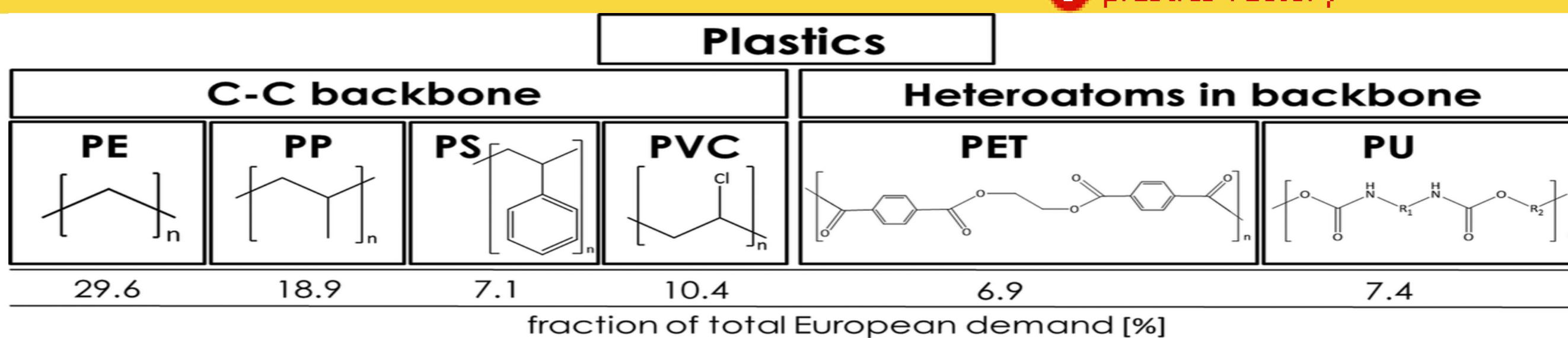
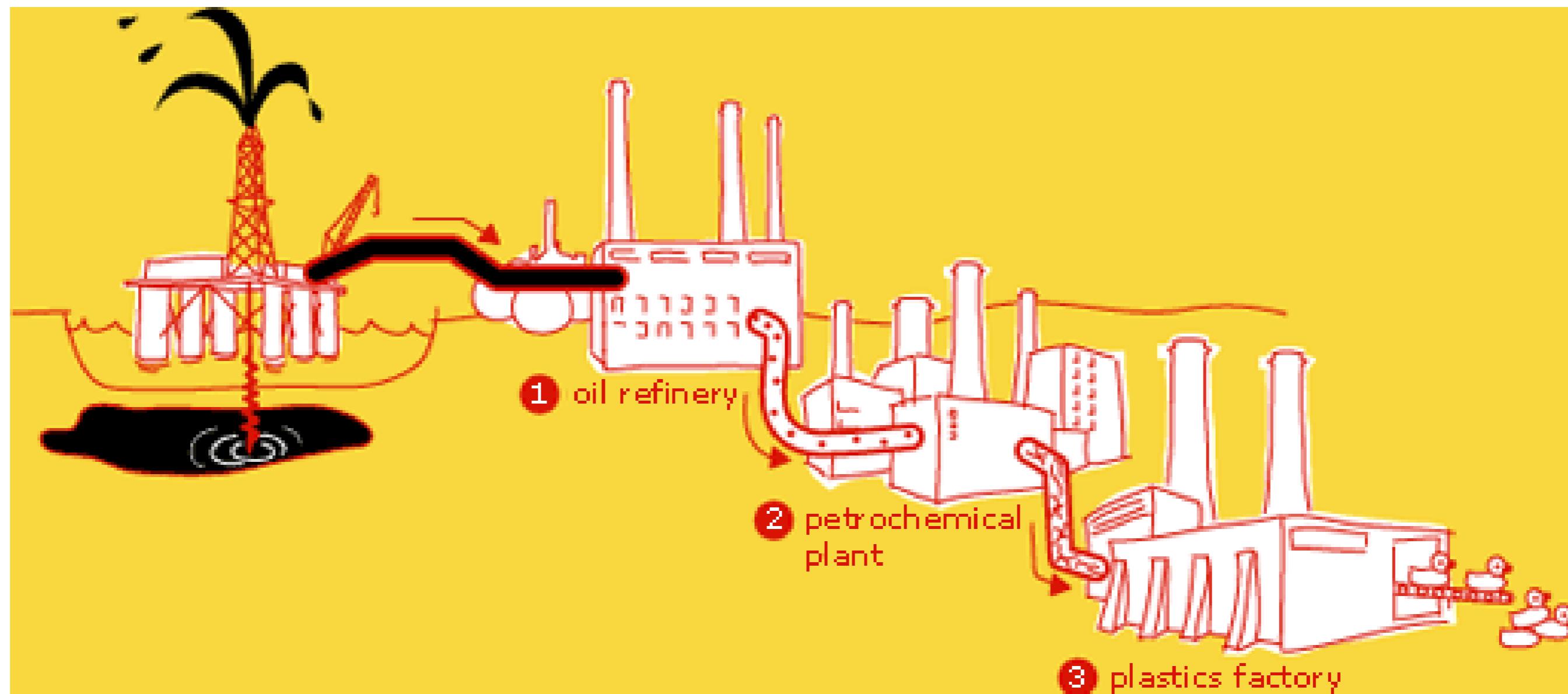


