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Life Cycle Assessment (LCA) of Waste Valorization Processes

Summer Camp | July 7 – 11, 2025 | Marseille, France



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Agri-food Waste Management for Sustainable bio-economy through Higher Education curricula and upskilling

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Goals

AGRIMA aims to foster universities' **capacity building** for the **green transition** through **innovative practices** and **higher education curricula updating** in **agri-food waste management** for the **circular bioeconomy**.

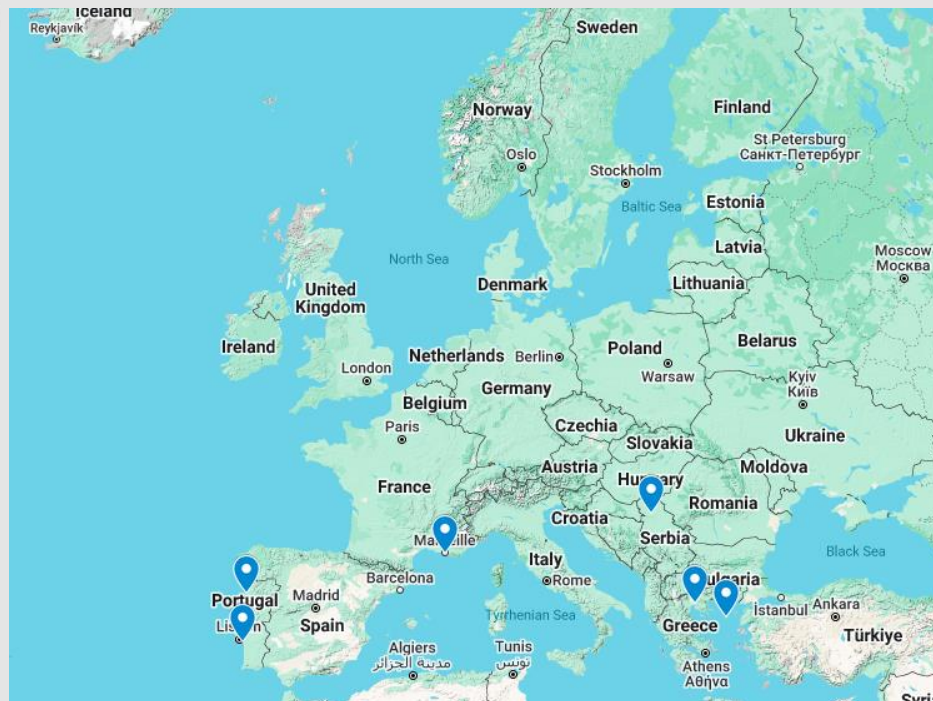
AGRIMA addresses:

- 1. Advancing pedagogical methods** for industrial agri-food waste valorisation **based on business-academia synergies**.
- 2. Integrating citizen science** in bio-economy-enhanced waste valorisation as a means of **civic engagement and environmental advocacy**.





