



COLLECTION - SORTING - REPROCESING - LEGISLATION - EXTENDED PRODUCER RESPONSIBILITY - DEPOSIT SYSTEMS - FUTURE TECHNOLOGIES

*Everything you need to know for your brand*  
**SESSION 2**

**MASTERCLASS**

**RECYCLING**

*a deep dive into recycling of household packaging*





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**The PROGRAMM**

**& etiquette of meetings**

*Masterclass Recycling – Session 2*



# The programm



## Five sessions into recycling of household packaging

26-01-2021

10.00 – 11.30 CET

### Collection & Sorting

1

- What is 'recyclable'?
- Legal background on packaging waste
- Collection systems
- Sorting of packaging & technologies used.
- Standard design & sorting issues in sorting
- New sorting technologies (digital watermarking & Image recognition)

02-02-2021

10.00 - 11.15 CET

### Reprocessing

2

- Reprocessing in Europe
- Additional sorting at the reprocessor explained
- Technologies in place
- Upcoming reprocessing technologies: Chemical recycling
- Recycling vs LCA vs CO<sub>2</sub>-emission

09-02-2021

10.00 – 11.15 CET

### Design & Certification

3

*All participants will receive PDF with Design for recycling Guidelines*

- Design for Recycling Guidelines;
- Training: How to make a self-assessment of recyclability for your packaging
- Mindeststandard in Germany, RecycleCheck in NL
- Certification conform RecyClass

16-02-2021

10.00 – 11.00 CET

### Producer Responsibility

4

- Everything you want to know on Extended Producer Responsibility (EPR-systems) throughout the world
- What is changing in EPR for packaging
- Presented by Lorax for legislation & registration, supported by SUEZ.circpack for everything on recycling

60 minutes

Date to be aligned with you

### One-on-one session

5

- Opportunity to ask additional questions in a one-on-one live session with a SUEZ.circpack expert.
- Get answers to your dedicated questions that are really important for you and your company
- No competitors listening!

# Etiquette during the meeting



- Slides will be provided after the meeting
- Question? ask via the chat
- Have your QR-scanning app ready on your mobile:

- SCAN ME -



- **Your competitors might be listening. Do not share anything that you do not want to be public**
- **Do not discuss prices, fees, margins, customers, etc.**
- **When you feel that regulatory rules are broken, please inform us via chat in order for us to take action.**



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1  
**RECAP OF**

**SESSION ONE**

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# Recap of Session One

September 15

10.00 – 11.30 CET

## Collection & Sorting

- What is 'recyclable'?
- Legal background on packaging waste
- Collection systems
- Sorting of packaging & technologies used.
- Standard design & sorting issues in sorting
- New sorting technologies (digital watermarking & Image recognition)

1



1. COLLECTION



2. SORTING

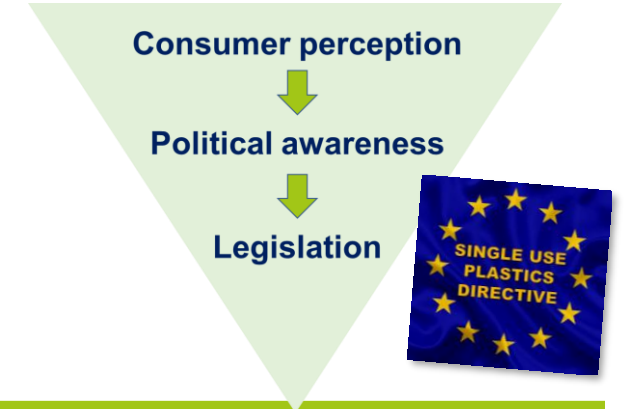


3. REPROCESSING



4. APPLICATION

= RECYCLABLE



Robotization

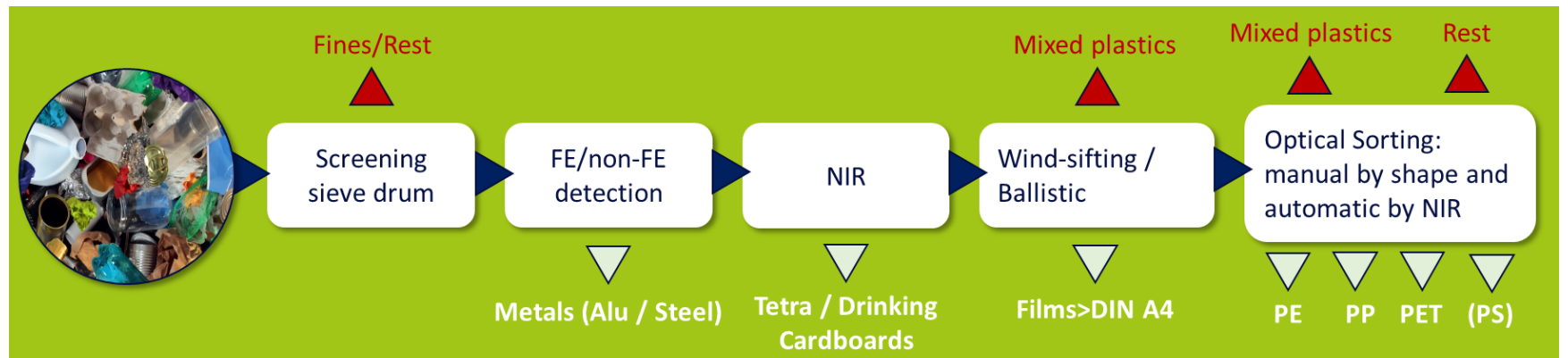
Image Recognition

Deep learning

EU targets 2025/2030:

Recycling:  
50% by 2025 and 55% by 2030

NEW Calculation of recycling:





