SCORE LCA

SCORE LCA WORKSHOP
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PLASTICS RECYCLING AND LCA

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Main technical and methodological contributions

- #1 : For several post-consumers waste streams generated in France, description of their whole recycling chain (mechanical recycling), thus including upstream steps (prior to “recyclers”)
- #2 : Potential implications of plastics formulation for their end-of-life (recyclability)
- #3 : Illustration of key methodological stakes and recommendations in terms of implementation and transparency

Studied plastics/sectors

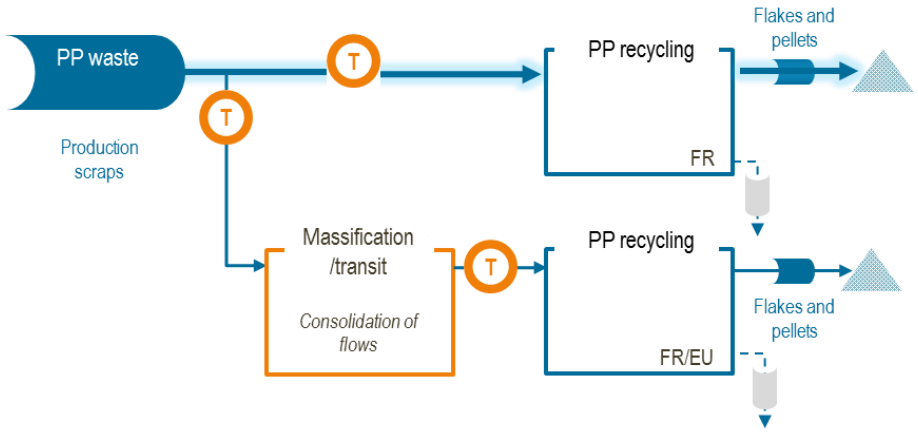
Polymers	Packaging		End of life vehicules	WEEE		
	Domestic	Industrial		SDA	LHA cold	LHA non cold
PP	x		x	x	x	x
PS	x	x (PSE)		x	x	x
PET	x					
HDPE	x		x			
LDPE	x					

x : Mechanical recycling only, current french context

SDA : small domestic appliance
LHA : large household appliance

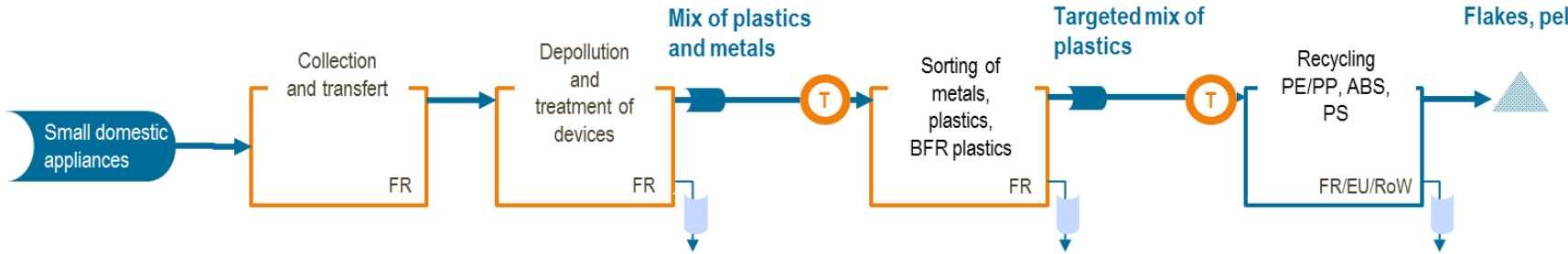
1 : Describing the whole recycling chain

Pre-consumer
(e.g. industrial scraps)



Upstream steps can vary widely (number, nature) according to the waste input

Post-consumer
(e.g. WEEE)



1 : Describing the whole recycling chain

- **“Upstream steps”** are sometimes mis-identified and thus modelled in a simplified (or even simplistic) way in LCA studies
- These steps can be very different depending on the origin and type of waste to be considered
- Important not to neglect these “Upstream steps” :
  - **Quantities of target polymers entering recyclers operations depend on upstream steps**, their complexity and the efficiency of each operation : plastics “lost” as impurities in other sorted fractions (e.g. ferrous metals, PUR foam fraction of LHA cold, sorting refusal, etc.).