Partners

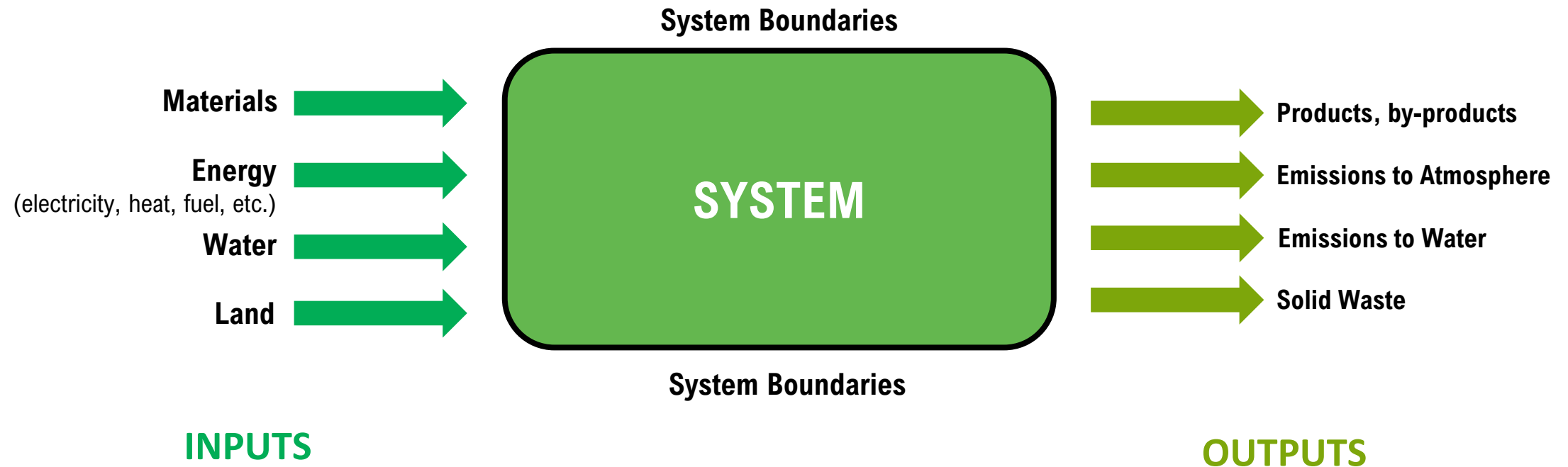


**Not
everything
that looks
sustainable...
actually is.**

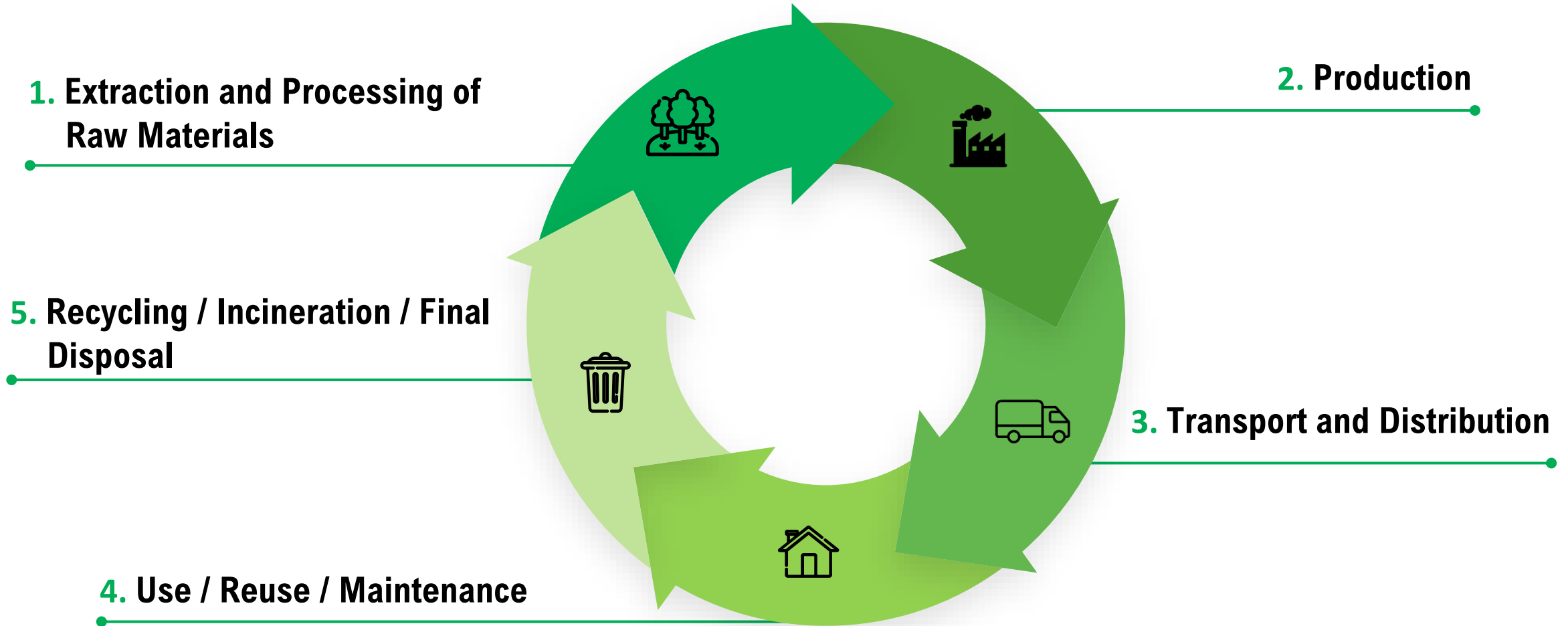


What is Life Cycle Assessment (LCA)?

Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle (ISO 14040)



The Product Life Cycle





“Do not design **products**!
Instead design **product cycles** that are
compatible with sustainable development.”

—PRé Consultants

Life Cycle
Thinking

Scenario
Thinking

Design
Thinking

EcoDesign: Shaping Sustainable Products

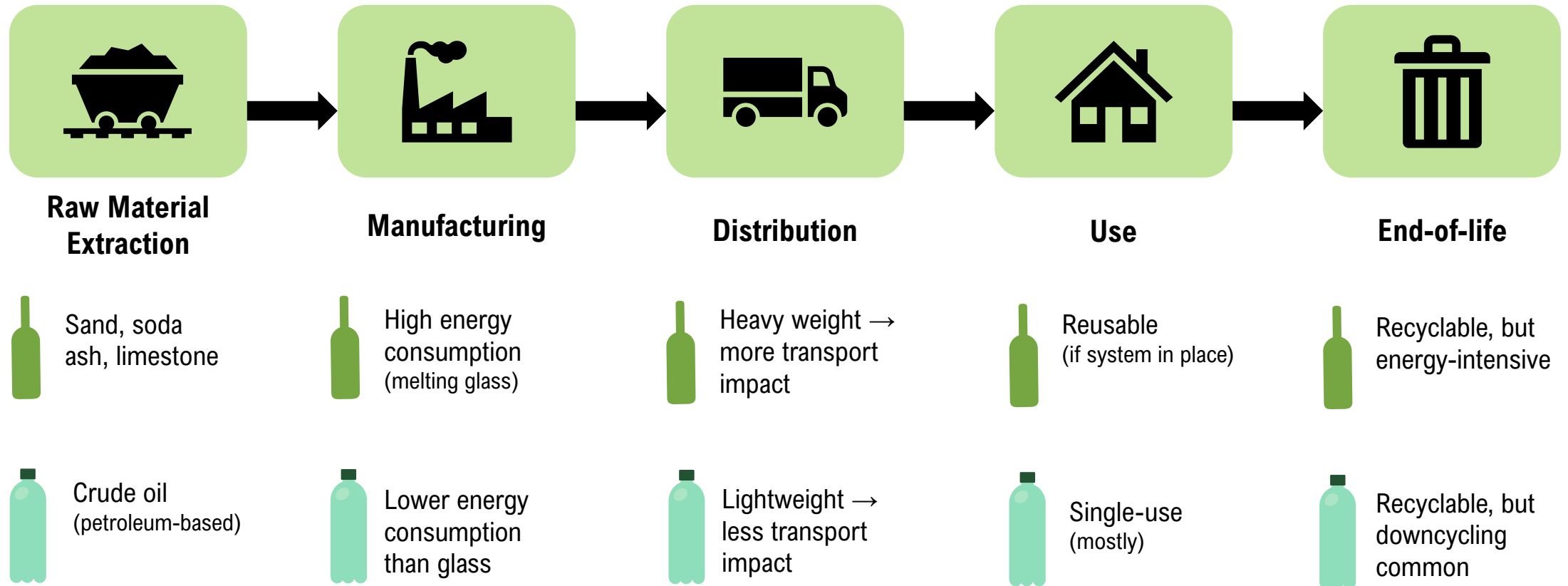
Decisions made during the development phase influence **up to 80 % of a product's environmental impact.**

Ecodesign integrates environmental considerations into product design, aiming to **minimize impacts across the entire life cycle.**



- Select **low-impact materials**
- Design for **durability** and **reparability**
- **Reduce energy** and **resource consumption**
- **Optimize** production processes
- Facilitate **reuse, recycling** and end-of-life **recovery**