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**REPROCESING**

**in EUROPE**

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# REPROCESSING of plastics

## TOTAL INSTALLED PLASTICS RECYCLING CAPACITY PER COUNTRY

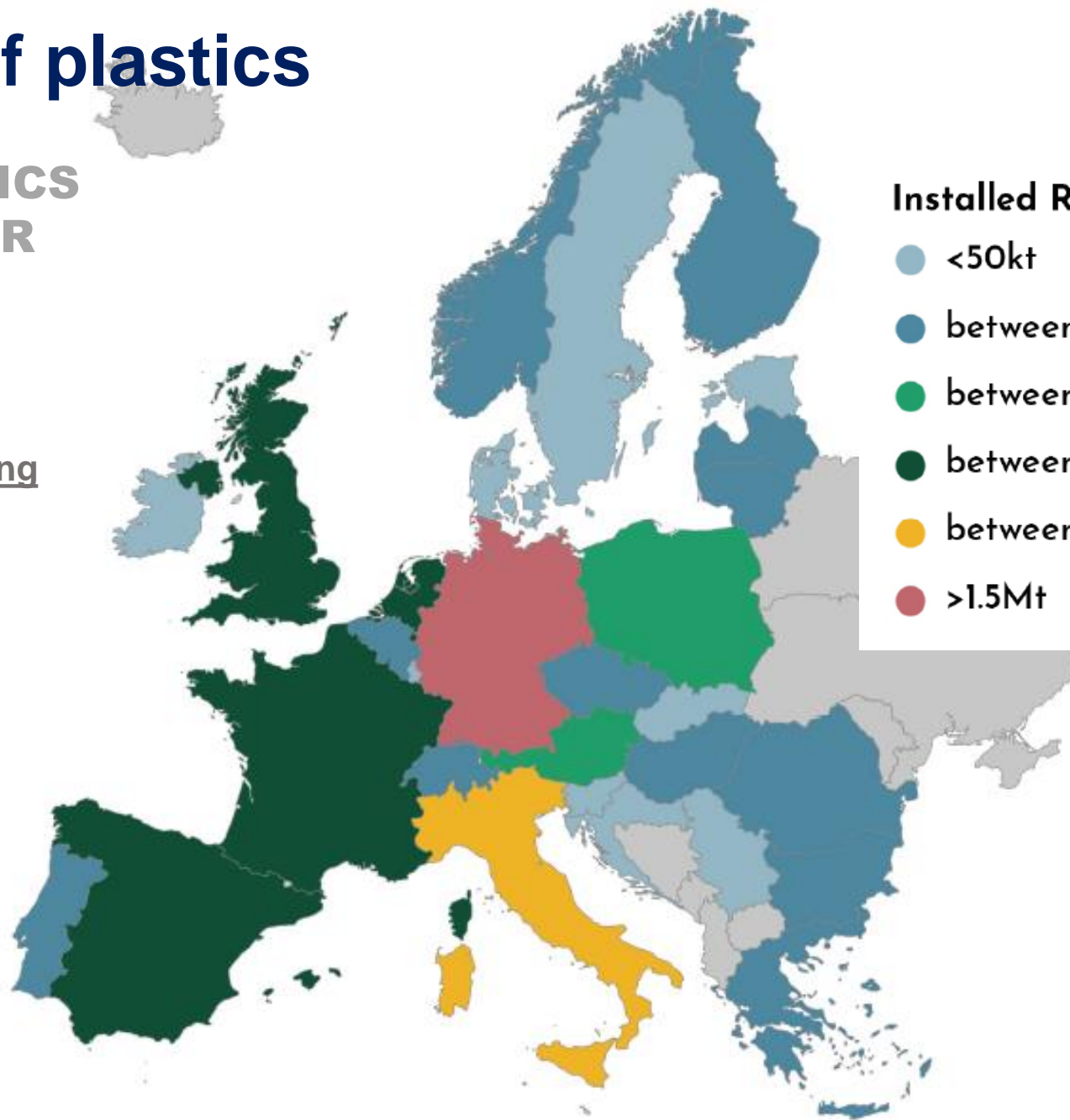
- 9,4 Mt of post consumer plastics sent for recycling
- 7,5 Mt of post consumer packaging plastics sent for recycling
- Conclusion = Growth needed!

# 600

## COMPANIES WITH

# 8.5 MT

## total installed recycling capacity in the EU



### Installed Recycling Capacity

- <50kt
- between 50kt and 250kt
- between 250kt and 0.5Mt
- between 0.5Mt and 1Mt
- between 1Mt and 1.5Mt
- >1.5Mt



# REPROCESSING of plastics



SHARE OF INSTALLED  
RECYCLING CAPACITY PER  
TYPE OF POLYMER

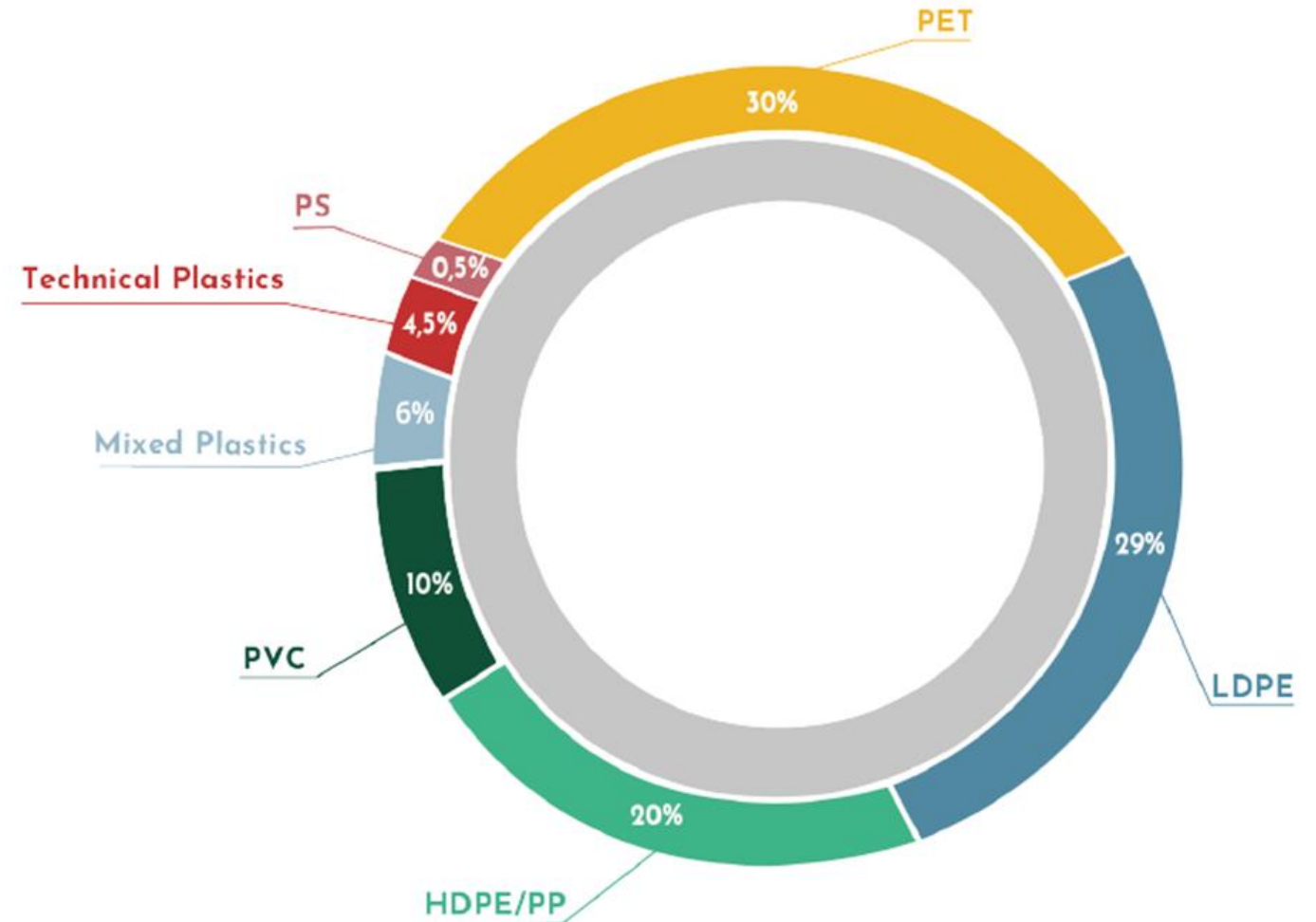
**80%**

**= PET, LDPE, HDPE and PP**

**5 countries**

**cover 67% of the total  
recycling capacity in  
Europe:**

**Germany, Italy, Spain, UK and France**





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**ADDITIONAL SORTING NEEDED**

**@ REPROCESOR**

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# Additional sorting @ the Reprocessor



>80% of recycling  
=  
sorting

# Additional sorting @ the Reprocessor

## How much additional sorting is required?

### ORIGIN?

#### Post consumer:

- Source separated?
- Sorted from residual waste?
- Deposit system?

#### Post industrial:

- Return logistics? Deposit? Re-Use?