    Particularly important for complex products with multiple materials (end-of-life treatment routes frequently involving shredding and sorting of mixed materials)
  - **Their environmental impacts could be significant** comparatively to the regeneration step alone. For post-consumer waste (WEEE, domestic packaging waste), order of magnitude may range from 100 to 300 kg CO_2 eq. / t of plastic recyclates
- Some LCA methodological guidelines require to consider all steps of the recycling chain, starting from the collection of waste / end-of-life products (for example, PEF)

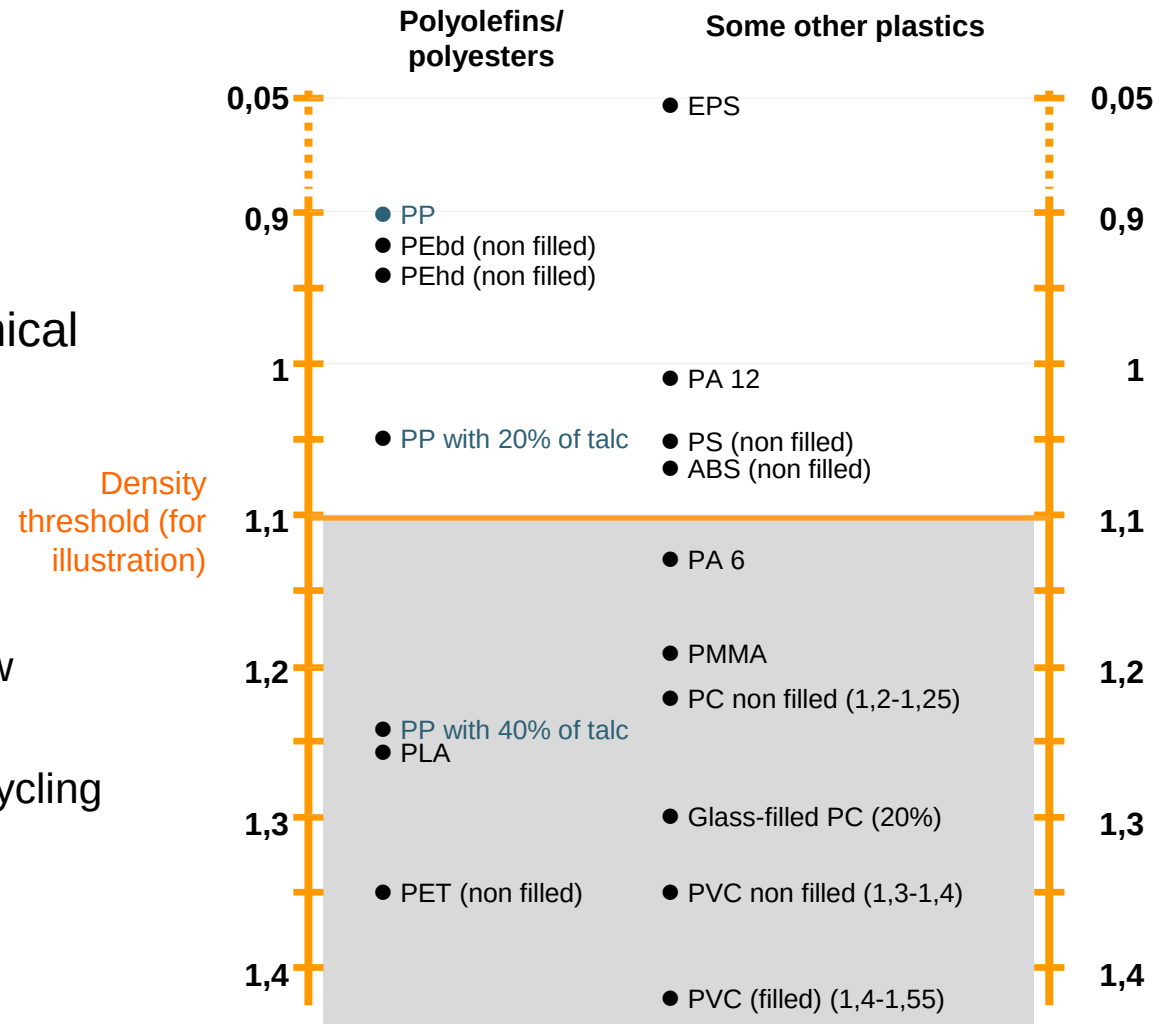
2 : Plastics formulation / recyclability