Potential plastic feedstock for gasification

Prof. Dr. Ir. Steven De Meester, 08/05/2019



Plastique c'est fantastique

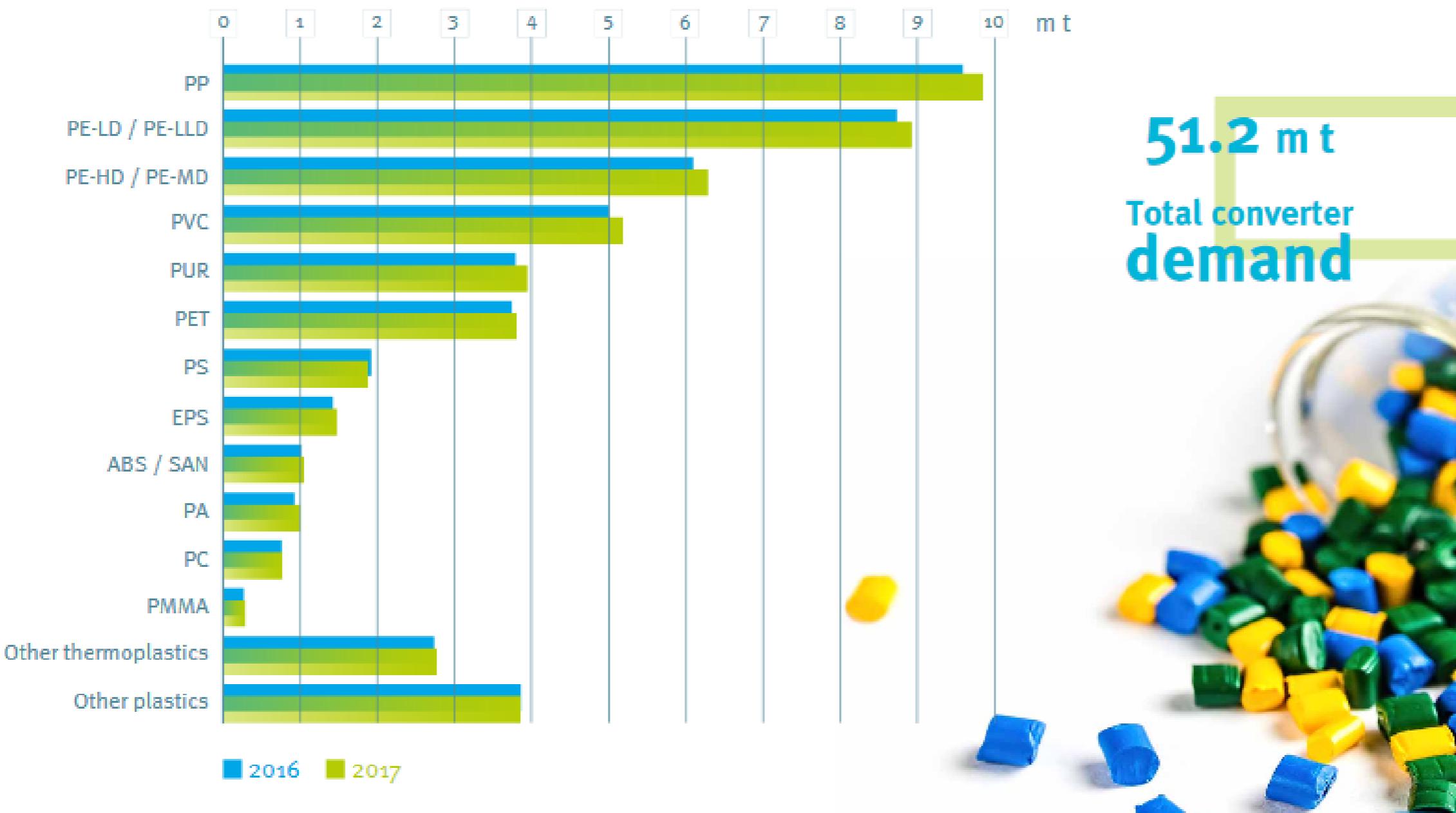


Plastique c'est fantastique

Plastic converter demand by resin type

Distribution of European (EU28+NO/CH) plastic converter demand by resin type in 2017.

Source: PlasticsEurope Market Research Group (PEMRG) and Conversio Market & Strategy GmbH