#### Post-production:

- Production scrap, mis batches, Obsolete stock

#### Sorting facility?

### Quality of INPUT?

- Target material (PET, PE, PP,..)
- % non-target-material
- Different types of polymer?
- Metals?
- Glass?
- Residue?
- Fat?
- Other materials?
- Silicon sealant tubes?
- Colors?

### Quality of OUTPUT?

- Purity of polymer?
- MFI?
- IV?
- Strenght?
- Food grade?
- Color?
- Smell?

### APPLICATION?

- Quality & safety requirements
- Bottle to bottle?
- Film to film?
- Thick wall product?
- Type of moulding?
- Dark or light product?
- Smell acceptance



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**SORTING**

**TECHNOLOGIES IN PLACE**

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# Technologies in place



>80% of recycling = sorting

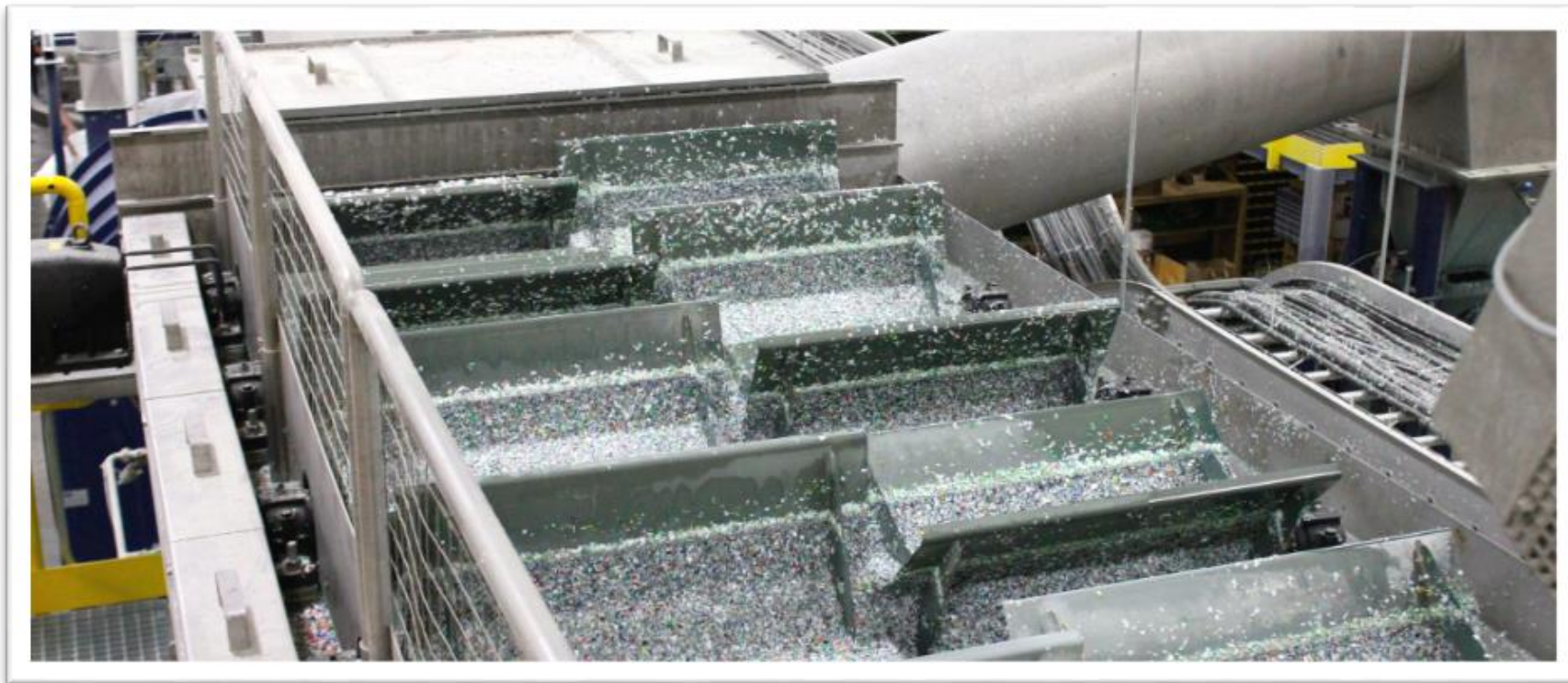
- Shredding & Washing
- Label separation
- Friction
- **Sink-float**
- **Optical sorting of polymer (NIR)**
- **Optical sorting of color (CCD camera's)**
- **Magnetic Density Separation (liquisort)**
- **Elutriator (zigzag windsifter)**
- Air classification (wind sifting)
- (Hydro)cyclone / Centrifuge
- **Tribo electric separation**
- Magnetic (FE)
- Pulping (Cardboard & Tetra)

# Technologies in place



## Sink-float technology:

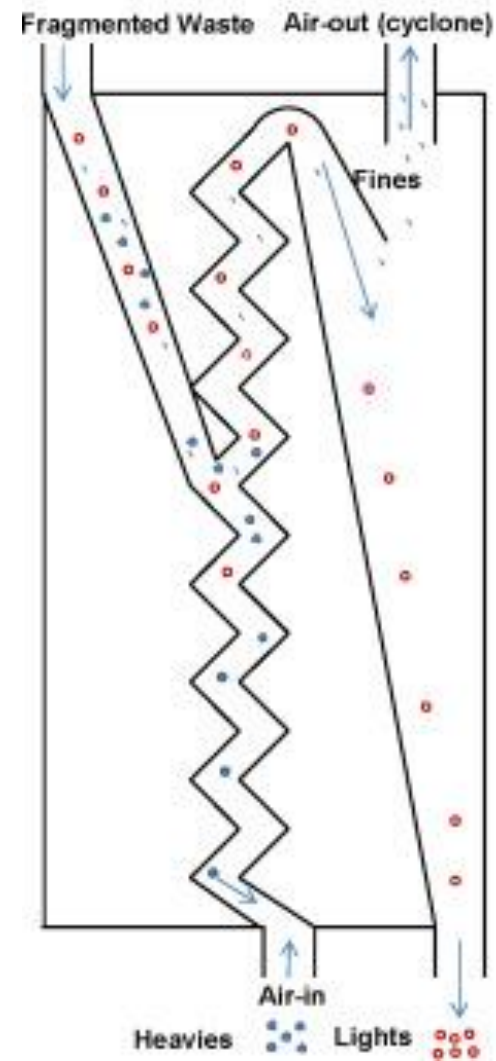
- PP, PE, foams and Silicon **float** in water
- PET, PS, PVC and most of the other plastics **sink**



# Technologies in place

## Elutriator (zigzag):

- Separating **light** from **heavy** particles
- Separating **labels** and **sleeves** from rigid packaging

