

Evaluation of the plastics packaging waste management system in Austria through MFA and LCA

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Objectives

Material Flow Analysis (MFA): Qualitative and quantitative analysis of the management of waste plastic packaging in Austria for 2013:

- For 7 product groups.
- For 8 Polymers.

Life Cycle Assessment (LCA): Evaluation of the potential environmental impacts of the status quo of the waste management system and comparison with three scenarios:

- All waste incinerated in a grate incinerator (waste-to-energy).
- Increased collection and sorting efficiencies for PET Bottles.
- Compliance with the proposed increased recycling targets of the EU.

Results - MFA

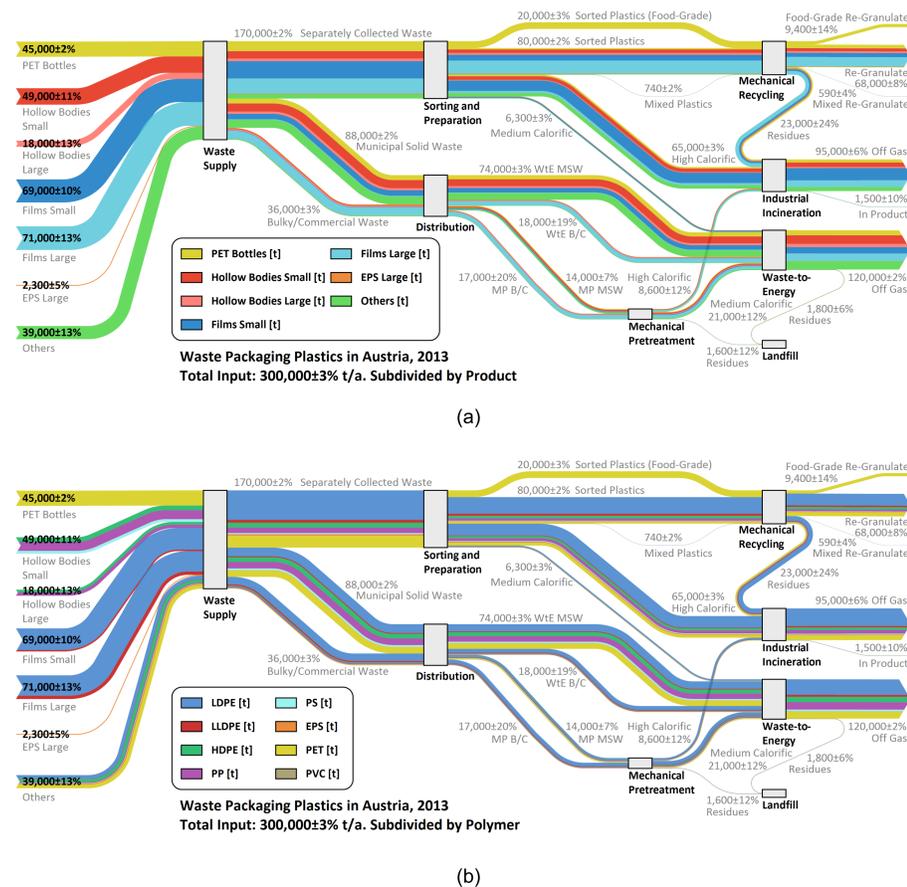


Figure 1: Results of the MFA subdivided by (a) product category and (b) polymer.

- The current recycling targets from the EU and Austria for waste plastic packaging:
 - **Target:** at least 22.5% of the total waste stream to be sent to mechanical recycling.
 - **Result:** 34% was achieved in 2013 (see Figure 2).
- 99% of the waste stream is recycled or recovered (with energy production), only 1% is landfilled (plastic residues from mechanical pretreatment and ashes from Waste-to-Energy).
- Especially films small and large, EPS large and PET bottles were collected to a large extent. Especially PET bottles, hollow bodies large, films large and EPS large were sorted efficiently.
 - **Higher recycling rates for EPS large, PET bottles and films large.**
- The results for the individual polymers correspond to those for the product categories:
 - The recycling rates (produced re-granulate) range from 38% (PET), over 30% (both EPS and LLDPE), 26% (LDPE), 23% (HDPE), 5% (PP), to 11% (PS).

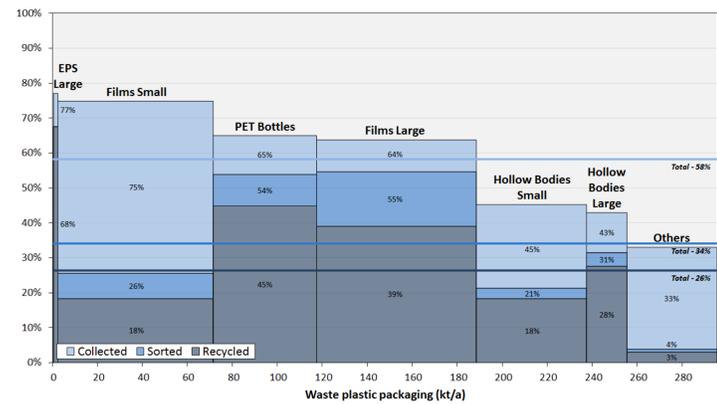


Figure 2: Comparison of the collection, sorting and recycling rates per product category.