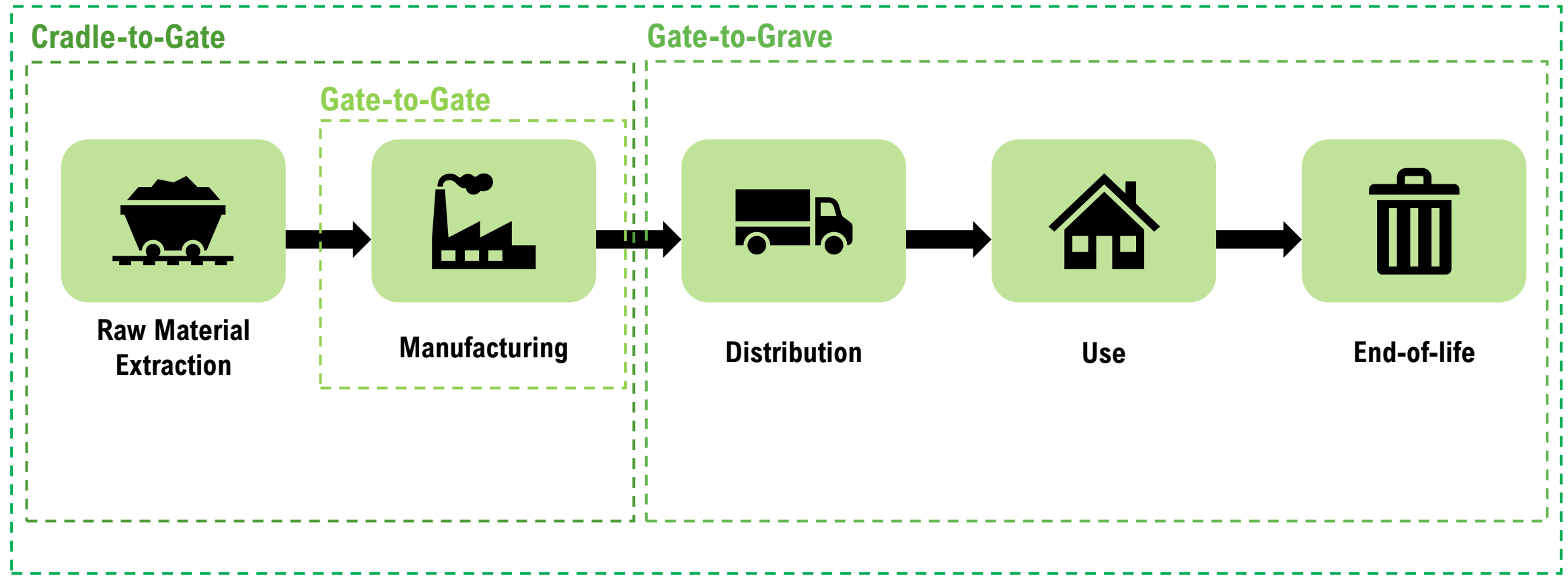
Glass Bottle vs. PET Bottle – a life cycle perspective



System Boundaries in LCA

System boundaries define what is included in an LCA study, and can strongly influence the final results

Cradle-to-Grave



LCA Methodology

Definition of Goal and Scope

Definition of the aims, context and boundaries of the study, identifying and describing the system to be analyzed, the functional unit, the reference flows and the data quality requirements.

01

Inventory Analysis

Compilation of an inventory of inputs (raw materials, water and energy) and outputs (emissions, waste, etc.) associated with each stage of the system's life cycle.

02

Impact Assessment

Quantification of the environmental impacts associated with input and output flows.

03

Interpretation

Interpretation of the results, according to the goal and scope of the study, identifying the main sources of environmental impact, as well as potential for improvement.

