

# Pyrolyse et gazéification des déchets d'emballages ménagers

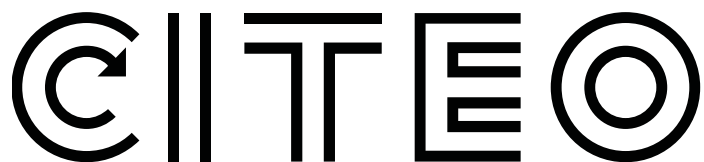
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Donnons ensemble une  
nouvelle vie à nos produits.



## Citeo, une entreprise privée avec des contraintes fixées par l'État



Donnons ensemble une nouvelle vie à nos produits.



**Un statut privé**



**Une mission d'intérêt général**

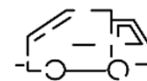


**Sans but lucratif**



**Sous agrément d'état**

### Rôle et missions de l'éco-organisme :



Organiser la collecte, le tri et le traitement des emballages et des papiers pour une meilleure performance et à un meilleur coût.



Piloter des programmes de recherche pour développer l'éco-conception et faire progresser les Process industriels.



Informier et sensibiliser les citoyens au geste de tri.

# La chaîne du recyclage

## Les opérateurs

**Recyclent et valorisent toujours plus de matériaux :**

- Moderniser les centres de tri
  - Assurer la qualité
- Développer les filières de recyclage et la valorisation énergétique

## Les collectivités

**Organisent la collecte et le tri, sensibilisent les habitants :**

- Apport volontaire
- Habitat collectif



## Les entreprises

**Eco-concevoir les emballages et papiers : moins complexes, plus faciles à recycler**

## Les citoyens

**Encourager et faciliter le geste de tri**

# 01

## PLASTIC : A CONSTANT INCREASE SINCE THE YEARS 50

Working for circularity

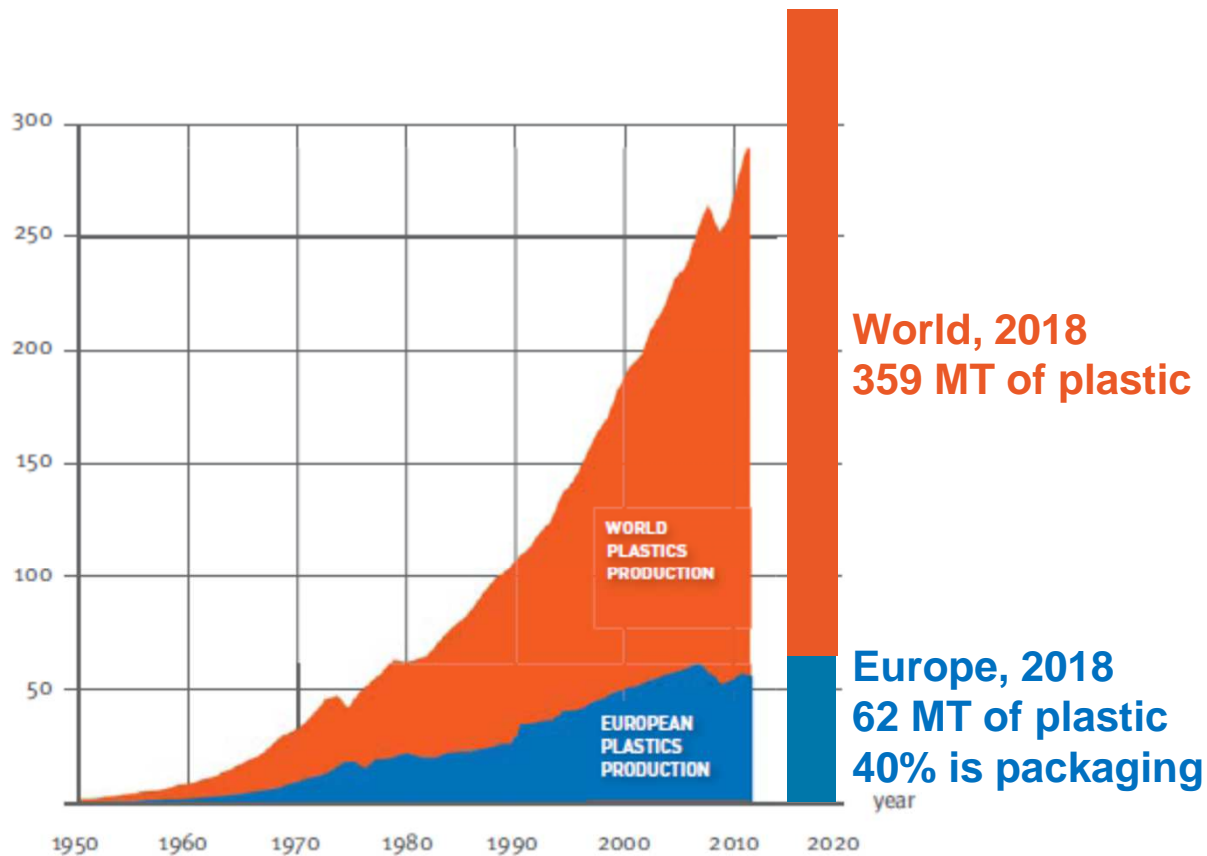
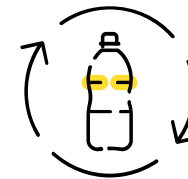