- Depending on applications/properties required, plastic parts may include functional additives, fillers, reinforcements, etc.
- Some product design/formulation choices may affect the ability of plastics to be recycled in the current state of practice. These issues vary according to the sector and are influenced by :
  - **Techniques currently used by the different operators in the recycling chain** : need to pay attention to density and changes in density, detection issues for instance
  - **Regulatory constraints** : important issues for sectors managing medium- and long-life products containing additives now subject to restrictions (e.g. POPs, CMR substances)
  - **Technical and economic trade-offs** : mechanical recyclers usually focus on a limited number of targeted polymers (PP, PE, PS, ABS for example), trade-offs on the interest of conducting or not extra-sorting steps

2 : Plastics formulation / recyclability

Some aspects likely to affect recyclability (from a mechanical recycling perspective) :

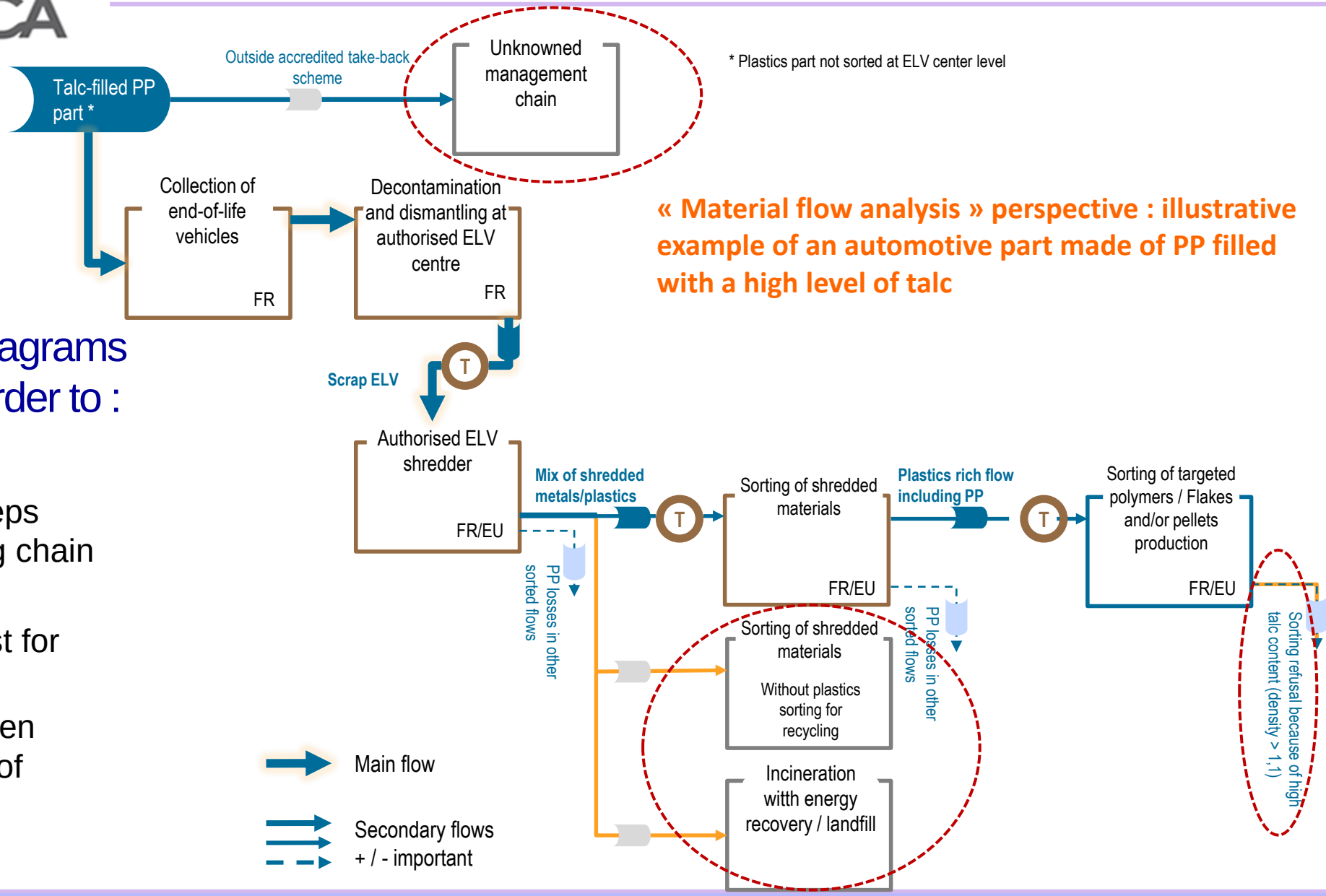
- ❑ Density and density change (illustrated, see opposite)
- ❑ Additives or coatings that make plastics non-detectable/undetectable by certain techniques
- ❑ Additives that can degrade the properties of the recycled raw materials
- ❑ Compatibility between polymers & risks of disrupting the recycling of other plastics



