Sustainability assessment of different types of coffee capsules

12th December 2023, Marieke Brouwer

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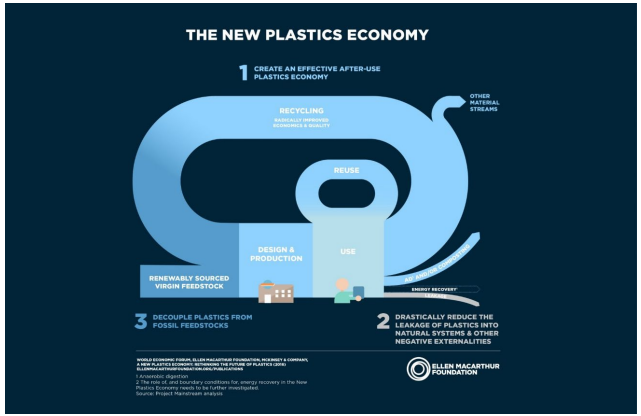
Sustainability assessment & systems perspective

- We aim to develop, test, process & research materials that are **really sustainable.**
- Current ‘standard’ sustainability assessment methods (e.g. LCA) **lack to include all important** aspects for the sustainability of materials in a circular biobased economy.
- Therefore, we include **multiple dimensions** of sustainability and a **systems perspective** to assess the sustainability of materials.

Report: Multi-dimensional sustainability of product-packaging combinations: https://doi.org/10.18174/633072



Sustainability assessment coffee capsules

Project: Increase circularity by the use of biobased and/or industrially compostable materials

Carried out by: Wageningen Food & Biobased

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Subsidised by: TKI BBE biobased in een circulaire economie

Funded by:

TotalEnergies Corbion

ADVANCED TECHNOLOGY INNOVATIONS

NOVAMONT A Versalis Company

NatureWorks

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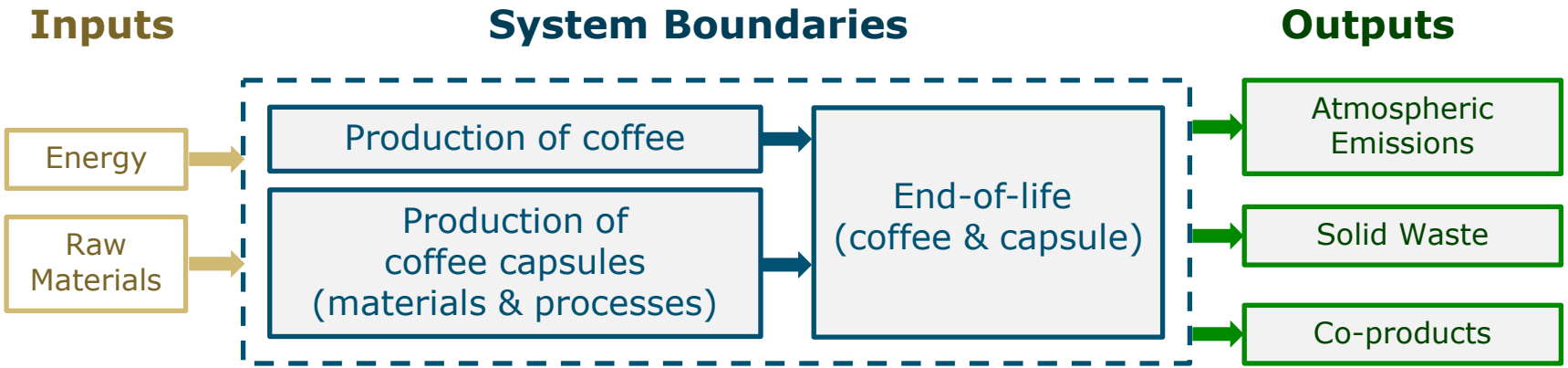
Ministerie van Infrastructuur en Waterstaat

Background & goal

- In Europe approximately 53 billion capsules were purchased by consumers in 2023.

