



CIRCULAR FOAM

End-of-life PU rigid foam collection and sorting from
the applications in refrigerators, insulation boards
and metal panels

Presenter: Elis Almeida | Date 11.09.2025 | Brussels, Final Conference



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Goals

End-of-life PU rigid foam collection and sorting from the applications in refrigerators, insulation boards and metal panels

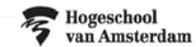
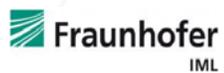


Assessment of the **current value chain for end-of-life cooling appliances**, including regulatory framework, with the aim of identifying and recommending processes enhancements to enable the **efficient sorting of polyurethane (PU) downstream suitable for chemical upcycling**.

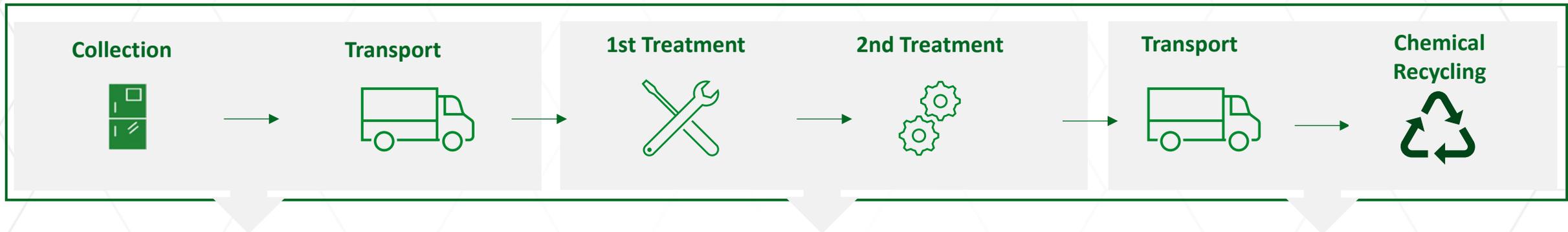


Identify the **current value chain for construction and demolition waste (C&D)**, including the **regulatory framework**, and design a preliminary model for **recovery and treatment** of end-of-life insulation boards and metal panels to ensure suitable PU downstream to feed the future chemical recycling processes.

Partners



EoL PU Value Chain – Cooling Appliances



- Due to the **WEEE Directive**, cooling appliances are **systematically collected**.
- Cooling appliances are **collected by different parties**, e.g., by distributors, manufacturers or municipal-waste collectors, and then transported to a **certified recycling facilities**.

- Appliances **undergo a two-step treatment** to separate materials and to **ensure that no ozone depleting substances are released**.
- **First treatment:** Removing the shelves, glass inserts, cables and draining the coolant.
- **Second treatment:** Shredding and sorting to separate solid fractions such as ferrous metals, non-ferrous metals, polystyrene, mixed plastics, polyurethane and the blowing agents.

- PUR in form of briquettes/ powder are most transported to waste to energy facilities. The solid fractions are recycled/ commercialized.
- **In the context of CIRCULAR FOAM Project, it is expected to replace incineration of PU downstream by chemical recycling.**

EoL PU Value Chain – Cooling Appliances

- In Germany there are currently **13 certified second-step treatment facilities**.
- **Entry points for PUR downstream collection.**



*Second Treatment Facilities
Distribution in Germany*

- Assessment of Recycling Technologies in Germany, Poland and in the Netherlands.
- PUR downstream samples analysis.
- Additional sorting and treatment steps (e.g., pelletizing) may be needed to meet the requirements for chemical recycling.

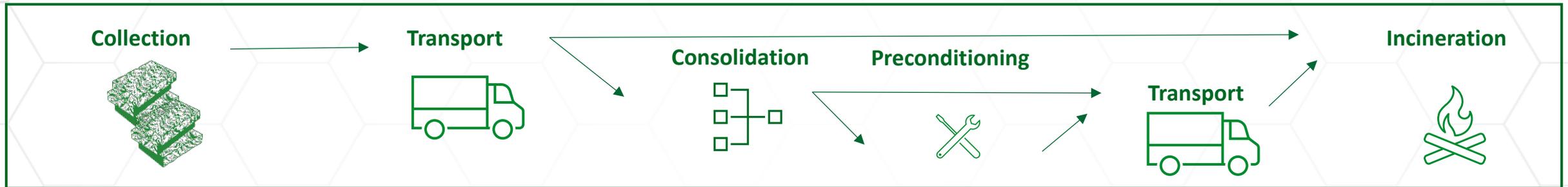


PUR Downstream (Briquette)



PUR Downstream (Pellets)

EoL PU Value Chain – C&D



- PU waste is disposed of **either separately or as mixed construction and demolition waste.**

- Currently PU-based waste is **not considered a valuable waste stream** and, therefore, it is processed into a **substitute fuel or just incinerated.**



Construction Waste



Insulation Boards (Mixed Waste)

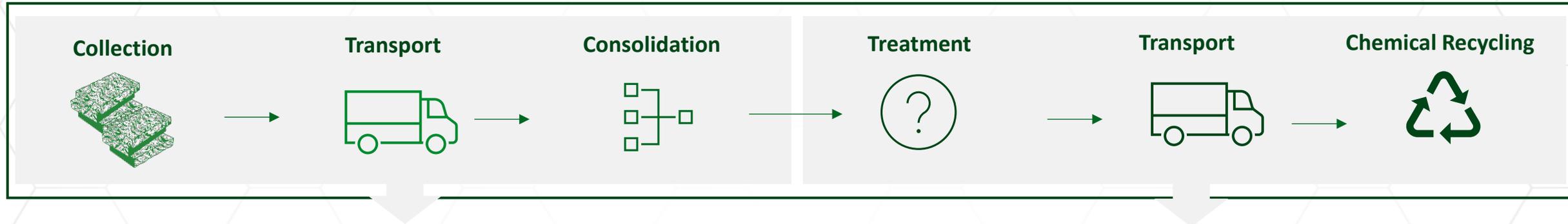


The Waste Framework Directive does not make any provisions with regard to separated collection of CDW.



Commercial Waste Ordinance: requires the separate collection of insulation materials and gives preference to re-use and recycling, no further separation of insulation materials, e.g. into PU, EPS or XPS is required / provides the obligation to forward non-separated materials (for technical or economic reasons) immediately to a pre-treatment plant, this applies to sandwich panels only.

EoL (Future) PU Value Chain – C&D



- **Collection** system should be driven by policies and their means of enforcement.
- **According to stakeholders, a separated collection on site tends to be considered feasible, but is mostly determined by the availability of space and economic incentives.**
- **Subsequent sorting** of mixed construction and demolition waste **might not a suitable option.**
- **Existing sites** of local waste management companies should be used as collection points.
- **Recommended network simulation:** at least 40 consolidation sites needed in DE to cover 80% of the geographical area.

- There is currently **no established recycling process** for EoL insulation boards and sandwich panels to ensure PU-downstream suitable for chemical recycling.
- The treatment processes **must include a fine sorting** process to **differentiate between PUR- and PIR-based** insulation materials.
- **Recovering** of blowing agents and **sorting** of brominated PUR must be taken into consideration.
- **In CIRCULAR FOAM a prototypical plant layout has been developed.**
- The capital-intensive nature coupled with low yields drives up product costs. Improvements on the sorting and/or the chemical technologies and/or public incentives might be needed for future project results implementation.