04

LCA & Sustainability



Profit

**Life Cycle Costing
(LCC)**



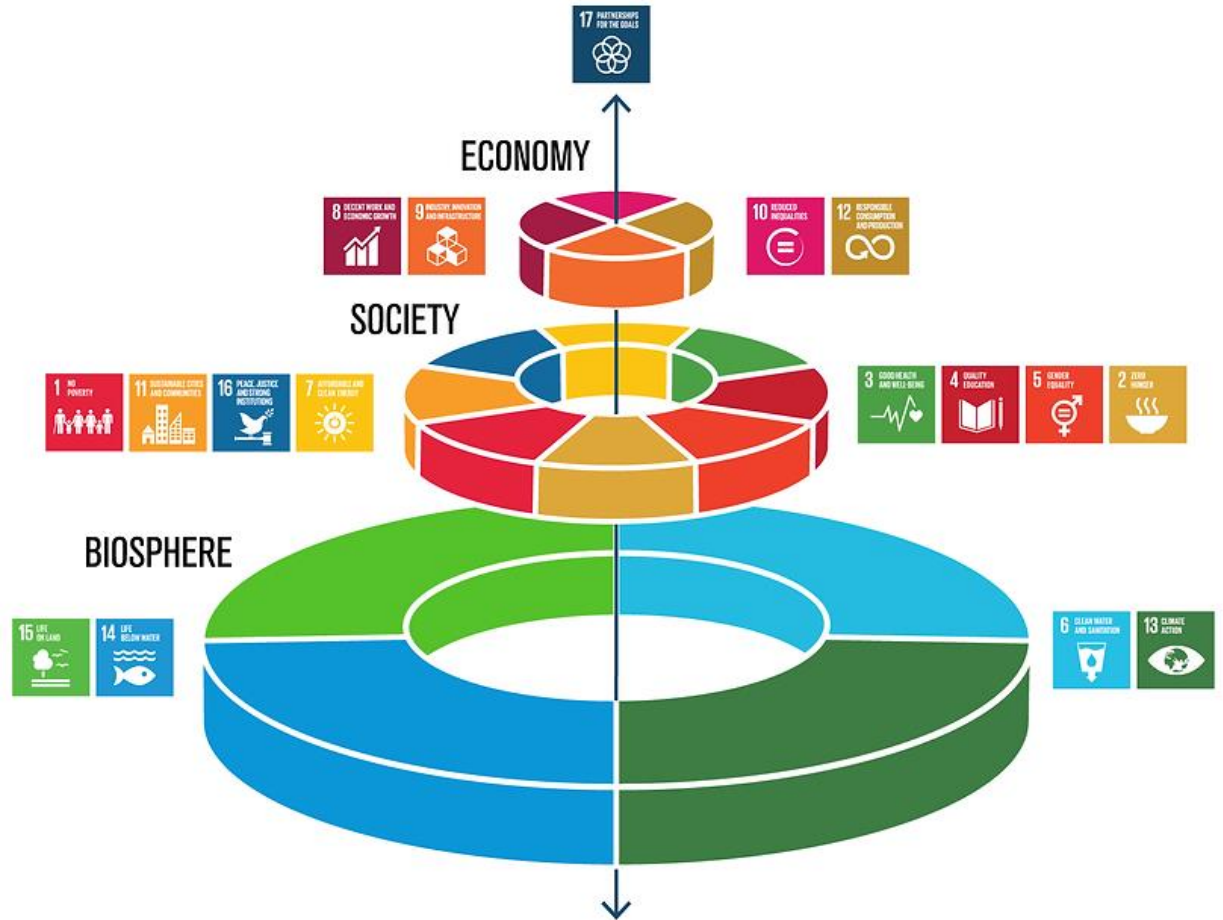
**People and
Society**

**Social Life Cycle Assessment
(S-LCA)**



Planet

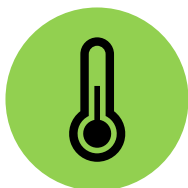
**Life Cycle Assessment
(LCA) - Traditional**



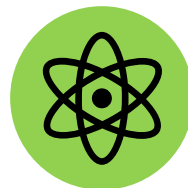
Environmental Impact Categories



Acidification



Climate Change
(aka Carbon Footprint)



Ecotoxicity



Eutrophication



Human Toxicity



Ionising Radiation



Land Use



Ozone Depletion



Resource Use
(fossils; minerals and metals)



**Photochemical Ozone
Formation**



Water Consumption

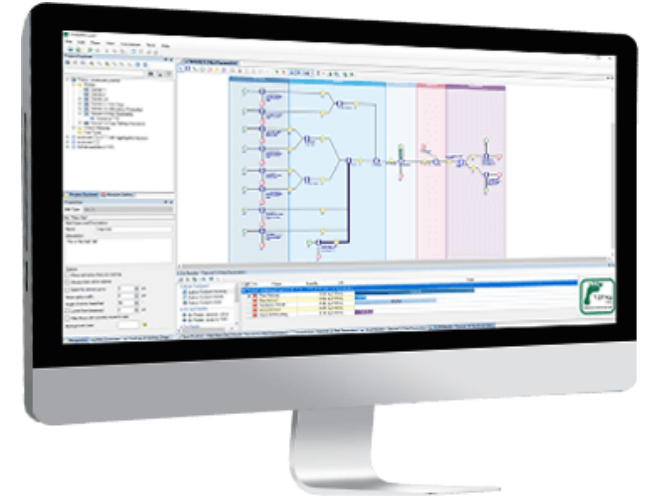
Impact Assessment Method: ReCiPe 2016 (Midpoint, Hierarchist perspective)