When assessing a given plastic product (including its end-of-life), the recyclability of this product must be evaluated taking into account its specific characteristics

1 and 2 : various types of diagrams are included in the report in order to :

- ❑ Describe the successive steps involved in a given recycling chain
- ❑ Highlight « non recycling destinations » that may exist for plastics
  - → Important to consider when modelling the end of life of plastics products

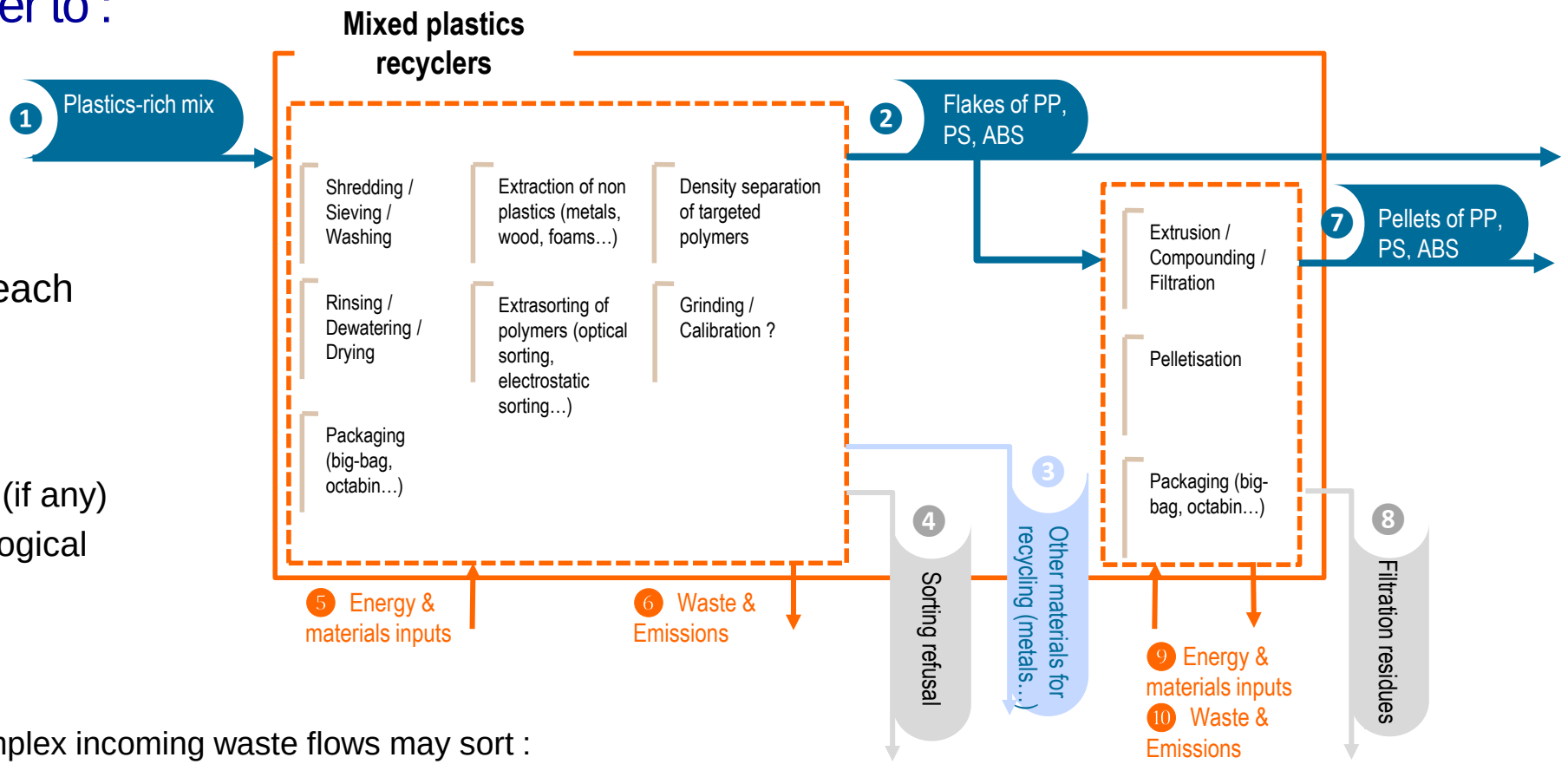


« Material flow analysis » perspective : illustrative example of an automotive part made of PP filled with a high level of talc

1 and 2 : various types of diagrams are included in the report in order to :

- Provide additional details on each step of the recycling chain
- Helpful to identify :
  - Primary data collection needs
  - Publicly available data sources (if any)
  - Points of attention on methodological issues

Subprocesses that might be performed at recyclers level : illustrative example for mixed plastics inputs from ELV, WEEE



Plastics recyclers that are processing complex incoming waste flows may sort :

- Metals (ferrous, non ferrous depending on the waste flow), that are sent to recycling
- Important amounts of « non recyclable materials » : plastics (non targeted polymers, plastics filled with mineral additive…) and other materials

3 : Key methodological stakes and recommendations

- Most steps in the recycling chains of post-consumers goods generate **several outputs** including the stream containing the targeted plastics. For each step, the following questions may arise :
  - How to consider **flows other than those containing the target plastics** under study ? Should their subsequent management (incineration, landfill, recycling…) be accounted for as a "burden/benefit" of the step ? Should these other flows be considered as "co-products" bearing a part of the burdens ?
  - Which rules for **allocating** the environmental burdens between outputs considered as "co-products“ ?