Figure 2: World plastics production 1950-2012

Includes thermoplastics, polyurethanes, thermosets, elastomers, adhesives, coatings and sealants and PP-fibers. Not included PET-, PA- and polyacryl-fibers

Source: PlasticsEurope (PEMRG) / Consultic



**Develop recycling to reach EU tomorrow's targets**

42% recycled today,  
55% target for 2030

**Improve quality of recycled material to open new outlets,**

especially for food contact and closed loop

## 02 EFFICIENCY CRITERIA

Some key elements



### PYROLYSIS

#### Optimization of the proportion of **Naphtha**:

- Fraction used in the production of monomers (ethylene, propylene, etc.), and new polymers.

#### **Reduction in coke** production:

- This by-product clogs reactors.

#### **Energy impact**:

- The energy impact is one of the main determinants of the environmental impact.

Crédit photo: Plastic Energy

# 03

## WHAT TYPES OF WASTE ARE ELIGIBLE?

There is no miracle: “garbage in, garbage out”



**Pyrolysis cannot be used to treat just any mixture of plastic waste.**

- PVC plastic waste excluded (presence of chlorine),
- PET unsuitable (presence of oxygen)
- Polyamides unsuitable (oxygen and nitrogen).

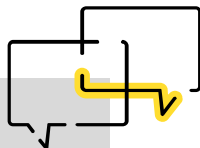
**The material must meet precise preparation and quality specifications**

**Gasification has a wider scope**

- Can also process carbon for biomass
- But different output (syngas)

## 04 WHAT POTENTIAL COMMERCIAL USES ?

### Focus on plastic recycling

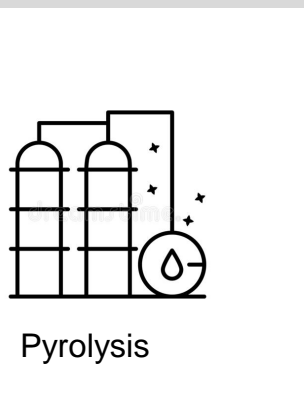


**The question of where pyrolysis oils enter the refinery is key.**

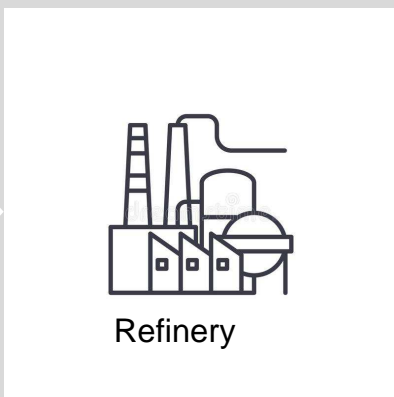
- If used as a crude oil, the hydrocarbon will mainly be used for fuel production.
- If it is fed into the steam cracker, the oil will be used to produce chemicals and new plastics.

