LIFE CYCLE IMPACTS OF WEEE PLASTICS RECYCLING WITHIN

PLAST2bCLEANED

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Why look into Waste Electric and Electronic Equipment (WEEE) plastic?

- The way in which we produce, consume, and dispose of e-waste is unsustainable
- High consumption rate of EEE, short life cycles and few repair options
- Presence of legacy additives, e. g. certain bromine flame retardants, makes recycling difficult due to high costs of separation of additives from other plastics.

About the project

- **Aim:** Develop human and environmentally safe recycling process for Waste Electrical and Electronic Equipment (WEEE)
- **Focus:** Recycling of Acrylonitrile Butadiene Styrene (ABS) and High Impact Polystyrene (HIPS) which contain 15wt% BFR and up to 5wt% of synergist antimony trioxide (ATO)

About the project

1 **Development pre-sorting technology**

2 **Closing 3 loops using dissolution under superheated conditions by separation of:**

(1) the polymer
(2) the bromine
(3) the antimony trioxide

3 **Process integration and scale-up**

4 **Performance testing of process and products**

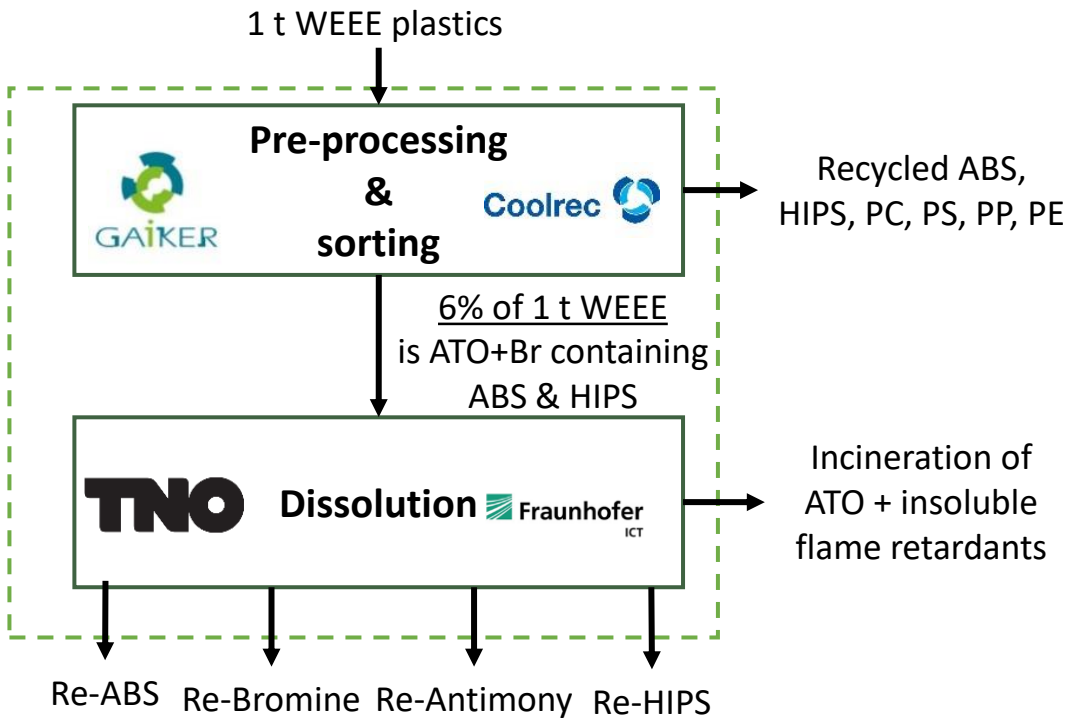
5 **System optimisation for sustainability and economic viability**