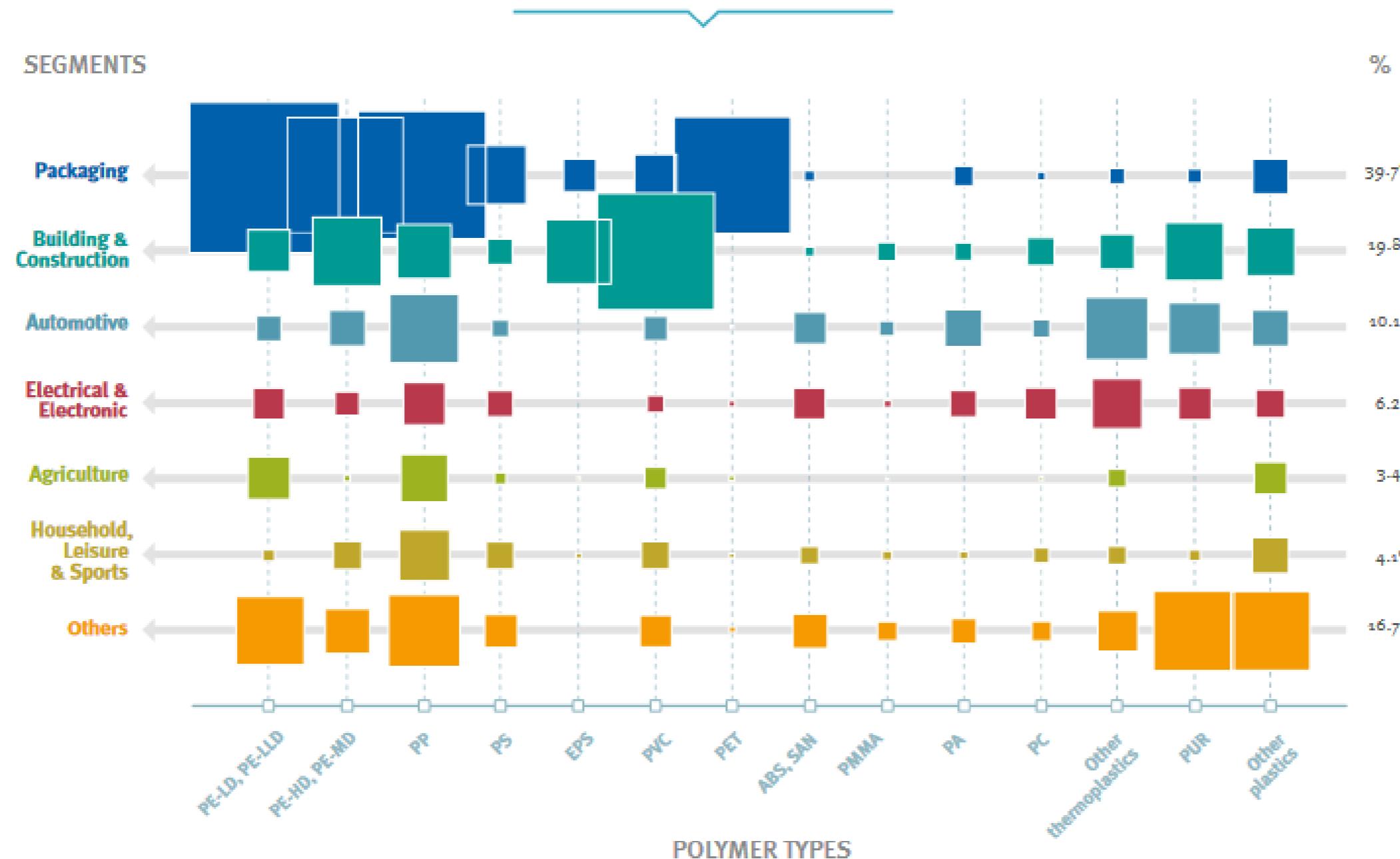


Plastique c'est fantastique

European plastic converter demand by segments and polymer types in 2017

Data for EU28+NO/CH.

Source: PlasticsEurope Market Research Group (PEMRG) and Conversio Market & Strategy GmbH