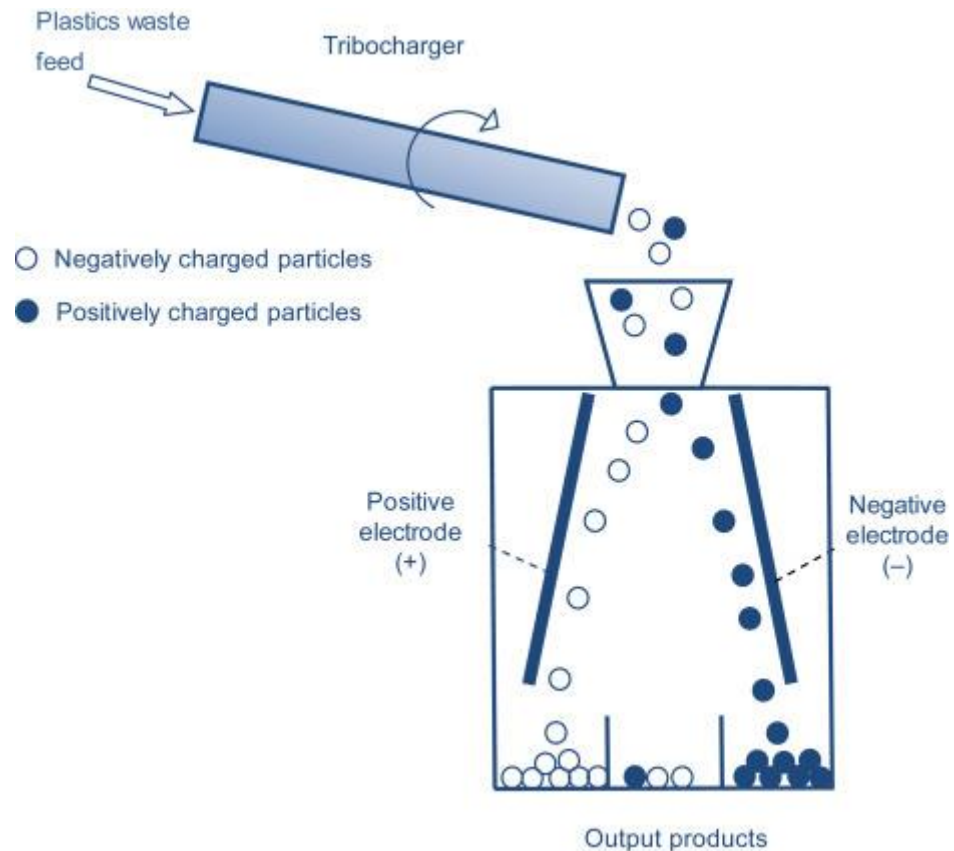




# Technologies in place



## Tribo electric static sorting:



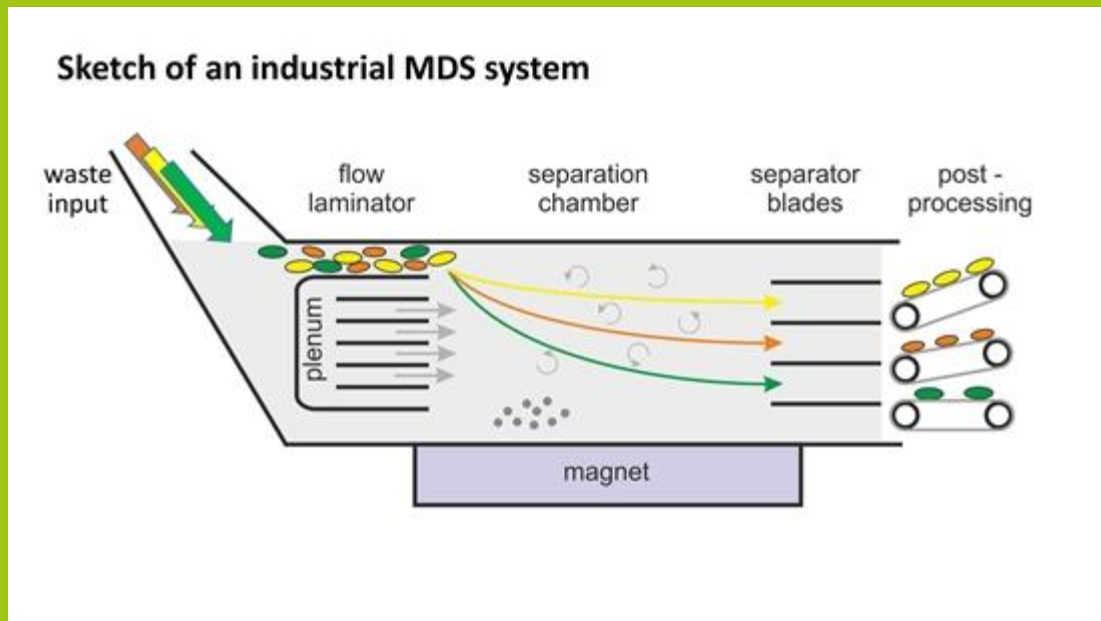
- Mixture of non-conductive materials
- Completely disintegrated material (no composite materials)
- Different tribo-electric charging behaviour
- Dry material (ideal surface moisture < 0.4 %)
- Dust-free material
- Particle size between 2 and 12 mm
- Ideally two-component mixtures
- PVC vs PE or PP vs PE
- ABS and PS from Electronics

# Technologies in place



## Magnetic Density Separator

- MDS is a smart way of sorting polymers by density
- Downside: density can be altered by additives



- **Plastics are grinded into smaller pieces (flakes)**
- **The flakes are released in the MDS, which contains magnetic fluid**
- **A magnet is used to create a density gradient field. This creates a different density at different heights**
- **Each type of plastic has its own density and sinks or floats to a specific level**
- **At the end of the bath, all plastic flakes flow to different compartments.**

# Technologies in place

## NIR & Color flake sorting:



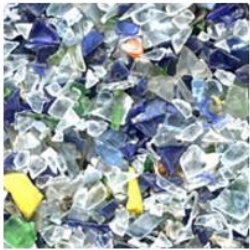
PVC flakes (window profile wastes)  
after sorting (accept)



PVC flakes after sorting  
(reject)



PET flakes after sorting  
(accept)