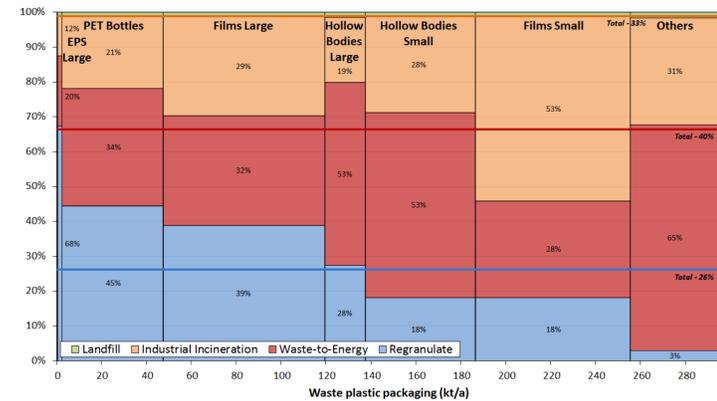


Figure 3: Final treatment of the product categories.

- The proposed future EU recycling targets will increase to at least 55% to be sent to mechanical recycling by 2025:
 - Theoretical scenario to illustrate the required increase for the collection and sorting efficiencies:
- | Product Category | Collection Eff. (%) | Sorting Eff. (%) |
|---------------------|---------------------|------------------|
| PET Bottles | 65 → 90 | 83 → 90 |
| Hollow Bodies Small | 45 → 80 | 47 → 70 |
| Hollow Bodies Large | 43 → 80 | 73 → 90 |
| Films Small | 75 | 34 → 50 |
| Films Large | 64 → 80 | 86 → 90 |
| EPS Large | 77 → 80 | 88 |
| Others | 33 | 12 |
- **Very high efficiencies will be required**, it is questionable if this can be achieved with current technologies, especially as the quality should also increase to ensure circularity of the material:
 - major technological improvements will be required, especially for the sorting process.

Preliminary Results - LCA

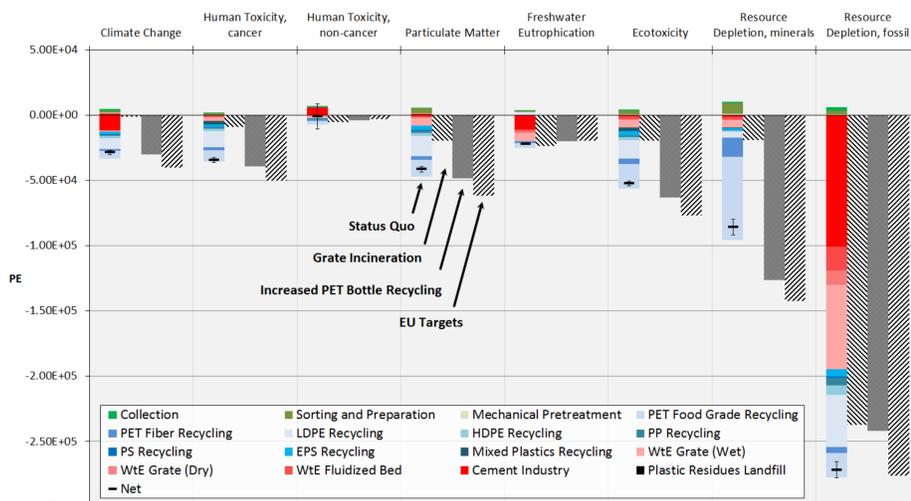


Figure 4: Results of the LCA for the status quo and the three alternative scenarios, expressed in Person Equivalents.

- **Status quo**
 - For all impact categories, **more environmental benefits than impacts were achieved**, resulting in a negative net impact.
 - For Human Toxicity non-cancer effects though, the tipping point between net impacts and benefits lies within one standard deviation.
 - With respect to the individual waste management processes, the impacts of the pretreatment processes (greens) are generally outweighed by far by the material (blues) and energy (reds) benefits.
- **Alternative scenarios**
 - For the majority of the impact categories, **as more material goes to mechanical recycling, more net environmental benefits are achieved.**
 - The reverse trend is seen for Human Toxicity non-cancer effects, Freshwater Eutrophication and Resource Depletion, fossil. Here, the largest part of the benefits are achieved by the incineration processes (especially the cement industry), which receives less material when more material is recycled.
 - The benefits from the EU targets scenario do not rise linearly in relation to the amount recycled, which is increased by about 60%. This indicates **increasingly less additional benefits can be achieved by recycling more material.**