Plastique c'est compliqué

2014 Europe Plastics Streams

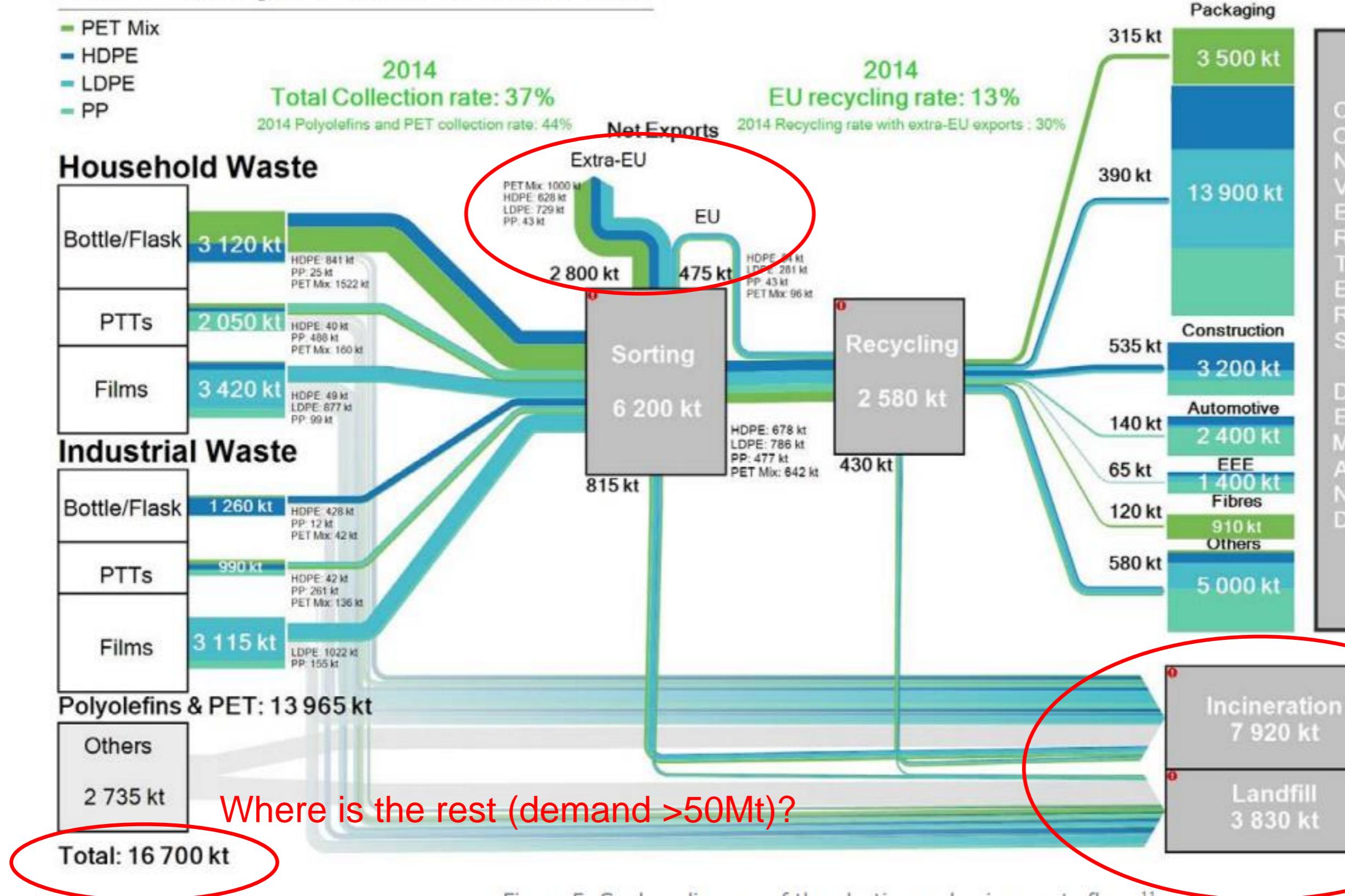


Figure 5: Sankey diagram of the plastics packaging waste flows¹¹

Plastique c'est compliqué

		Technique	Advantages	Challenges
Mechanical recycling	sorting	Flotation (sink-float)	Well-known technology	Efficiency determined by density differences plastics Mainly <u>limited to binary mixtures</u>
		Melt filtration	Cost-effective Particle size Useful to remove non-melting contaminants	Potential pressure fluctuations in production
		FT-NIR	Additional melt pressure Post-drying not required Well-known	Black undetectable Plastic should be dry Pre-treatment
		Tribo-electric (electrostatic) separation Froth flotation	Efficient for various plastics Small particle sizes allowed Efficiency	Precursor step required In development for recycled plastics <u>Density overlaps remain</u>
	Reprocessing	Magnetic density separation	Improved density-based technique Multiple polymer fractions in a single step	Cost-effectiveness
		X-ray detection	Accuracy Useful for PVC High value recycling Well-known technology Straightforward	Thermal-mechanical degradation Challenging for complex mixtures <u>Miscibility of polymer blends</u>
			Generates pure value-added products Operational for PET	Requires high volumes to be cost-effective Mainly limited to condensation polymers <u>Complexity of reactions</u>
Chemical recycling	Chemolysis		Suitable for highly heterogeneous mixtures of plastics Simple technology	Requires high volumes to be cost-effective Low tolerance for PVC <u>Stable waste supply</u> <u>Deactivation of catalyst</u> Absence of suitable reactor technology
		Pyrolysis		
	Fluid Catalytic cracking		Narrow product outcome Less stringent reaction conditions leads to favourable economics	Presence of inorganics High cost of hydrogen High investment and operational costs Further research required
		Hydrocracking	Quality of produced naphta Suitable for mixtures of plastics	
		IH ² process	Promising technology for the production of liquid fuels out of biomass	
Hydrogen technologies	KDV process		Different elements already commercialized Also suitable for oxygen and halogenated compounds	Chemistry still unknown Lack of technical information <u>Amount of noxious NO_x</u> Specific drawbacks of air
	Gasification		Syngas is a valuable intermediate Cost of air Well-known technology	