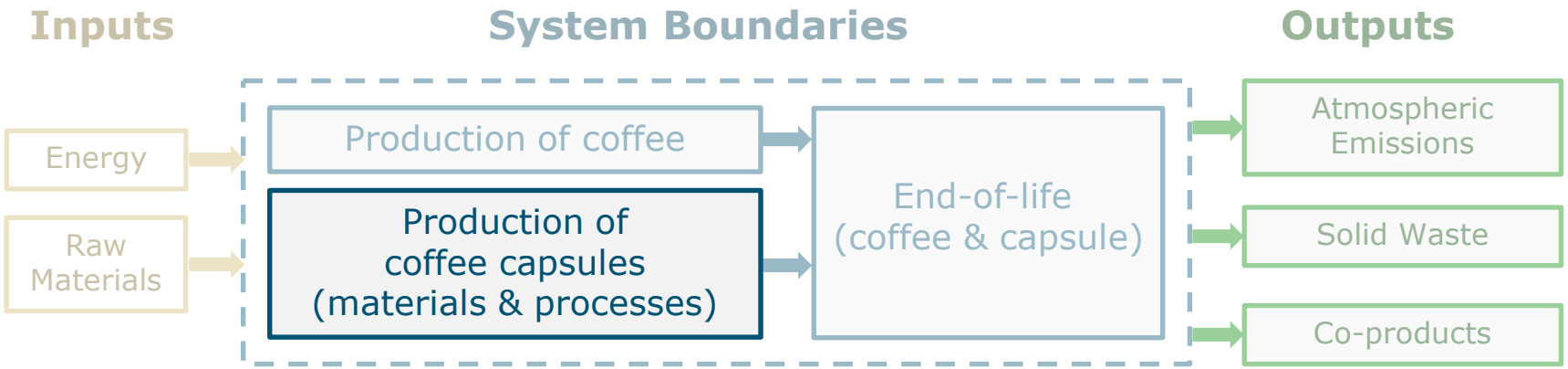
- The **aim** of this study is to *compare* different types of coffee capsules in terms of sustainability,
    - from *feedstock production to end-of-life*
    - and from a *systems* perspective

Scope: system boundaries



- **System boundaries**: from materials & production to end-of-life
- **Scenarios**: "What-if end-of-life scenarios", 100% collection to the end-of-life option
- **Geographical:** NL (with EU additions)

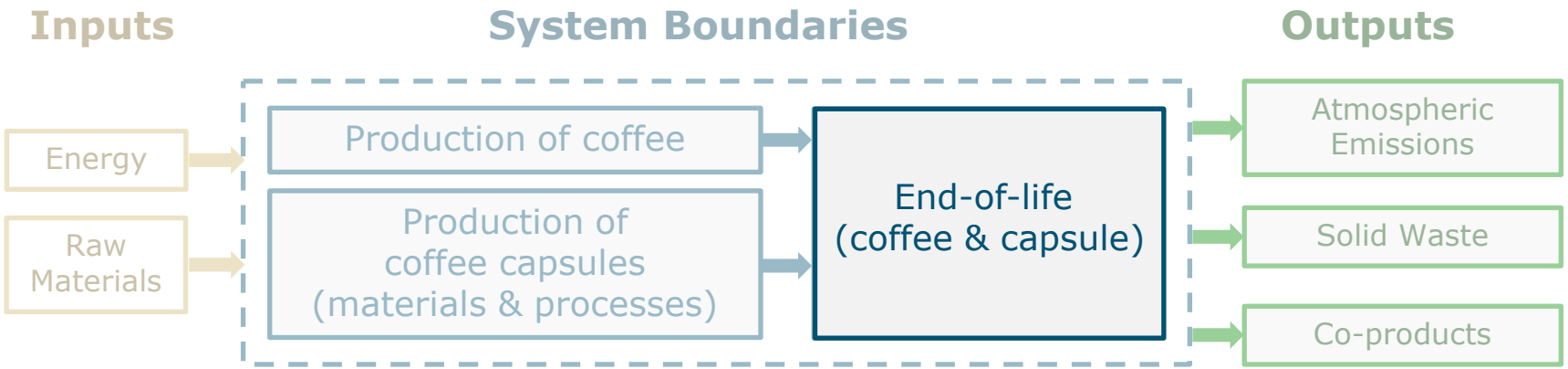
Scope: product



Single-serve style coffee capsules:

- Compostable and bio-based plastic capsules (PLA, PHA)
- Conventional plastic capsules (PP, HDPE)
- Aluminium capsules, with and without recycled content (assumed 40% post-consumer)

Scope: end-of-life



	Industrial composting	Recycling via mono-collection	Recycling via LWP waste collection	Incineration with energy recovery	Landfill with energy recovery
Compostable Plastic	x		x	x	x
Conventional plastic			x	x	x
Aluminium		x	x	x	x

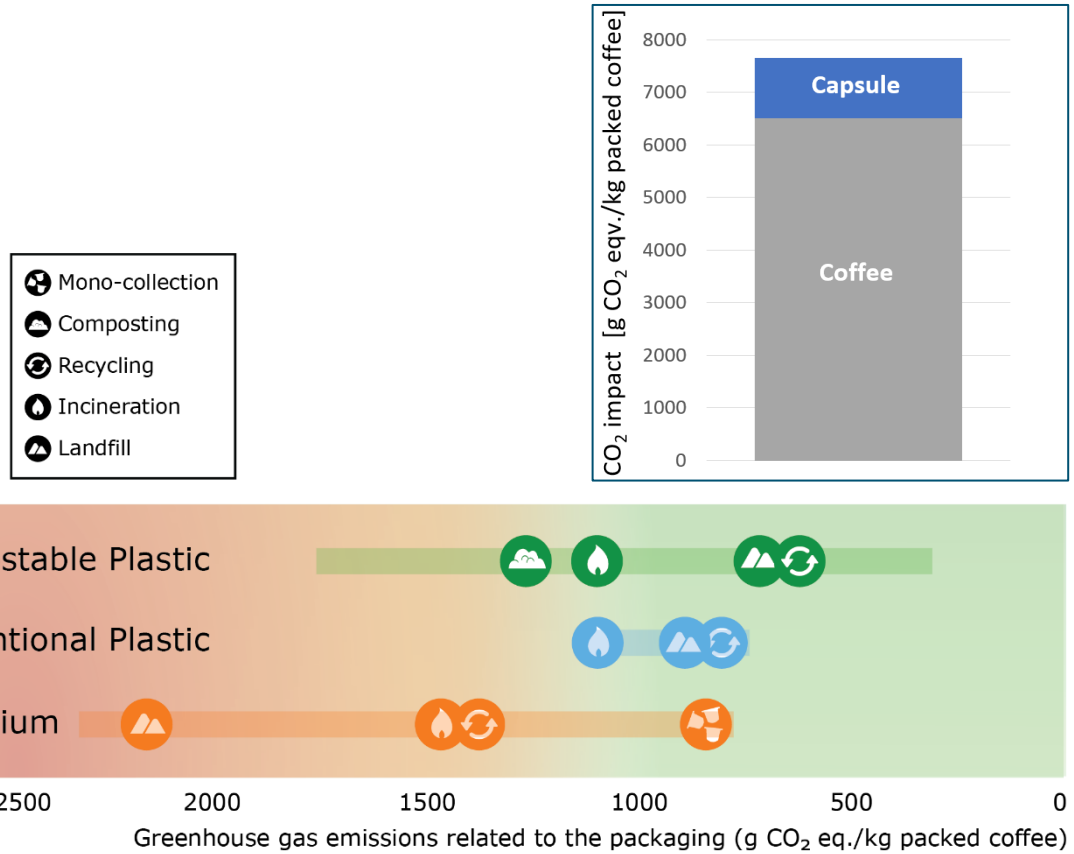
Approach

- Sustainability assessment in multiple dimensions (MuDiSa tool WUR), for example:
    - **GWP-100:**
        - Functional unit: 1 kg of packed coffee
        - Allocation approach: Closed loop approximation
        - Incl. biogenic carbon
    - **MCI**: Material Circularity Indicator (Ellen MacArthur Foundation)
    - Littering (persistence of materials) – however less relevant for this application
- **System effects**
    - Consider both (food) product and packaging
    - In this case coffee and capsule are discarded together