LCA Softwares



SímaPro

umberto®
know the flow.



openLca

sphera™

One
Click LCA

Ecochain

Databases



www.LC-Inventories.ch



Production of Biochar from Agri-Food Waste for Environmental Applications

Cradle-to-Gate

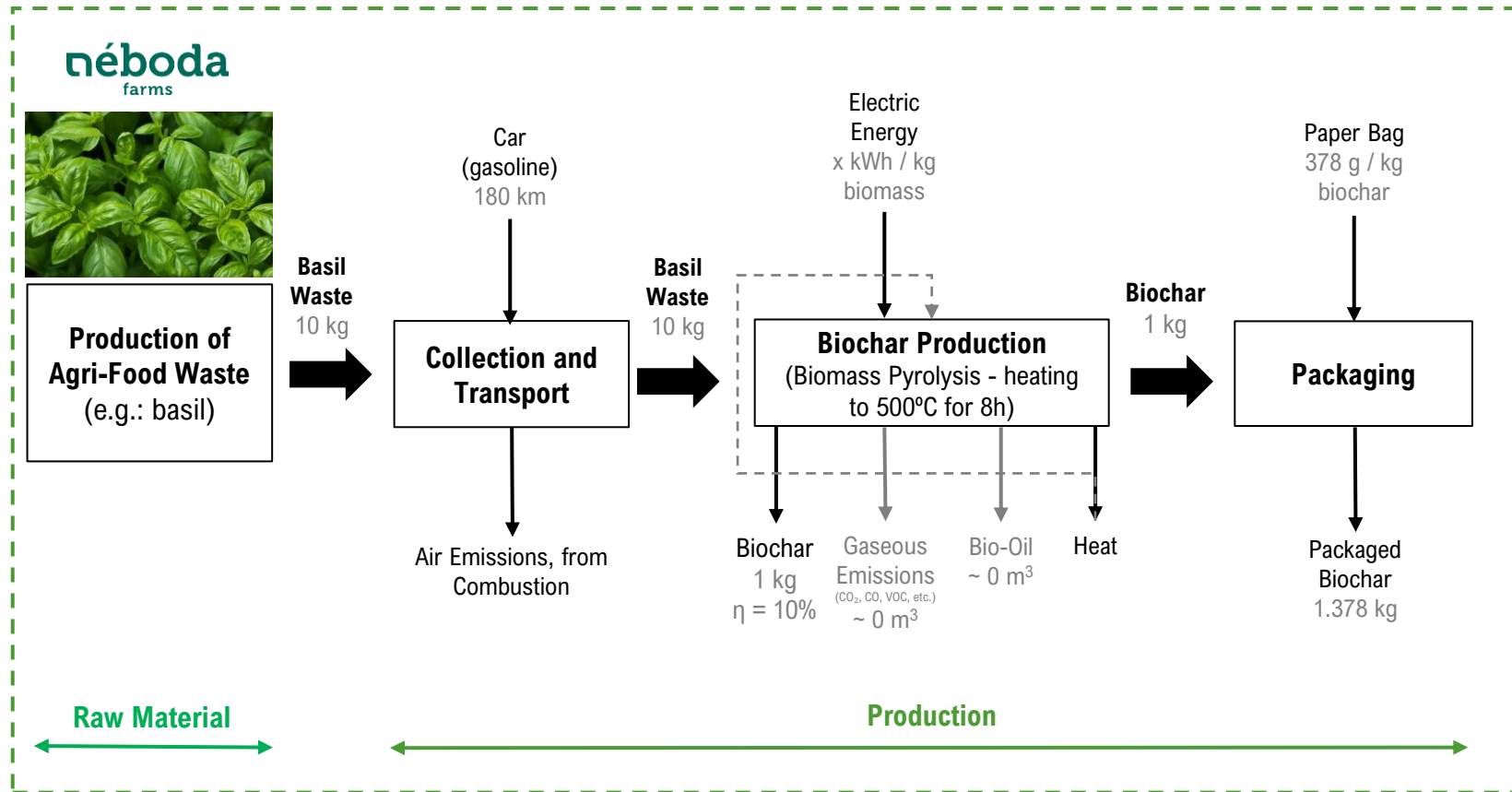


Fig. 1 - Biochar produced from basil waste.