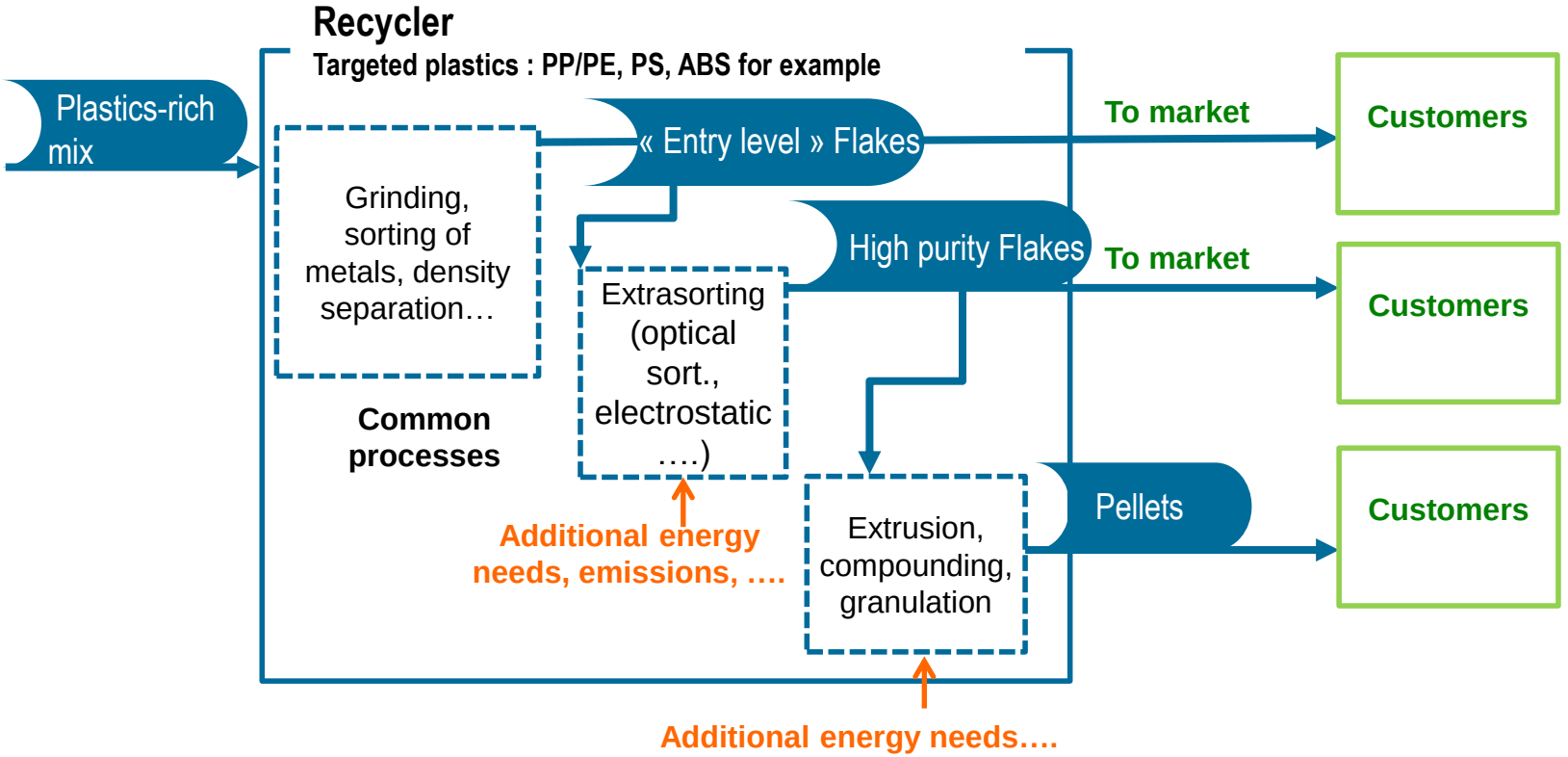
→ *Such choices are likely to have an extremely important impact on the environmental results*

→ *Not all evaluation contexts necessarily raise these types of issues !*

Evaluating the environmental footprint of the activity of a plastics recycler is a different context than evaluating an action (for example, implementation of a new EOL technology) or developing the environmental profile/LCI of a specific recycled polymer

3 : Key methodological stakes and recommendations

- Ecoprofiles of plastics recyclates :
  - Can be produced in various “states”: flakes, pellets, powder for example
  - Energy and materials requirements may vary greatly between the production of flakes and the production of pellets for instance
  - Relevant to identify intended uses / target audience :
    - An average profile (mix of flakes & pellets) may be relevant for some uses
    - For other uses, it is much better to prepare an LCI for each most common state delivered to the market



Depending on the goal of the LCA/LCI study, a “black-box” approach to represent the whole activity of plastics recycler may not be appropriate

3 : Key methodological stakes and recommendations

- Study report includes :
  - **A review of a selection of relevant publications**
  - **Identification, description and illustration of methodological issues** and their potential impact on environmental results (illustrative focus on GhG)
  - **Formulation of recommendations** concerning:
    - Methodological choices
    - Metadata and choices to be documented in order to enhance transparency and allow for an adequate use of the work by future users

Thank you for your attention !