GWP-100 (traditional)

Production of coffee biggest contribution

End-of-life: **recycling** is preferred option for all capsule materials



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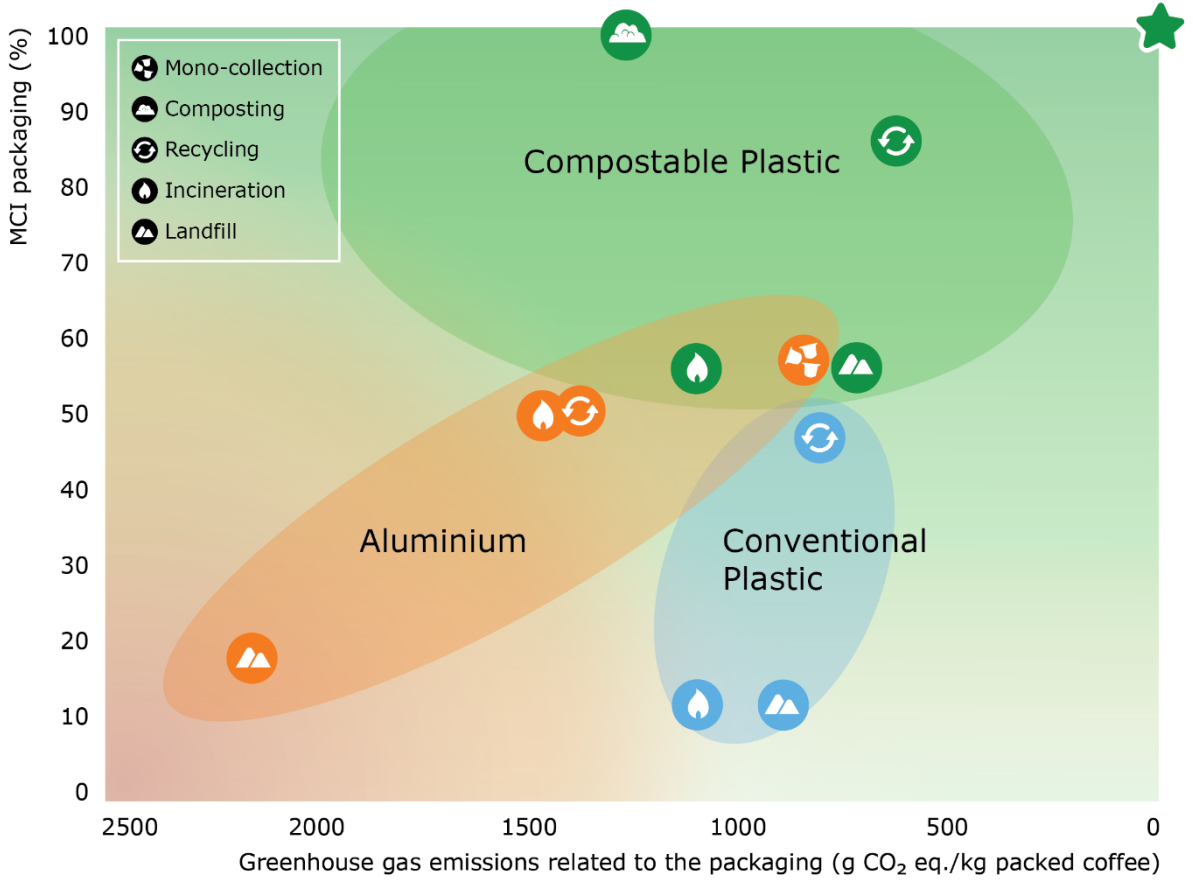
Multiple dimensions (GWP + MCI)