LCA study

TITLE	**Screening LCA of PLAST2bCLEANED dissolution process**
GOAL	Quantifying environmental impacts of PLAST2bCLEANED dissolution process
SCOPE	Two perspectives: 1. **WASTE PERSPECTIVE** – gives insight into environmental impacts of processing WEEE plastics by P2bC dissolution process and comparing it with current reference scenario 2. **PRODUCT PERSPECTIVE** – gives insight into environmental impacts of using recycled ABS and HIPS in a product compared to the use of virgin polymers.
IMPACT ASSESSMENT METHOD	ReCiPe 2016 Midpoint (H) – Screening LCA focused on carbon footprint (GWP), additional impacts will be added in the full LCA study.
SOFTWARE AND DATABASE	Simapro 9.1 software; Ecoinvent 3.6 and Industry data 2.0
ALLOCATION	Economic allocation
GEOGRAPHY	Europe
TRL	Dissolution process at TRL 4 → Scale-up of the process to TRL 9

Project scope: 1) Waste perspective

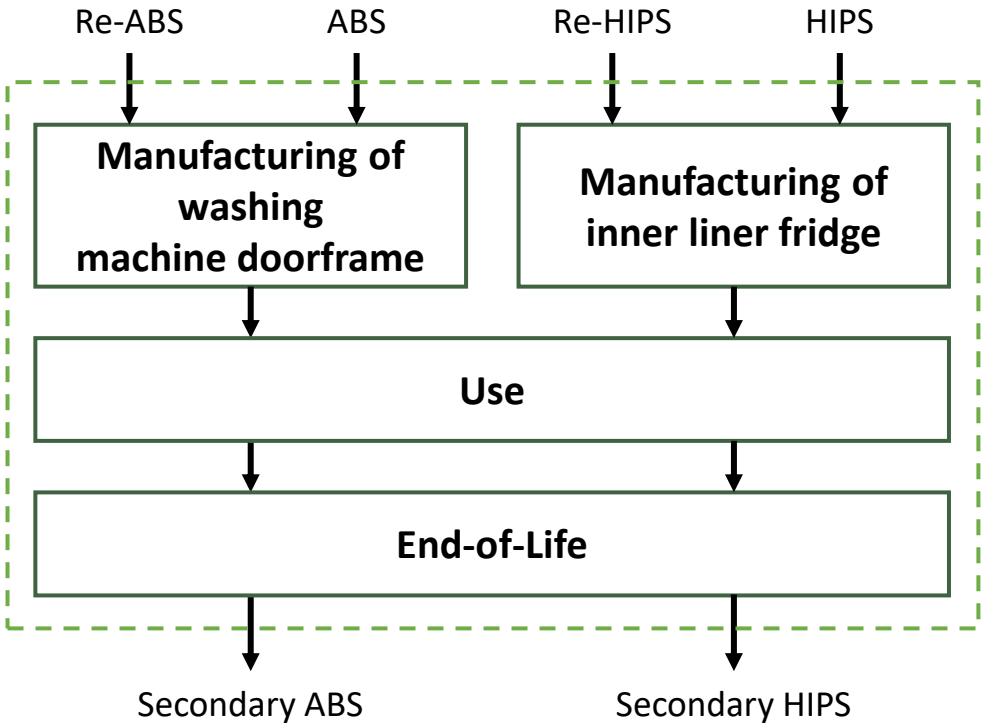
FU: "End-of-Life treatment of 1 tonne of WEEE plastics in a defined average composition and particle size, coming from a WEEE treatment plant"