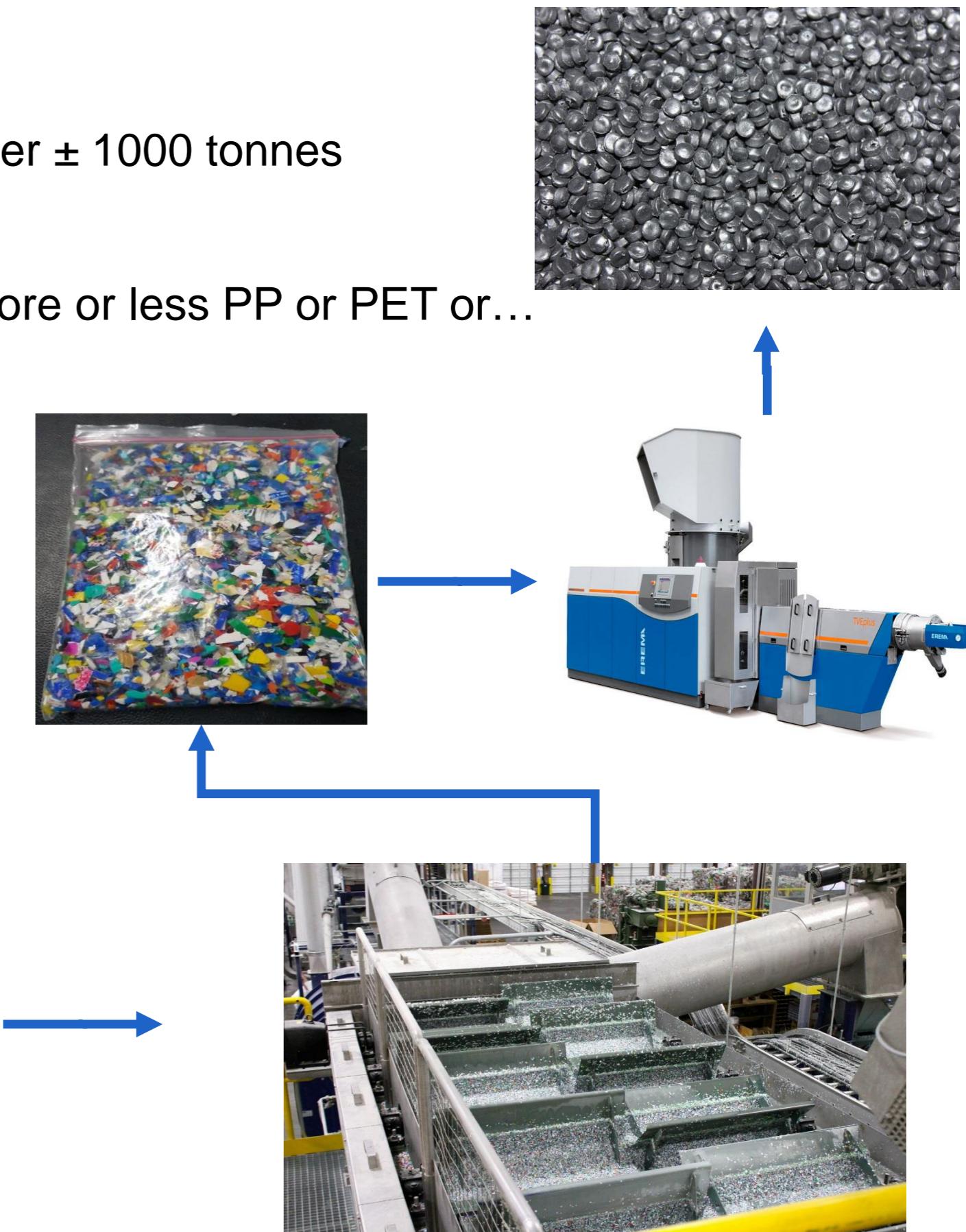
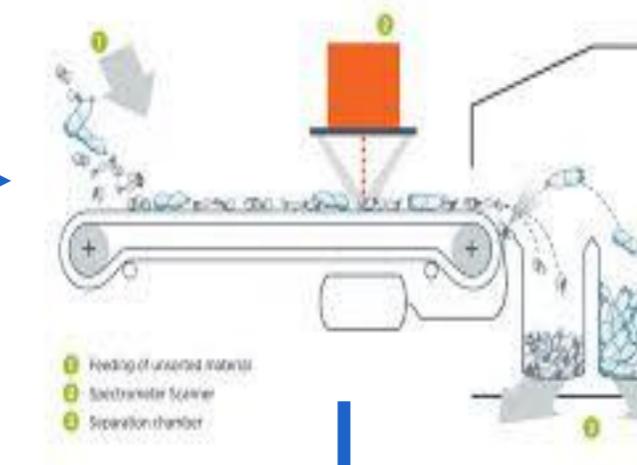
Many challenges
related to complexity
of input mixture

- I guess we should not worry about quantity available
- Maybe we should worry about logistics?
- Definitely we should worry about making the process robust → Taking into account complexity of feedstock