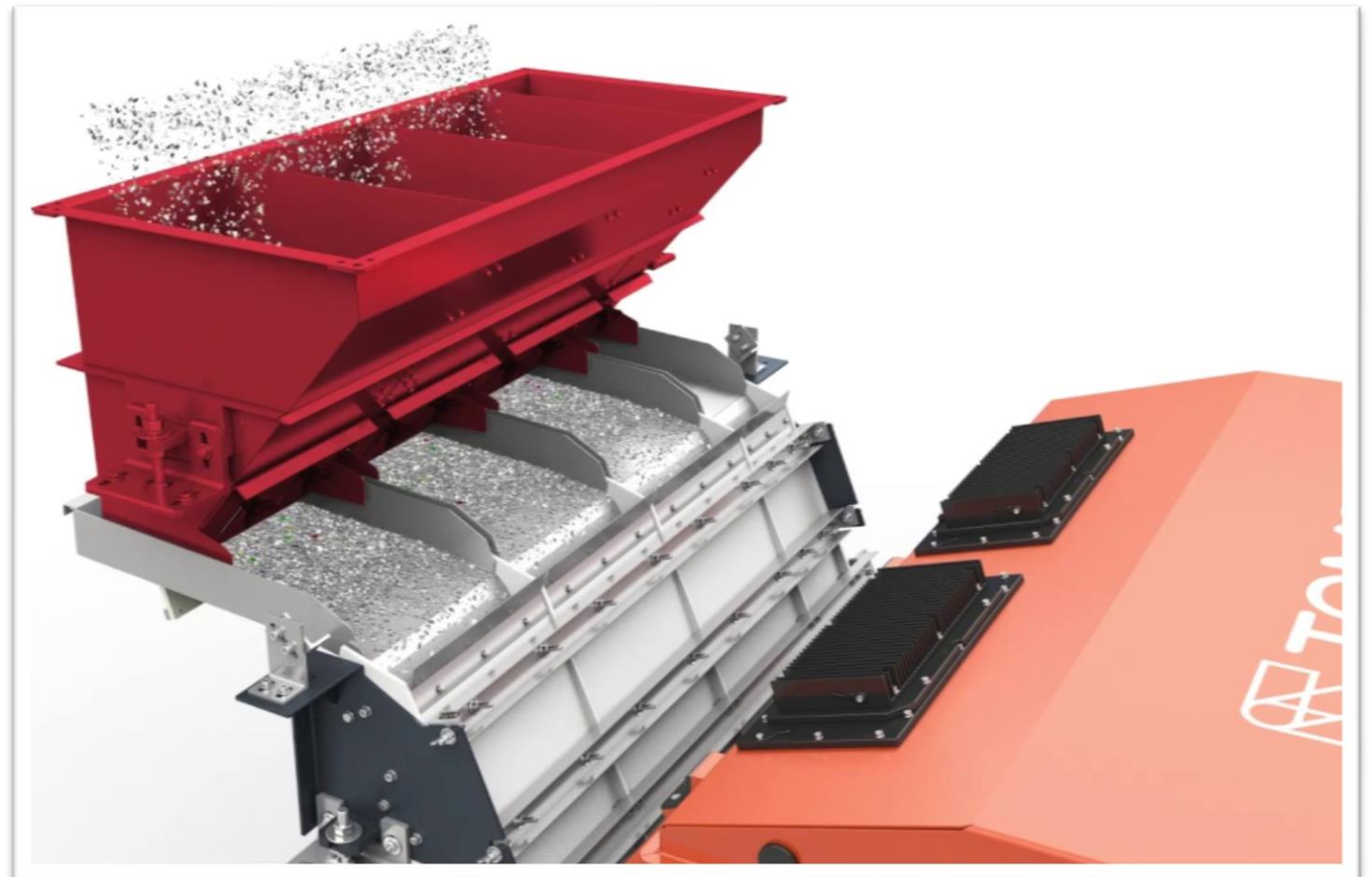
Ground flakes after sorting  
(reject)



PET flakes after sorting  
(accept)



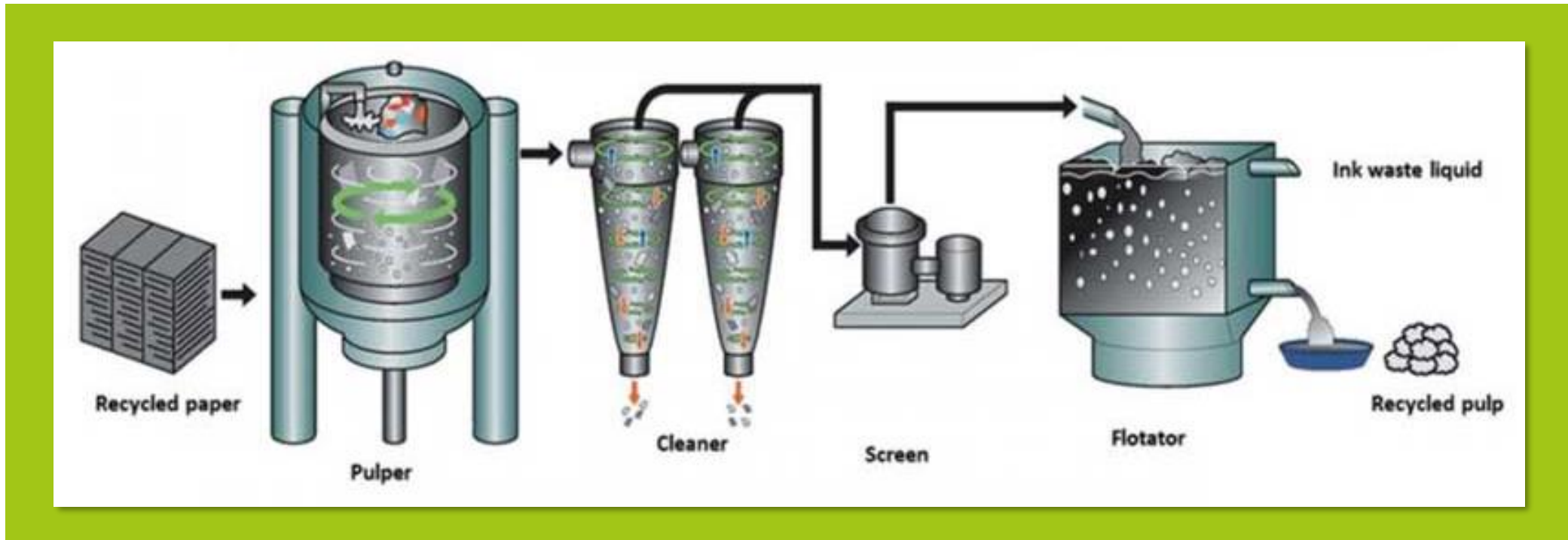
PET flakes  
(reject)



# Technologies in place

## Pulping Paper & Cardboard

- Cardboard & paper can be recycled
- What happens with laminated materials? Plastics? Alu?



# Technologies in place

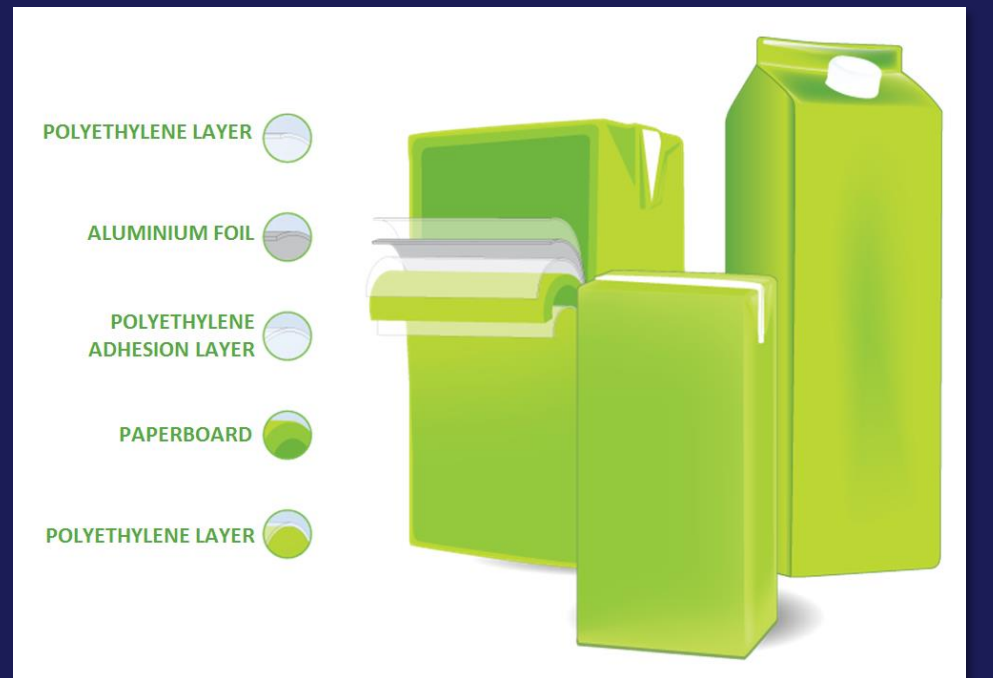


## Pulping Beverage Cartboards

Beverage cartons consists of:

- 75% paperboard
- 21% polymers (PE)
- 4% Aluminium (oxygen barrier)