Project scope: 2) Product perspective

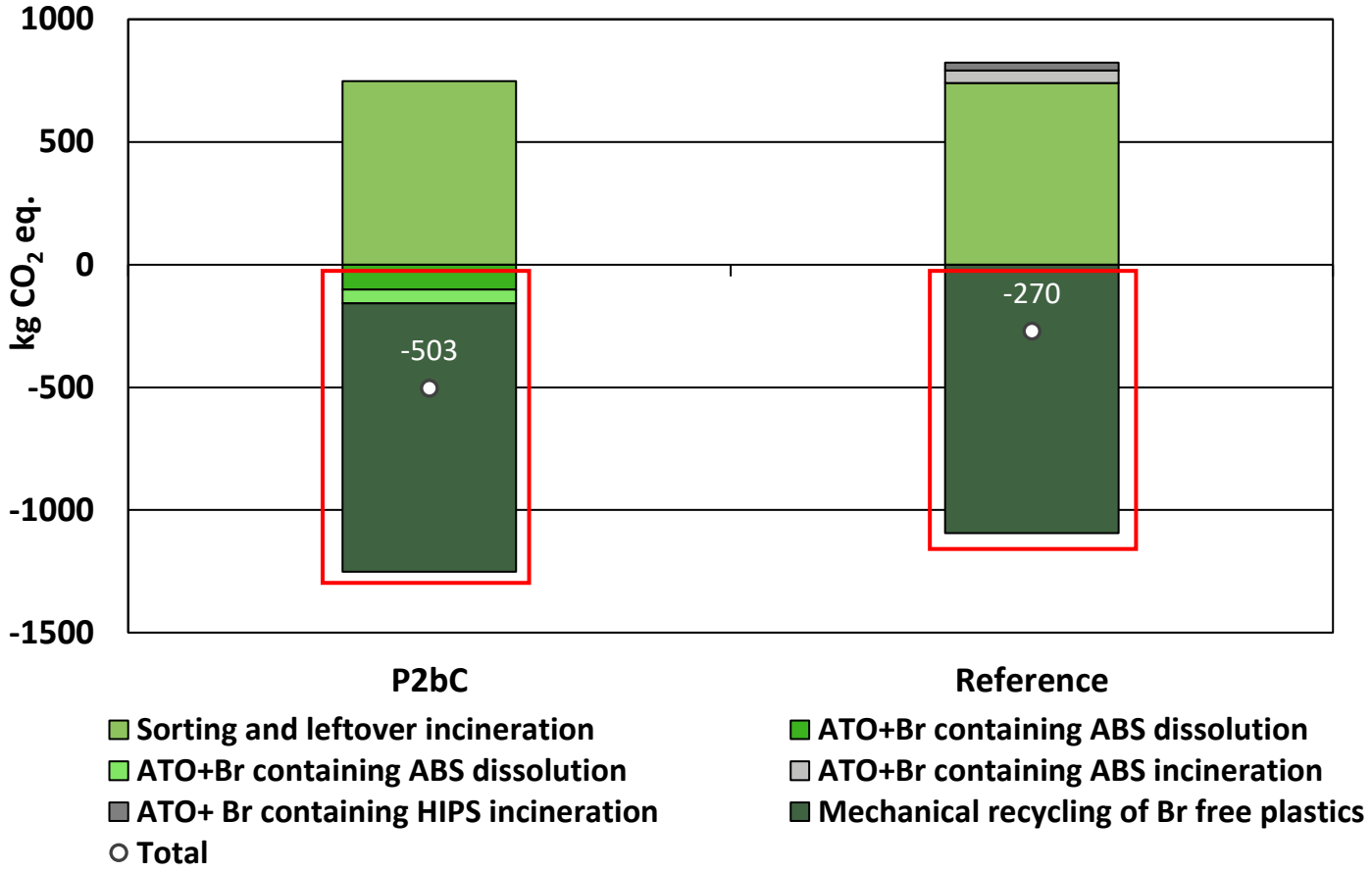
1. *FU of ABS part: "1 external door frame of a washing machine with an overall running time of 220 washing cycles per year and an expected lifespan of 10 years (7000 running hours)".*

2. *FU of HIPS part: "1 inner liner (of a household refrigerator's cabinet with overall running hours of 78840 hours and an expected lifespan of 9 years".*