Functional Unit: 1 kg of biochar
produced from basil waste

Production of Biochar from Agri-Food Waste for Environmental Applications

Gate-to-Grave

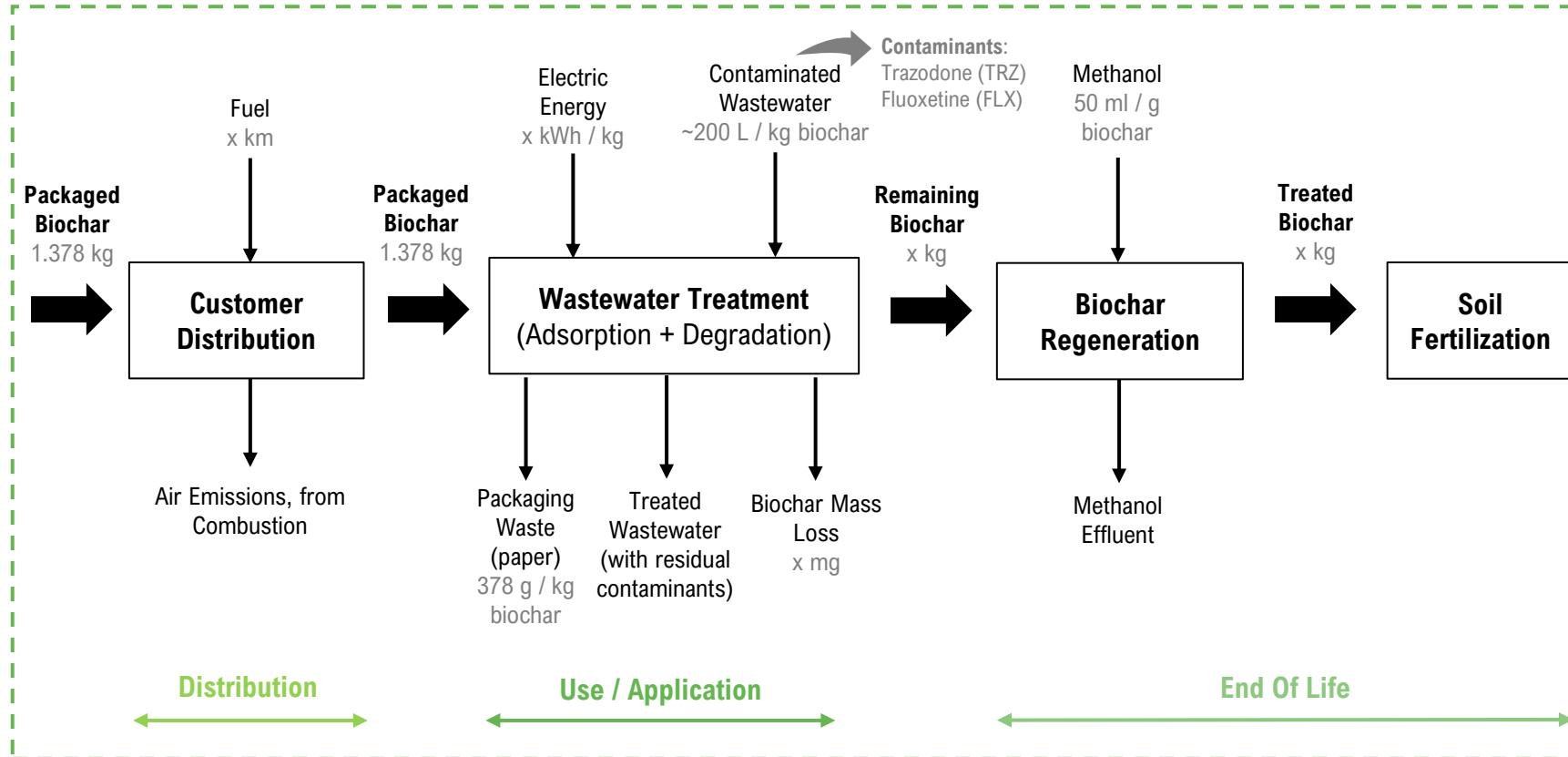


Fig. 2 - Laboratory degradation tests.

Functional Unit: 1 kg of biochar, if the aim is to evaluate biochar as a soil fertilizer / 1 m³ of treated wastewater, if the aim is to evaluate water treatment



DO YOU HAVE ANY QUESTIONS?



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