How do these plastics come on the market

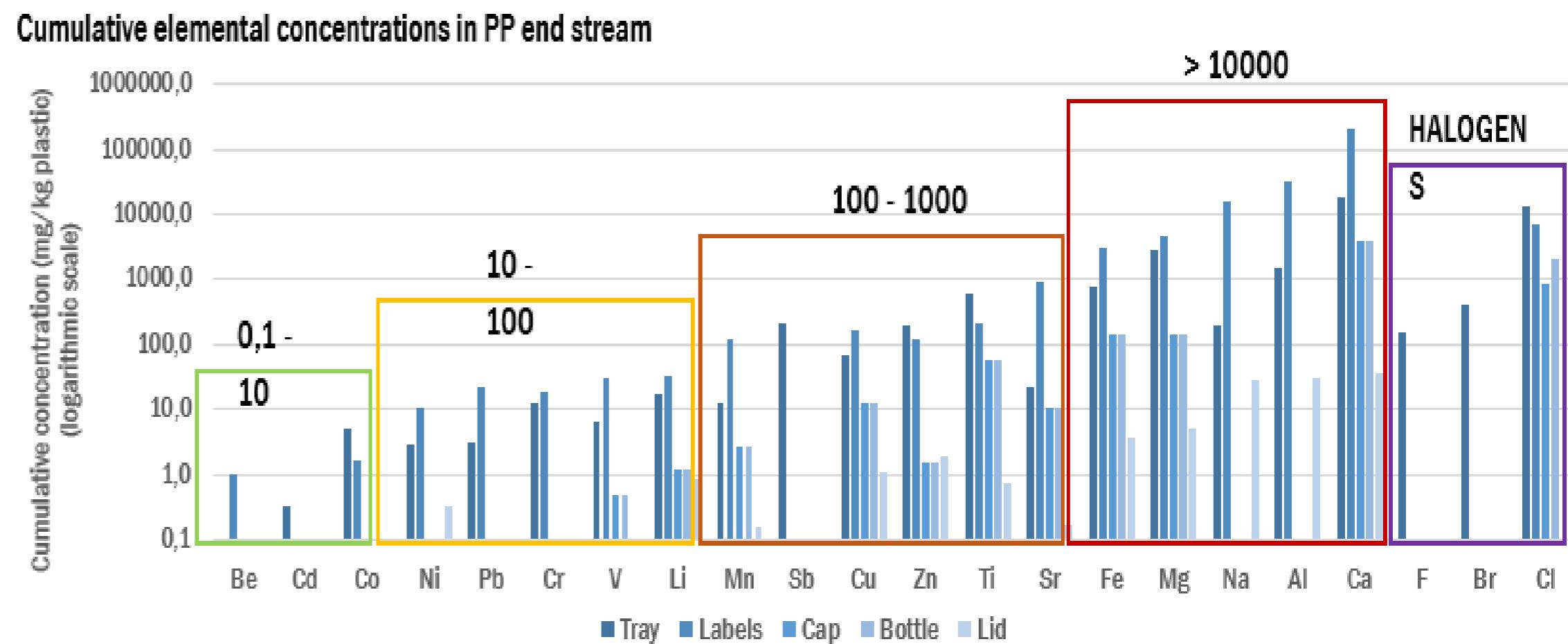
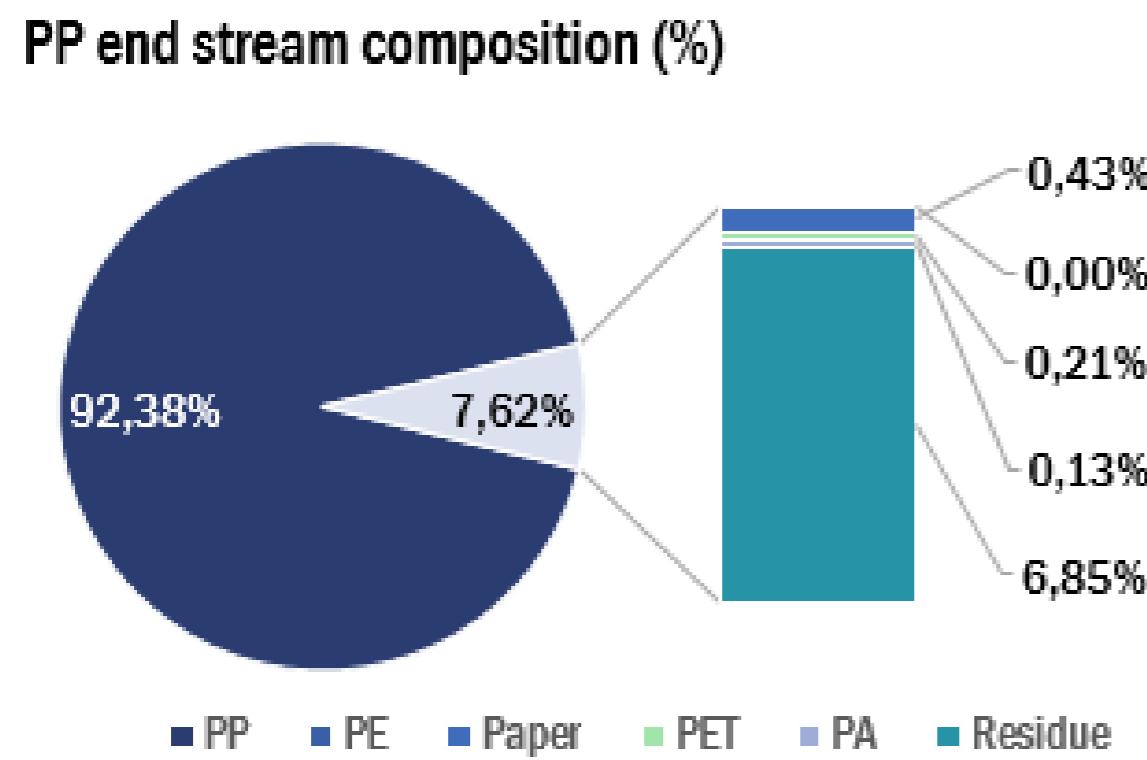
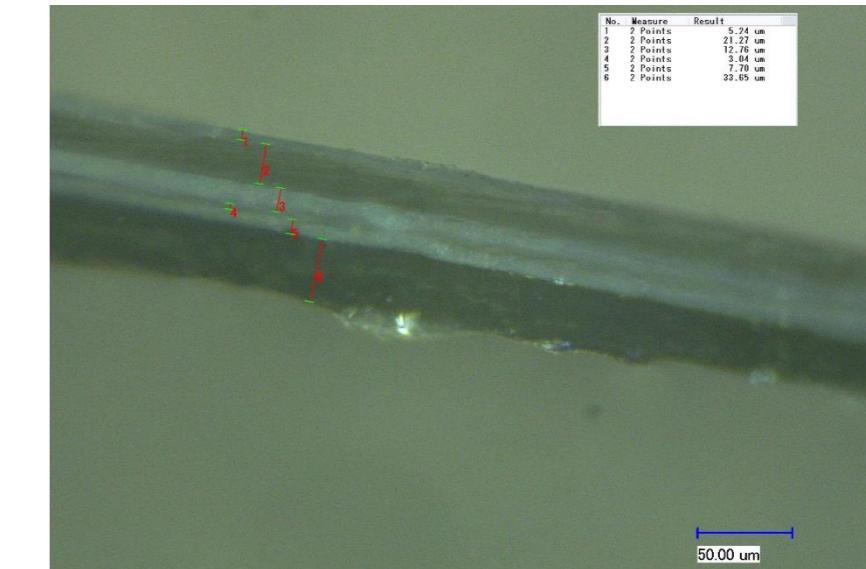