- After the sorting the beverage cartons get separated into the components by pulping in water
- Paper fibres get reused as household paper, cardboard boxes, paper bags and envelopes
- Alu and plastics mainly go to incineration or end-up as heating material into the cement industry
- new plant, which can sort out the value material are planned but not working now



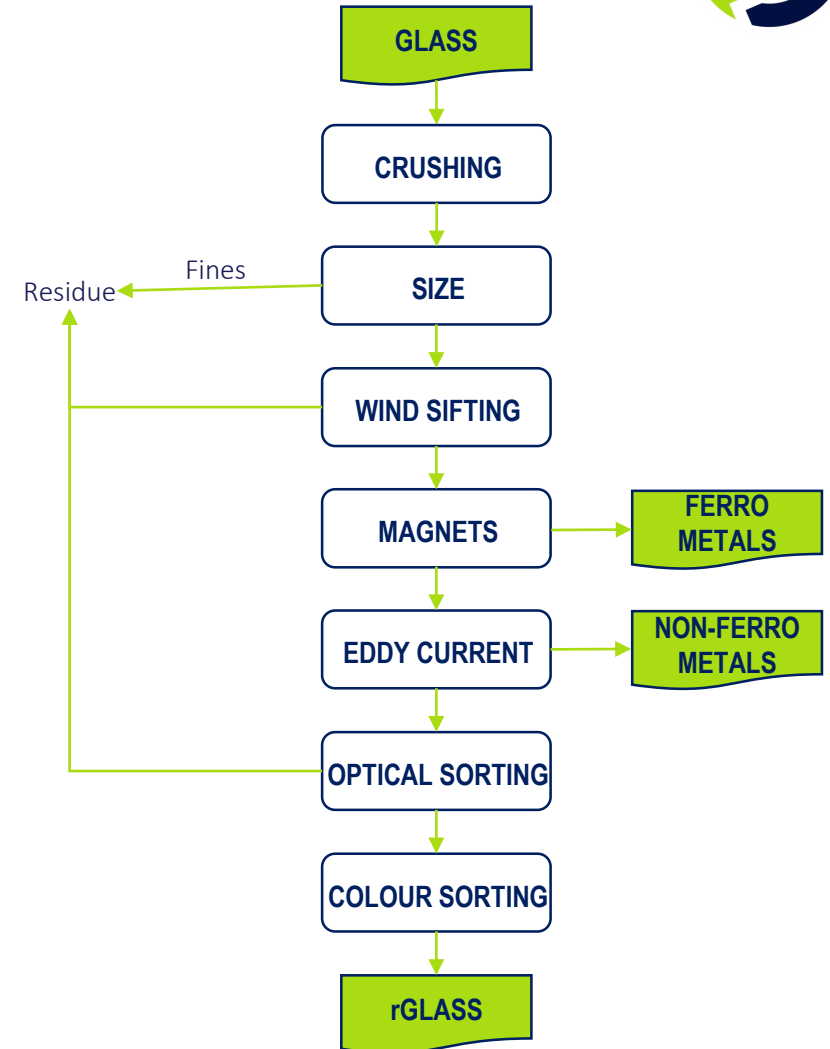
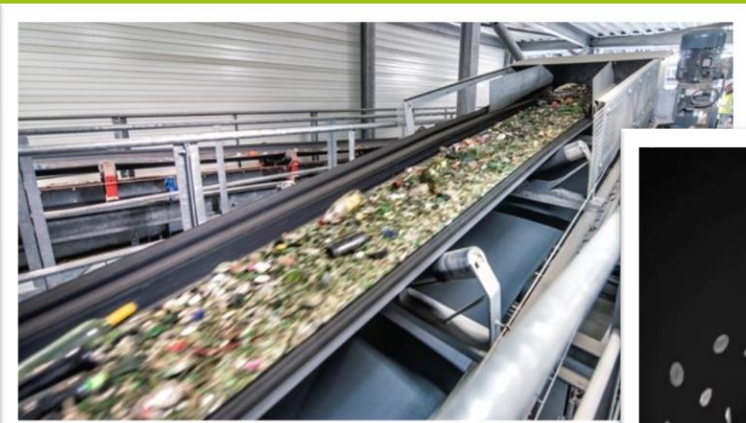
# Technologies in place

## Glass sorting

- Different sorting technologies in place
- Magnet, wind sifting, color sorting, etc.
- Plastics do NOT get recycled



<https://www.youtube.com/watch?v=jE4cxE4Ai9U>  
3.03 min



Sorted by colour & size



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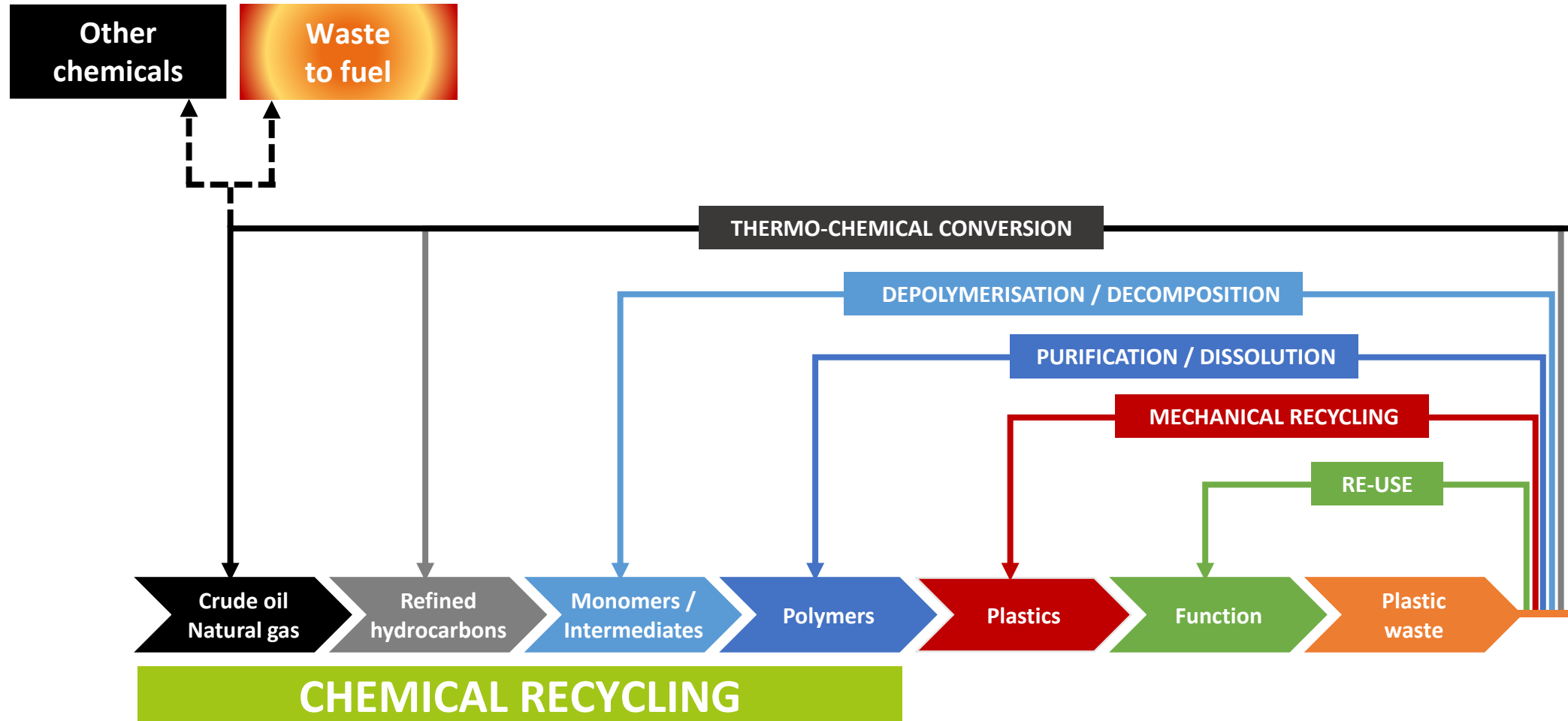
**CHEMICAL**

**RECYCLING**

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# Chemical Recycling





# Chemical Recycling



## Pyrolysis

- Cracking + condensation , temperature (typically 400°C) is used to break the polymers down to hydrocarbons (back to oil)
- Mainly used for polyolefins (PE/PP)
- The oil must be post-treated or mixed with other oil products
- Process cost?
- Considered recycling?

