & 2018
Agora Energiewende & Wuppertal Institute	2019
CE Delft	2019
BASF SE	2020
- Lower emissions due to **elimination of mixed plastic waste's incineration**
- **CO₂ emissions reduction** for plastics manufactured with chemical recycling building blocks instead of virgin feedstock materials



For a copy visit: www.cefic.org



Chemical Recycling: Relevant EU Legislation

REACH

- Chemical substance on the market

Regulation 1907/2006

Waste Management

- Landfilling
- Waste Framework
- • Packaging and Packaging Waste
- • Single Use Plastics
- • Waste Shipments Regulation

Directive 1999/31/EC

Directive 2008/98/EC

Directive 94/62/EC

Directive 2019/904

Regulation 1013/2006

Food Contact

- Plastic materials
- • Recycled Plastic Materials

Regulation 10/2011

Regulation 282/2008

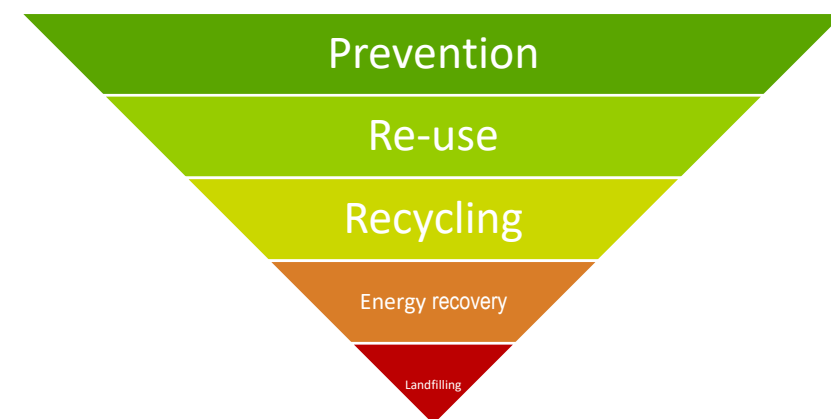
→ End of life

- Vehicles
- Others ...

Directive 2000/53/EC

Incentives

- Non-Recycled Plastics Packaging Waste Tax



Can we achieve a Circular Economy for Plastics without Chemical Recycling?

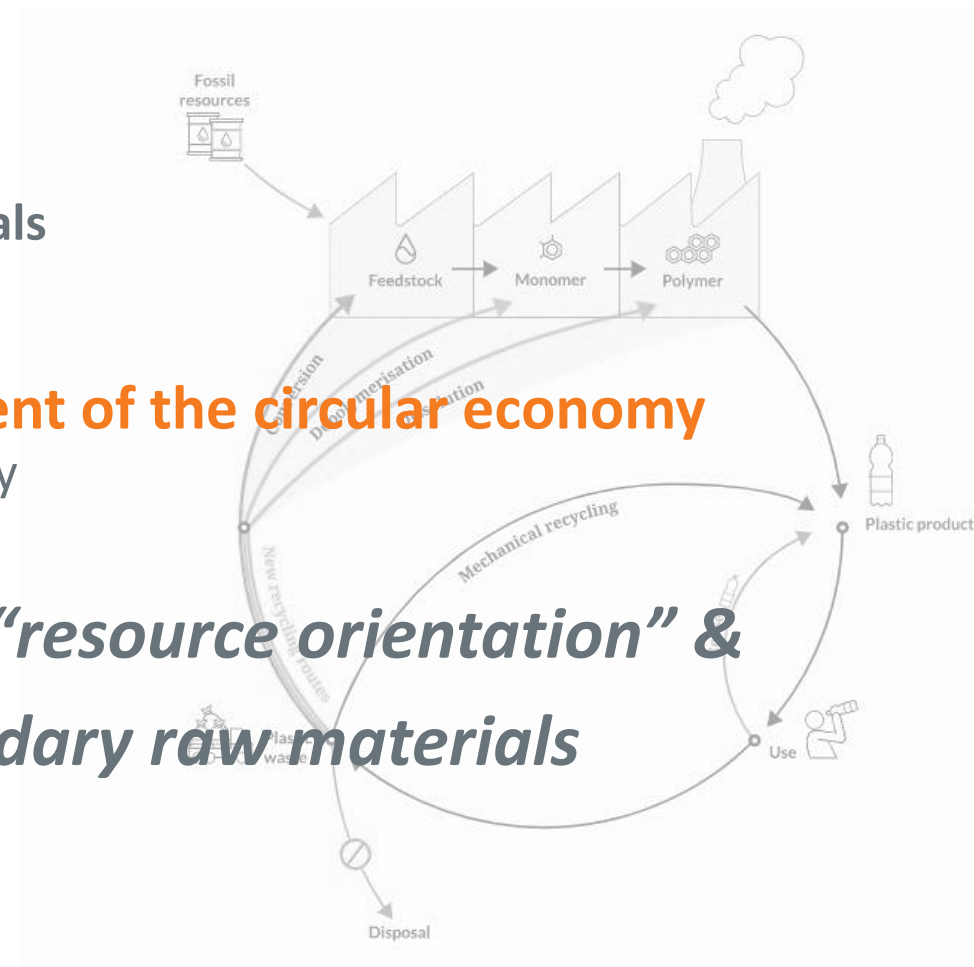
Resources:

- Middle East: oil + gas
- US: shale gas
- Europe: end of life products = **secondary raw materials**

Europe can take a leadership role in the development of the circular economy

- (Chemical) Recycling is an integral part of a circular economy

*Shift from a “waste orientation” to a “resource orientation” &
Create a single market for secondary raw materials*



Thank you!

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