Per ±10000 tonnes ← QUANTITY → Per ± 1000 tonnes
PP/PP/PS/PET/
PVC/organic/... QUALITY More or less PP or PET or...



How do these plastics come on the market

- Do not underestimate the complexity, even of the ‘most cleaned’ waste streams
- Example of clean PP

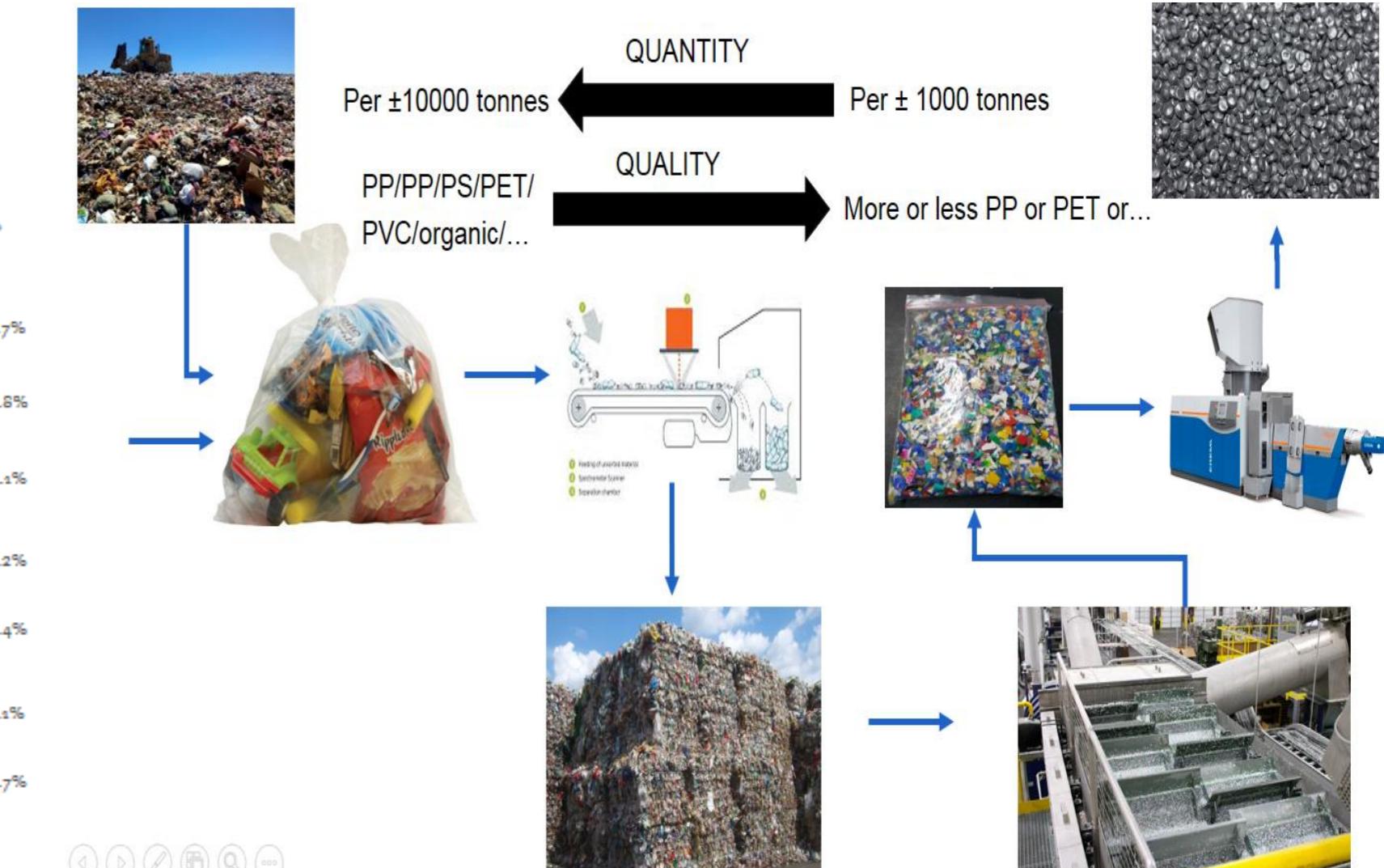
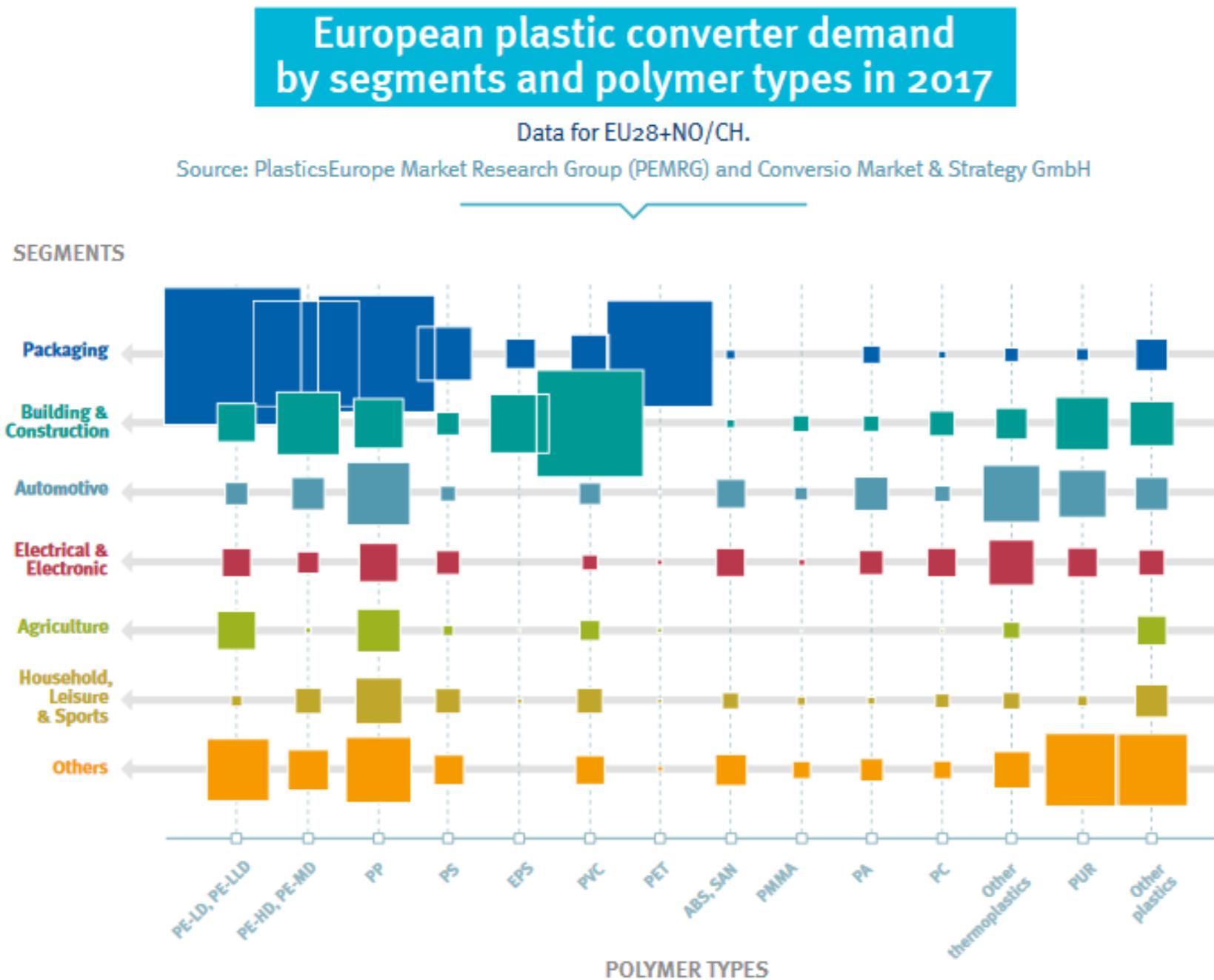


How do these plastics come on the market

- + Usually quite dry and with high C-H content
 - + Big masses, big demand
 - + Can be degraded to monomers (styrene, caprolactam, ...)
 - + Cleaning can be done at different stages (pretreatment, liquefaction, ...).
Much to be explored.
 - + Potential synergistic effects with biomass
-
- Variable feedstock with low density
 - Quite some minor components: halogens, metals, other inorganics
 - Tar production, gas flows and cleaning, difficulties with catalysts

From low cost (-100 €/t) to higher cost of feedstock (+500€/t)

Discussion: target streams?



Acknowledgements



Avec le soutien du Fonds européen de développement régional
Met steun van het Europees Fonds voor Regionale Ontwikkeling



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