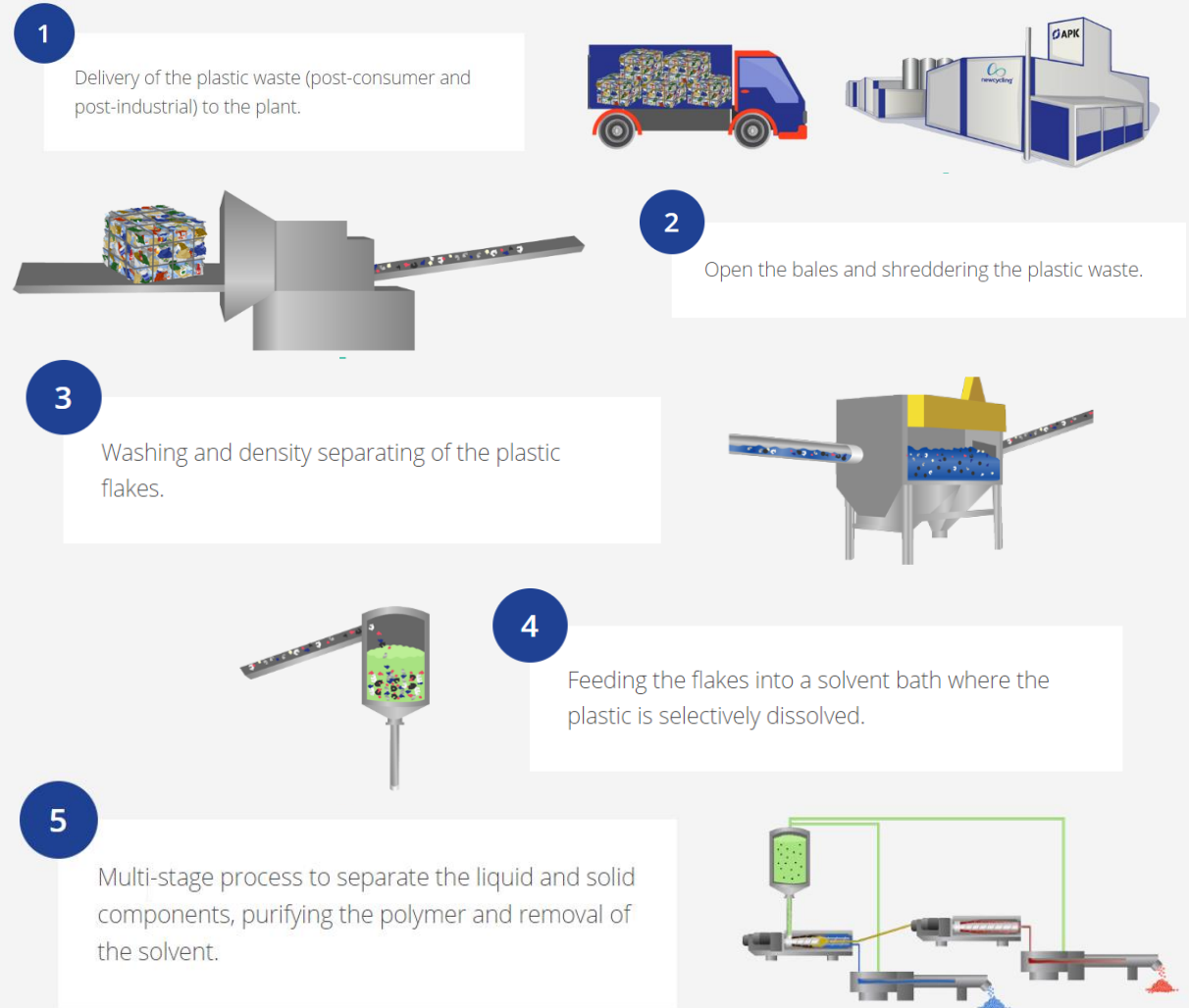


# Chemical Recycling



## Purification

- Mostly used with PVC and PS. Multi-layer packaging containing PE/PP also targeted
- Use of a reagent to remove additives or contaminants
- The polymer structure is not affected



# Chemical Recycling



## Depolymerisation

- Mostly used with PET, PA and PU.
- Breaking of molecular bonds using a chemical, enzymatic, and/or thermal agent.
- The processes using a chemical solvent (like glycol or methanol) to break the polymers are called solvolysis
- In the case of PET, DMT (Dimethyl Terephthalate), TPA (Terephthalic acid) or BHET (Bis-HydroxyEthyl-Terephthalate) can be obtained as an intermediate product to synthesize PET



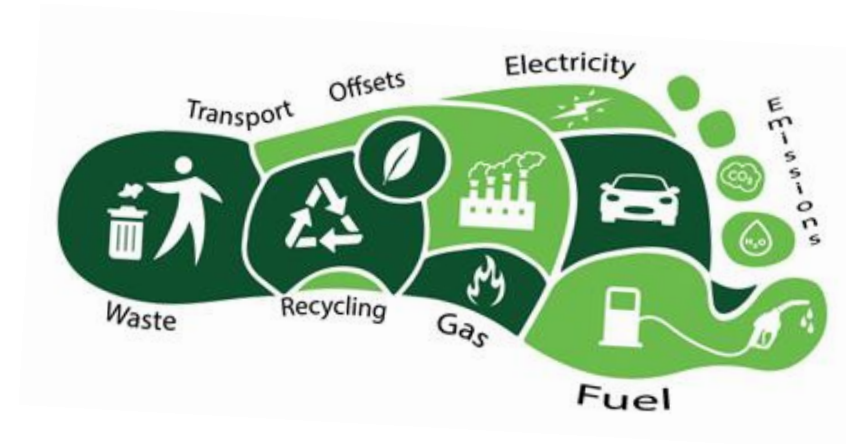
# Chemical Recycling



## Carbon footprint

- Incineration of plastics has a climate impact of 1,5 ton CO<sub>2</sub>-eq per ton input.
- Mechanical recycling for PET has a climate impact of -2,3 ton CO<sub>2</sub>-eq per ton input.
- Chemical recycling van residual plastics and DKR 350 has an climate impact of 0 to -0,5 ton CO<sub>2</sub>-eq per ton input (pyrolyse, low-temp- gassification and integrated hydrolysis);
- Chemical recycling of PET by the Ionika technology (depolymerisation) has a climate impact of -1,5 ton CO<sub>2</sub>-eq per ton input.
- Solvolys of EPS has a impact of -1,5 ton CO<sub>2</sub>-eq per ton input.