**Originally, almost all pyrolysis units were designed for “plastic-to-fuel”**

**Projects are now turning towards recycling “plastic-to-plastic” and “plastic-to-chemicals”**



Pyrolysis



Refinery



# 05 ENVIRONMENTAL IMPACT

## Not so efficient than mechanical recycling



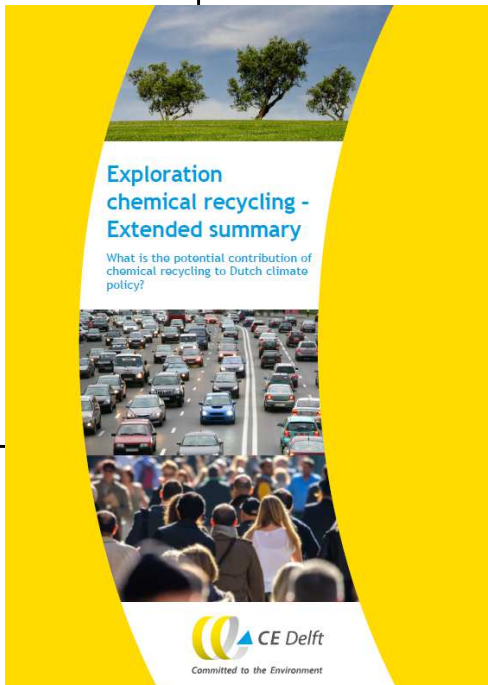
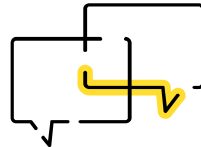
### Evaluation of pyrolysis with LCA – 3 case studies

According to ISO 14040:2006 and ISO 14044:2006

Update July 2020

**Practitioner of the study:**  
Sphera Solutions GmbH  
Hauptstr. 111-113  
70771 Leinfelden-Echterdingen

**Commissioner:**  
Dr Christian Krüger  
BASF SE, Corporate Sustainability  
67056 Ludwigshafen



**The available analyses are mainly based on the energy required to depolymerise and then recreate plastics.**

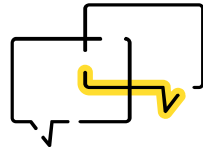
- The environmental impact of pyrolysis appear less attractive than that of mechanical recycling.
- But it is better than that of incineration.
- And the quality of the recycled plastic is higher



# 06

## TRACEABILITY, MASS BALANCE

Necessity to build confidence with brands, retailers and consumers



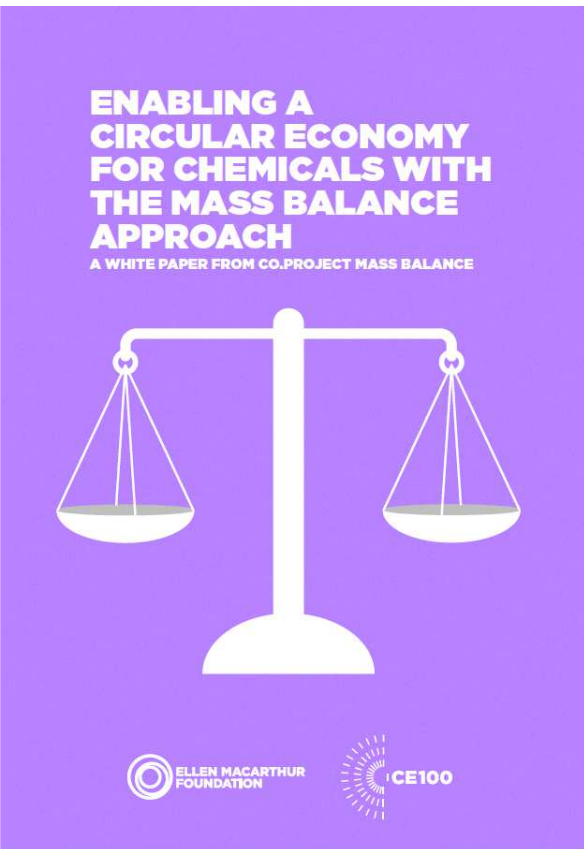
**Pyrolysis is a technology that does not provide physical traceability of recycled flows.**

- Pyrolysis oils are intended for use by refineries and petrochemical platforms along with a larger proportion of fossil hydrocarbons.

**Players in the sector are developing what is known as “mass balance” calculation conventions**

**The definition of mass balance is the subject of debate**

- Distinction between “plastic-to-oil” and “plastic-to-plastic”
- Geographical perimeter
- Calculation of yield and recycling rate



# 07 SOME PROJECT ALREADY RUNNING

One on the main topics in CITEO R&D

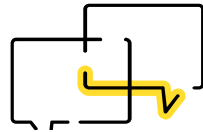
## Projet FUSCIA



## Projet PLASTHYC



## 08 SOME KEY QUESTIONS



### **Which waste will you process?**

- Quality and preparation required

### **Will you be sustainable?**

- Energy consumption & environmental impacts

### **Time to market**

- When can we expect commercial scale plants ?

### **What size for tomorrow's plants?**

- Industrial threshold / optimum

### **What are the necessary partnerships along the chain ?**

- Role of recyclers, polymer producers, plastic users ...

# Question?

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