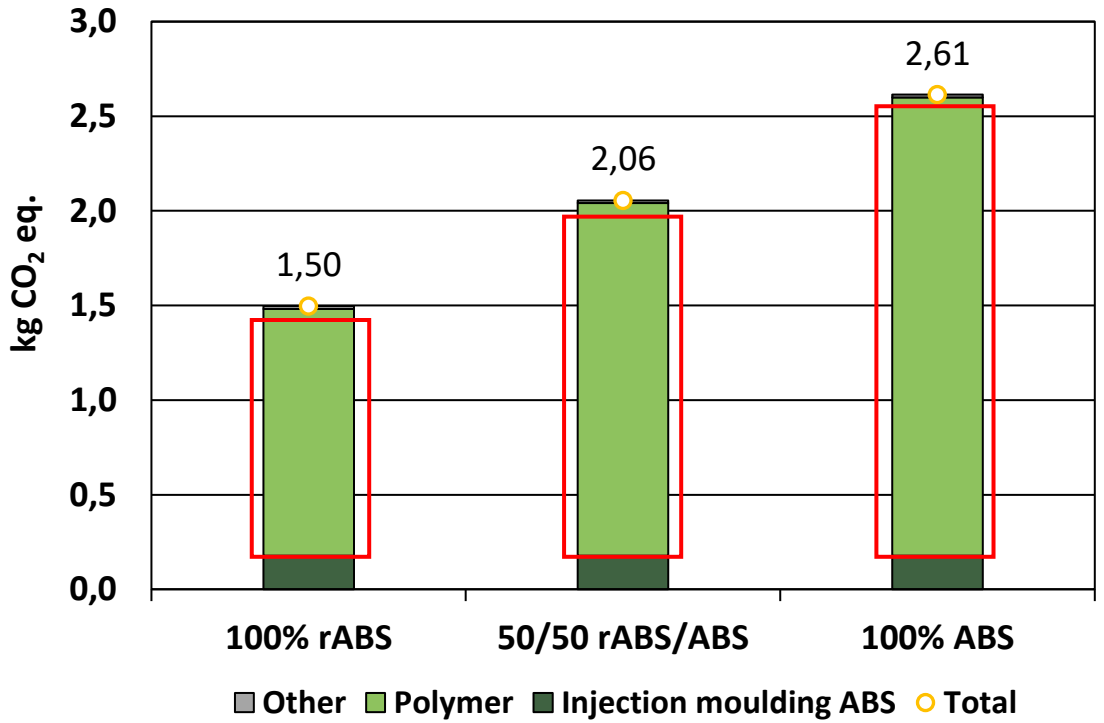
Waste perspective. 1) Carbon footprint of P2bC process vs. Incineration

- The carbon footprint benefit of dissolution process almost doubles compared to incineration.
- This doubling in CO_2-eq reduction is reached through recycling about 6% additional WEEE waste.
- *The increase in beneficial impacts still excludes the potential Bfr and ATO recovery.*



Product perspective. 2) Carbon footprint of the production of external door frame (ABS)

- There is a significant CO_2 reduction in using recycled material instead of virgin ABS. The main cause is that the polymer is recovered which results in avoidance of virgin ABS.
- The polymer itself has the largest contribution in the environmental impact of the production of the door frame, 87-93% of global warming impact is caused by the polymer production.



Conclusion and next steps

THE CARBON FOOTPRINT OF THE PLAST2BCLEANED DISSOLUTION PROCESS IS REDUCED BY 86% COMPARED TO THE CURRENT INCINERATION SCENARIO, BY ONLY RECYCLING ABOUT 6% ADDITIONAL WEEE WASTE

Next steps:

Adding the quality factor and the recovery of Bfr and ATO fraction in the full LCA analysis will change the environmental impacts.

LCA methodology alignment discussions are taking place between Plast2bCleaned, NON-TOX, and CREAToR, who are HORIZON 2020 projects all concerned with developing new technologies for WEEE waste recycling. Aligning the LCA approaches between studies allows a fair comparison of technologies and brings additional value to the projects.

Thank you!

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