Source: CE-Delft, Verkenning chemische recycling, april 2019





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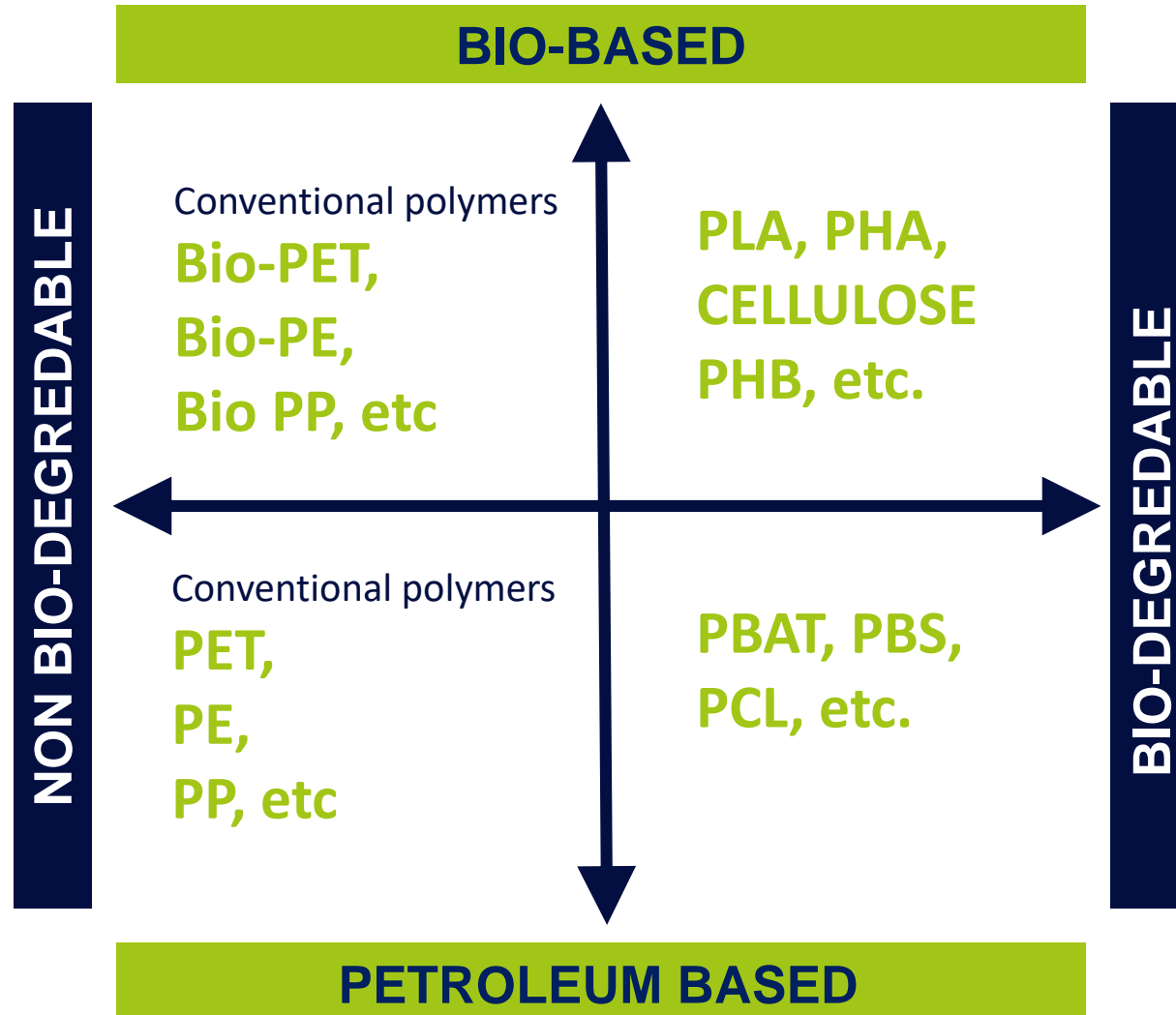
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# Can Bio-Based Plastics be recycled?

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# Bio-based plastics





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# Recycling, LCA's, CO<sub>2</sub> & corporate reduction pledges

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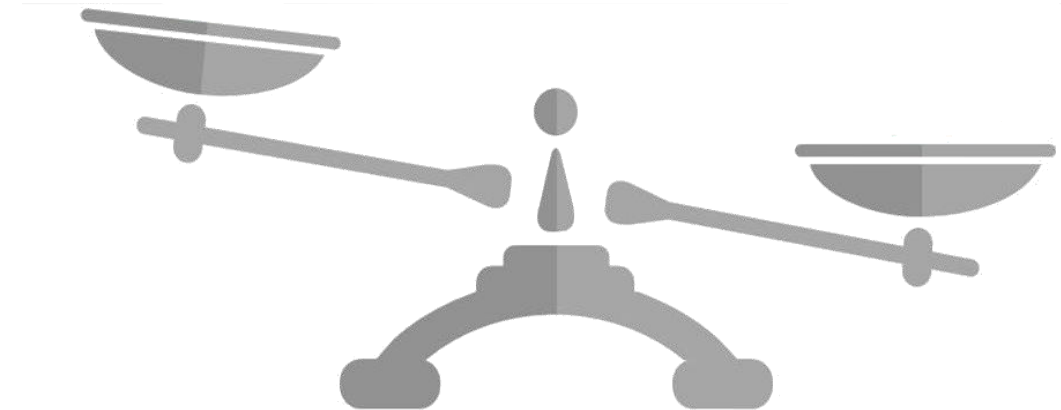


# Recycling, LCA's. CO<sub>2</sub>, etc.



## A balancing act....

- Reducing plastics vs Recyclability
- Recyclability vs Carbon footprint
- Carbon footprint vs LCA
- Prevention of littering?
- Consumers perception, expectations and demand
- Recyclability vs Recycled content





# Recycling, LCA's, CO<sub>2</sub>, etc.





# Recycling, LCA's. CO<sub>2</sub>, etc.

**Carbon footprint**

- Life Cycle Analysis (LCA)
- KG's of CO<sub>2</sub> emitted per ton of material

	INCINERATION	RECYCLING	ADVANTAGE
Paper	2.059	1.080	979
Glass	658	375	283
HD PE	3.925	1.153	2.772
LD PE	3.467	1.373	2.094
PP	5.131	2.237	2.894
(E)PS	5.632	949	4.683
PET	4.801	2.084	2.717
Steel	1.243	829	414
Aluminum	7.827	1.045	6.782

Source: CE Delft

# Recycling, LCA's. CO<sub>2</sub>, etc.

## Lowest CO<sub>2</sub>?



**GLASS 0,33 ltr**

- 256 gr glass
- 2,2 gr steel

**ViCO<sub>2</sub> = 171,2 gr**  
**ReCO<sub>2</sub> = 97,8 gr**



**PET 0,5 ltr**

- 22 gr PET
- 2,8 gr PP + LDPE

**ViCO<sub>2</sub> = 119,9 gr**  
**ReCO<sub>2</sub> = 52,0 gr**



**ALUMINIUM 0,33ltr**

- 9,6 gr alu
- 0,3 gr PE

**ViCO<sub>2</sub> = 77,5 gr**  
**ReCO<sub>2</sub> = 10,3gr**



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# Questions & Answers

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**Thank you for your attention!**

*See you next time!*