Compostable capsules perform well on both dimensions

MCI 100% in case of composting, this is not feasible for recycling options



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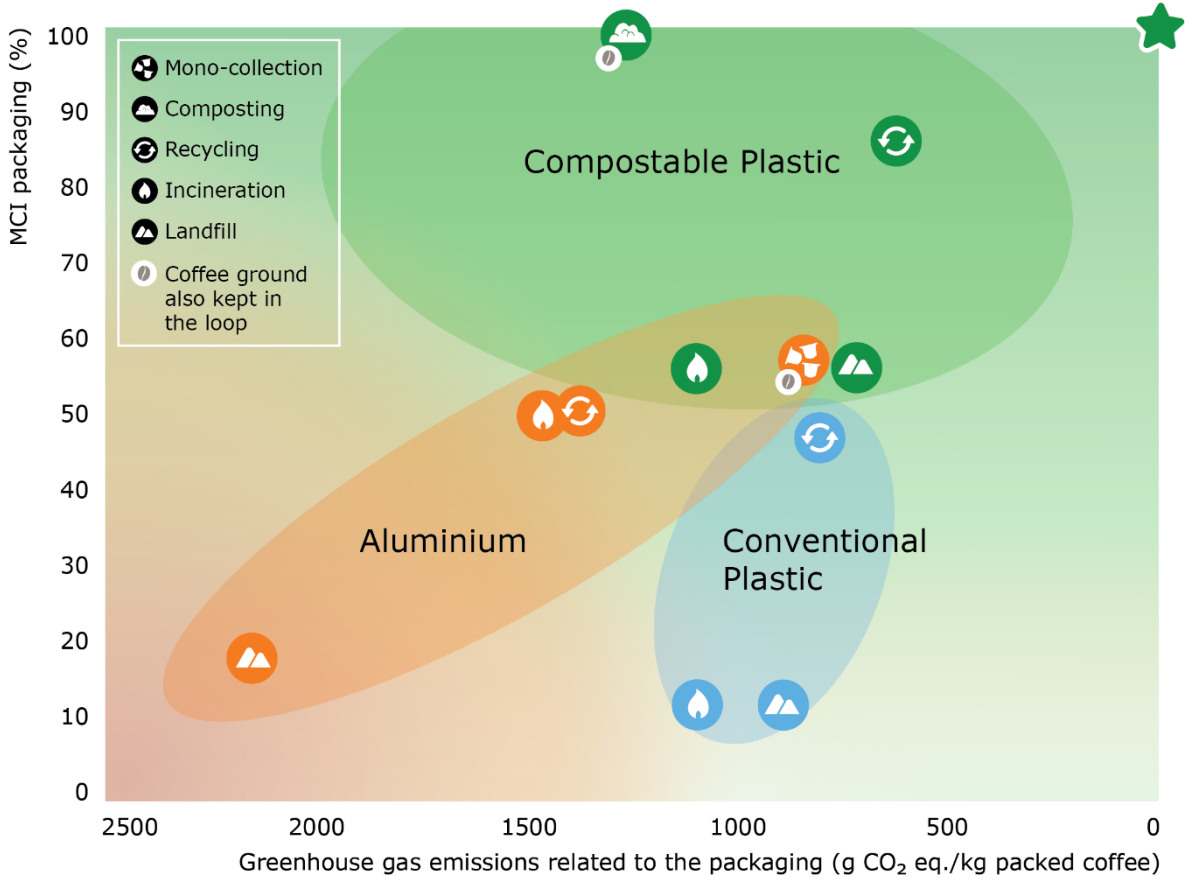
Multiple dimensions & system effects

Two scenarios keep **both** coffee grounds and capsule material in the **loop**:

- composting of compostable plastic capsules
- mono-collection of aluminium capsules



