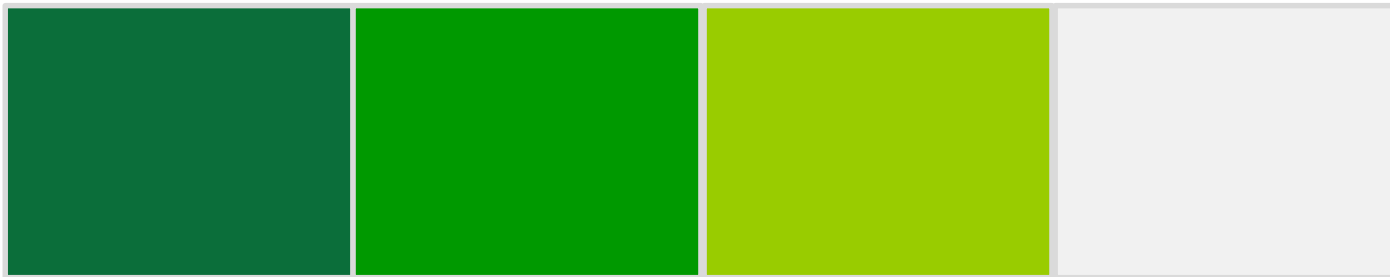


The sustainability of bio-based plastics

- quantifying environmental and socio-economic aspects of a computer mouse for a circular economy



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LCM 2017 - 05th September 2017

Session: Bio-based materials within the circular economy: opportunities and challenges

- **Title:** „New pathways, strategies, business and communication models for bioplastics as a building block of a sustainable economy“ (BiNa)
- **Funding:** German Federal Ministry of Education and Research
- **Scope:** Development of recommendations of action for bio-based plastics at the overlap of sustainability (LCA, LCC and S-LCA), communication and politics
- **Project Partner:**



- **Further Partner:** Advisory boards and cooperating companies



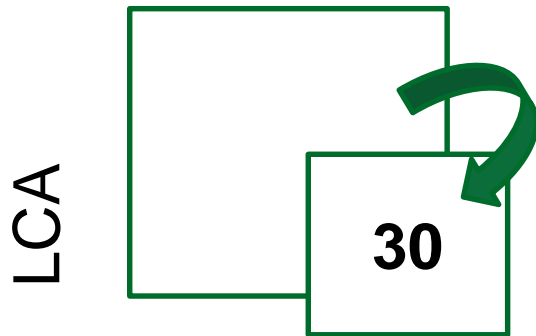
- ✓ Guideline for the **communication** of bio-based plastics
- ✓ Guideline for the **sustainability assessment** of bio-based plastics

Introduction - bio-based plastics



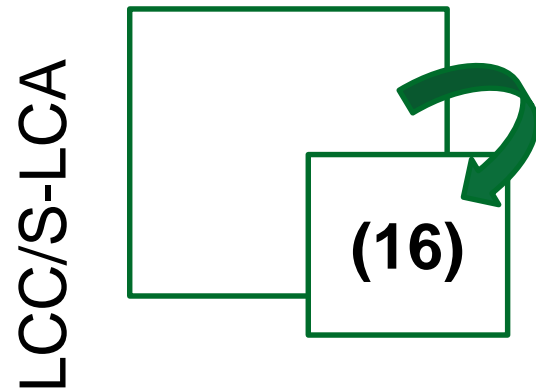
	Durable	Biodegradable
Bio-based	Bio-Polyethylene, Bio-Polyamides, Bio-Polyurethanes, i.a.	Polyhydroxyalkanoates, Polylactic Acid, Starch Blends, i.a.
Fossil-based	Polyethylene, Polypropylene, Polyvinylchloride, i.a.	Polybutylene Adipate Co-Terephthalate, Polybutylene-succinate, Polycaprolactone, i.a.

Sustainability studies



Sustainability methods

- ISO family 14040/44, 16760 etc.
- ILCD/PEF
- Eco-profile (PlasticsEurope)
- PCR UN CPC 347



- ISO 15686-5, DIN EN 60300-3-3
- VDI 2884, VDMA 34160.
- E-LCC / S-LCC (UNEP/SETAC)
- S-LCC (Benoit-Norris)
- LCWE (Barthel)

Status quo of bio-based plastics



- Increasing amount of LCA studies for bio-based plastics available
- Little information on S-LCA and LCC for bio-based plastics available
- Existing methodological gaps are of general nature
- Latest ISO standard for bio-based products gives not much additional guiding
- Existing product category rules allow the inclusion of bio-based plastics but do not provide sufficient guiding
- The comparison of bio-based and fossil-based plastics with current methods difficult
- A joint guideline for fossil-based and bio-based plastic should be developed to allow comparable results for both plastic types (LCA, LCC and S-LCA)

Case study - computer mouse housing

Background

Prologue: Substitution of fossil-based plastic with bio-based plastic due to intransparency of fossil value chain. Strong focus of NagerIT on social aspects.

Functional Unit: 1 computer mouse housing

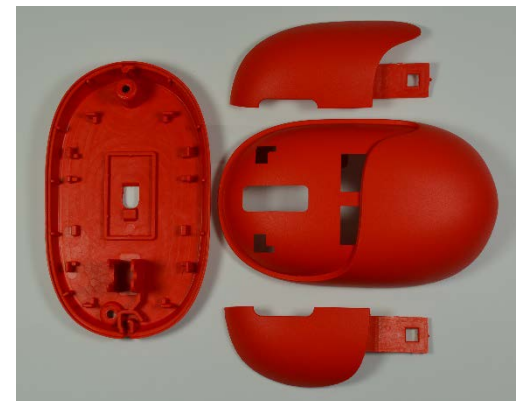
Material: PLA-Blend

LCA: ISO14040/44, ILCD/PEF and BiNa guideline

LCC: ISO15686-5, DIN EN 60300-3-3: and BiNa guideline

LCWE: Dissertation L. Barthel: and BiNa guideline

System boundary: Cradle-to-Grave



LCC – economic assessment: quantifying material and energy costs along the entire value chain

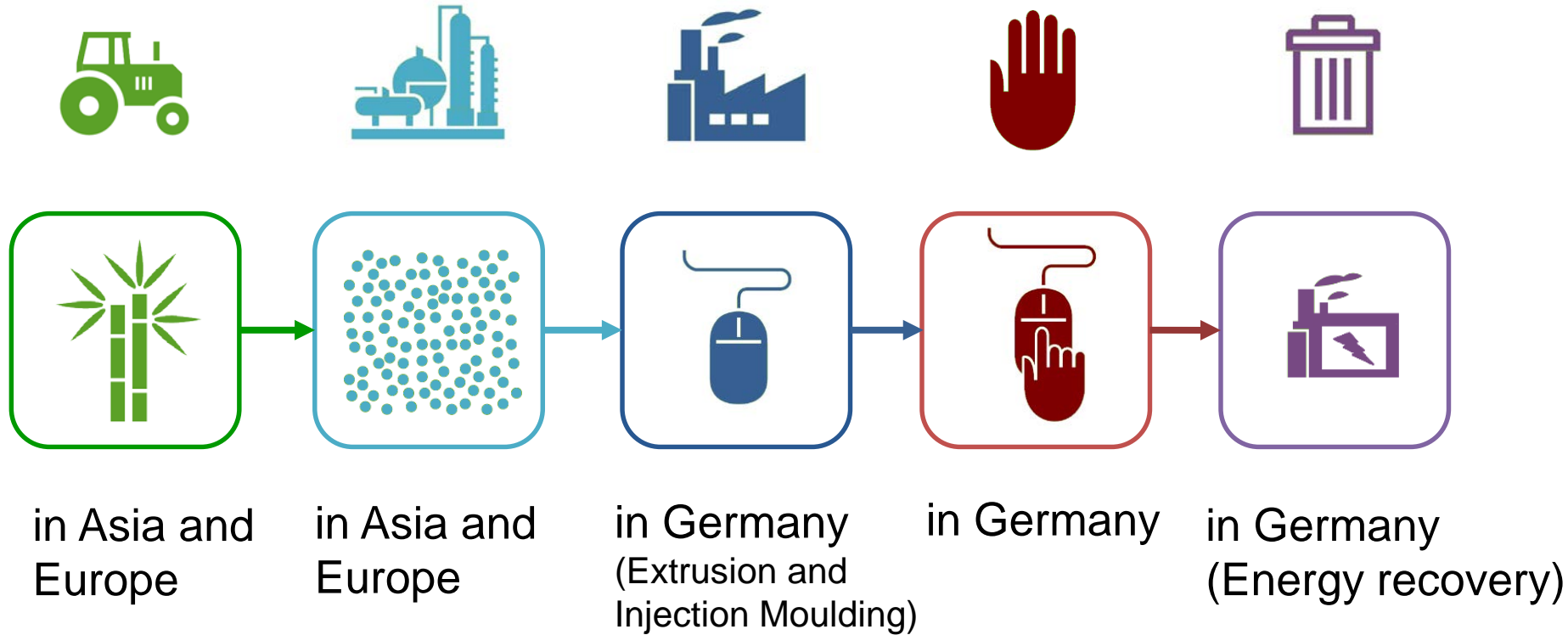
- Based on statistical background data (EUROSTAT) and specific foreground data (costs and revenues of products and bio-blends)
- **3 Indicators**
 - Value added, revenues, costs (material, energy, other)
 - Energy cost sensitivity
 - Regional distribution of value added