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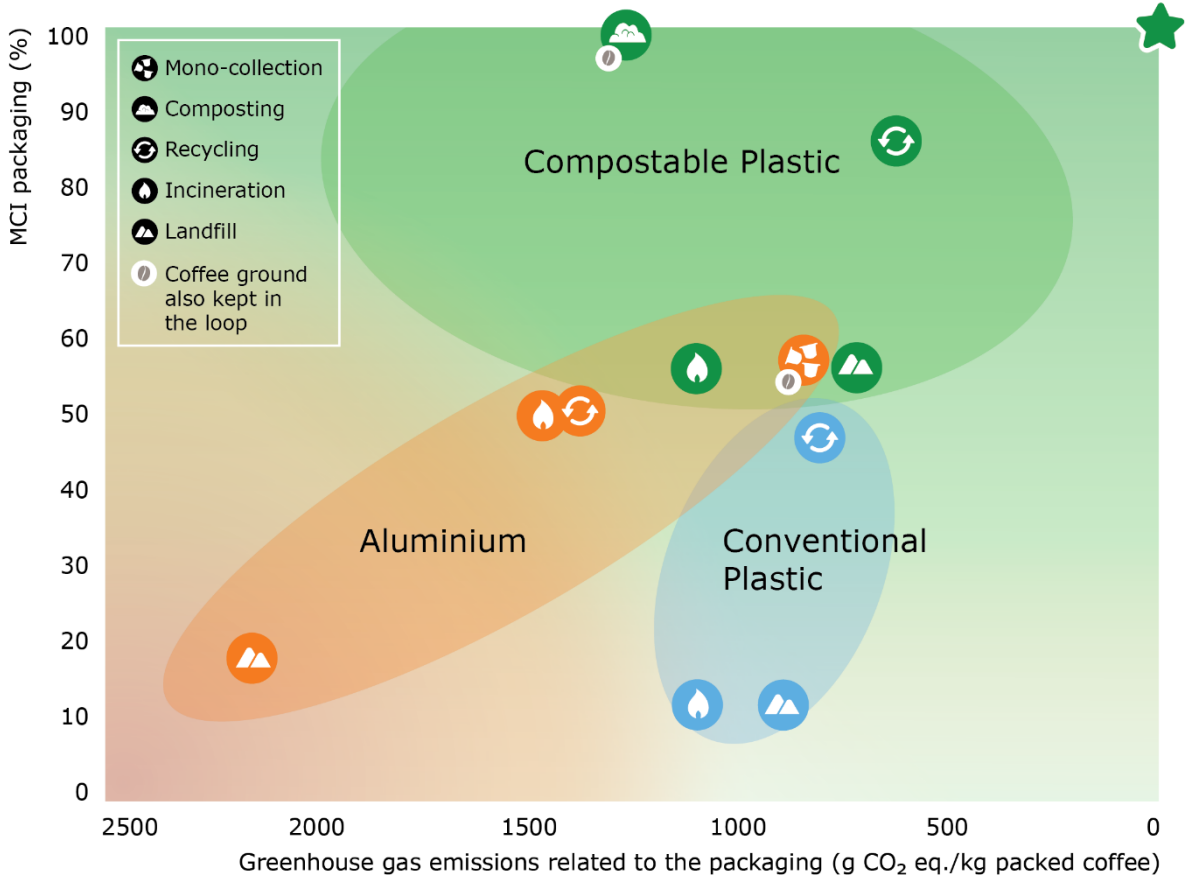
Multiple dimensions & system effects

When disposed in wrong container:

- Compostable plastic has **limited negative effects**
- Aluminium & conventional plastic will **cause contamination** in compost



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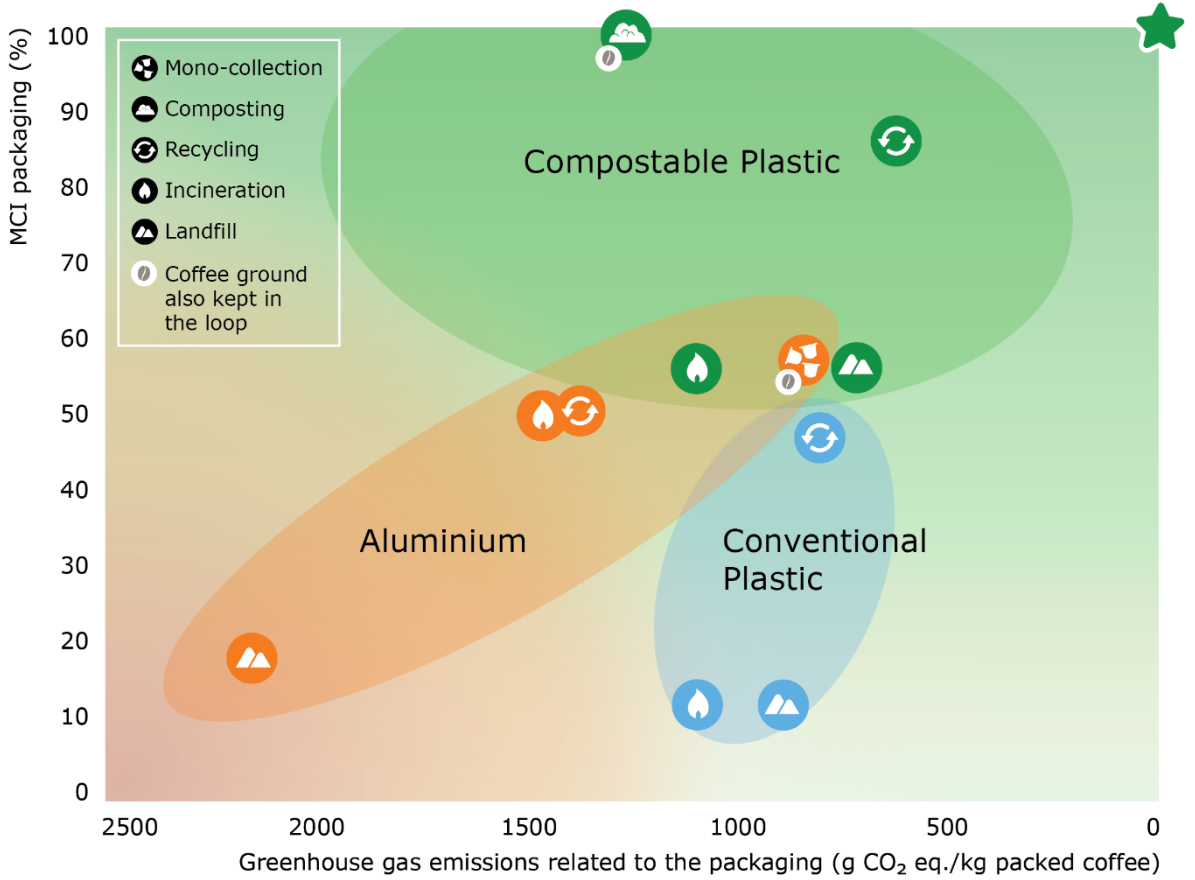
Multiple dimensions & system effects

Preferred options:

1. Compostable capsules that are composted
2. Aluminium capsules that are mono-collected



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Hurdles to overcome

Compostable coffee capsules

- Currently not accepted in municipal organic waste in the Netherlands

Aluminium capsules

- Low participation rate in voluntary mono-collection system

Overall recommendations

- To assess sustainability, it is vital to:
  - take into account not only greenhouse gas emissions, but also other circularity indicators.
  - consider the entire system, i.e. the (food) product in combination with the packaging and the end-of-life routes.
- Increase common understanding of sustainability, circularity, etc.
- Further develop sustainability indicators.
- In general policy makers should be aware that setting policy targets only for packaging materials can result in non-sustainable outcomes.
- To achieve full sustainability all involved stakeholders must be aligned and cooperate.

Thank you

Full report can be downloaded at: https://doi.org/10.18174/641509

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