LCWE – social assessment: analyzing social aspects along the entire value chain

- Based on statistical sector information (EUROSTAT)
- Little information on S-LCA and LCC for bio-based plastics available
- **5 Indicators**
 - Occupational safety (lethal / non-lethal accidents)
 - Percentage of women working along value chain
 - Qualification level according to ILO (International Labour Organisation)
- Automated evaluation based on LCA-model
 - Ensures consistency with LCA and reduces manual effort

Case study - computer mouse housing

Life Cycle



Raw material production

Polymer production

Processing

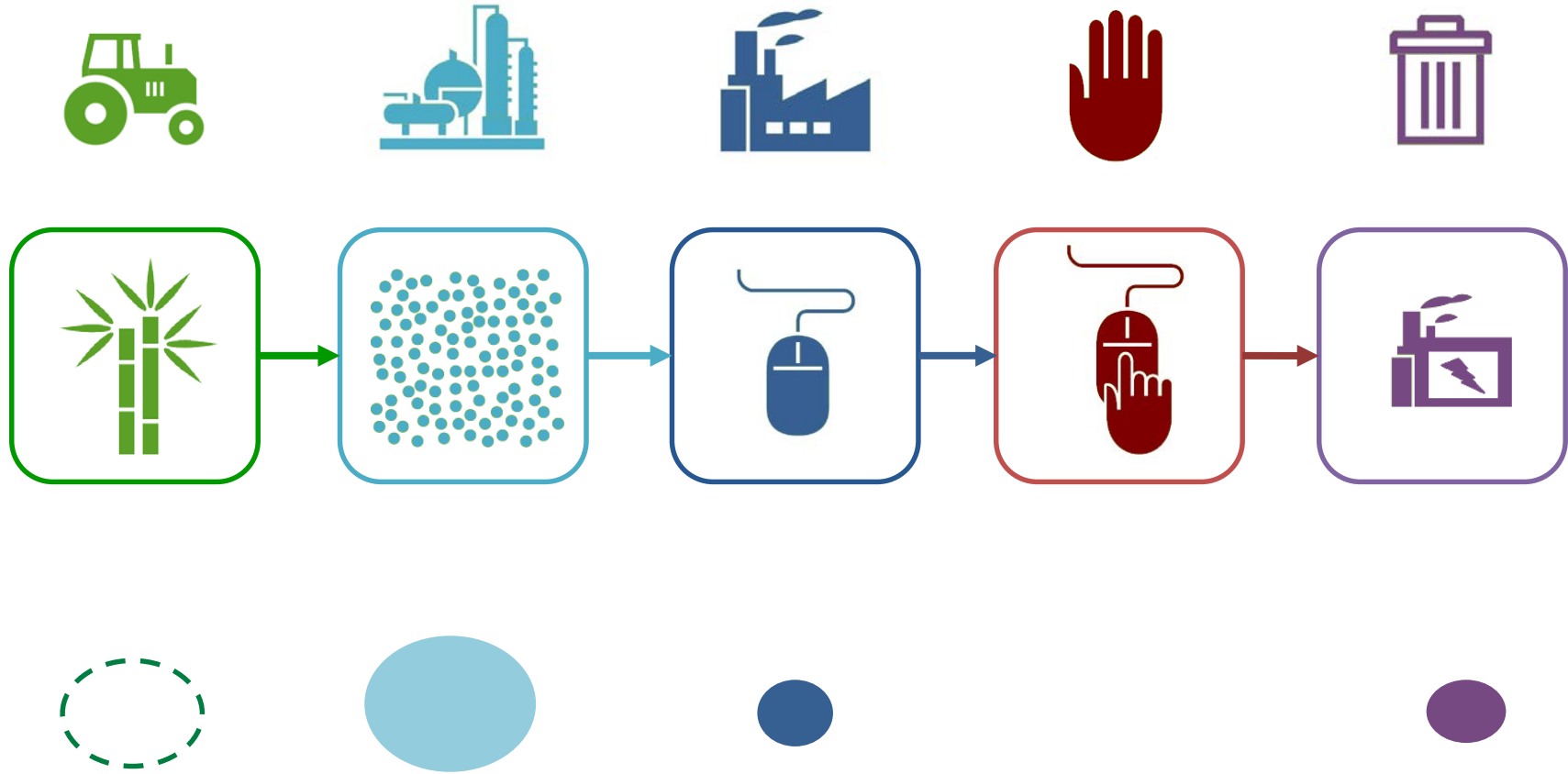
Use

End-of-Life

Case study - computer mouse housing

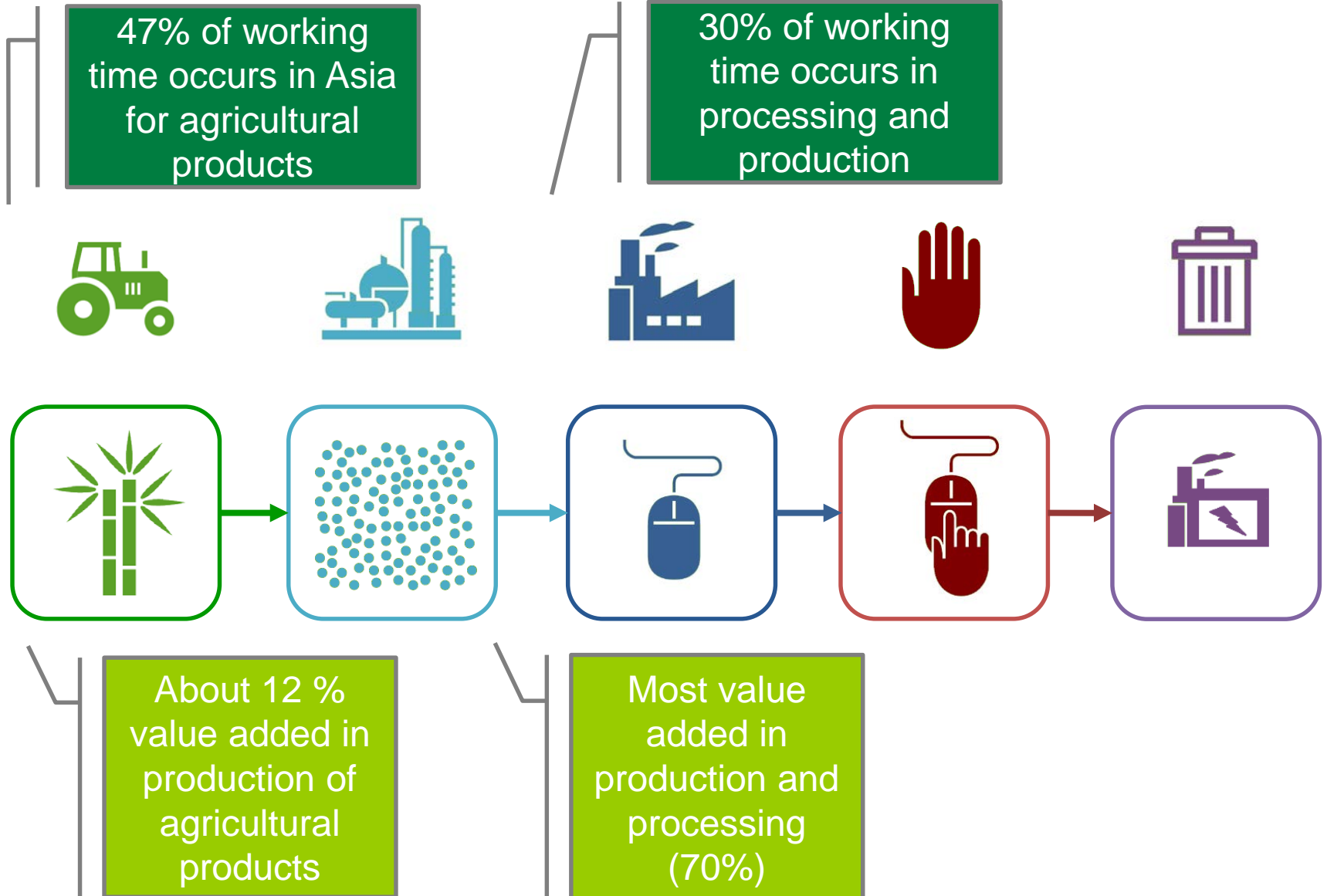
Results - LCA – GWP

Global Warming Potential

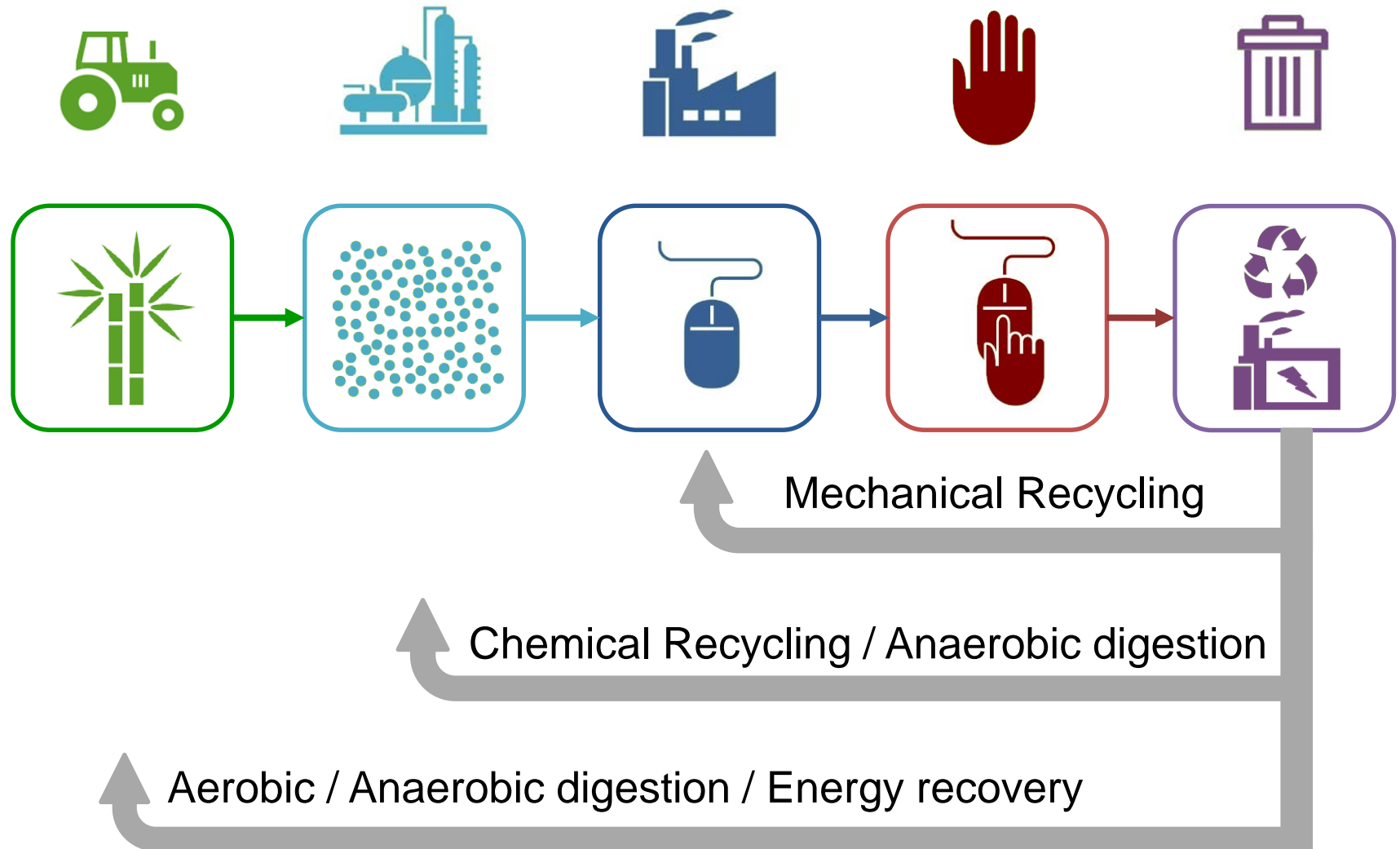


Case study - computer mouse housing

Results - LCWE and LCC



Circular economy and bio-based plastic



Circular economy: challenges and opportunities of bio-based plastics

Challenges

- Business as usual
- Recycling streams – hen-and-egg-problem (novel bio-based plastics)

Opportunities

- Reduction of land use
- Establishment of a true circular economy
- Drop-in bio-based plastics use of existing recycling streams

- Current methodological gaps make a valid estimation difficult
- A joint guideline for bio-based plastic and fossil-based plastics is needed
- To develop truly sustainable bio-based plastic all three pillars have to be taken into account
- Assessment for fossil-based and bio-based plastics has to be transparent and fair
- The BiNa project sets up a first building block to reach this goal by developing a guideline for bio-based plastics
- → First step for the development of an circular economy with bio-based plastics

Thank you very much!

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