PRIMUS

LCSA and beyond: a demonstrator case study using LCSA, plastic littering, circularity and system dynamics for the PRIMUS project

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Introducing the PRIMUS project

PRIMUS

- ***Reforming secondary plastics to become the first raw material choice of high added value products***

- *4 demo cases*

Introducing the PRIMUS project

DEMO 1

Automotive Interior Aesthetic Components

FUNCTION UNIT

1 item (354.5g)

SYSTEM BOUNDARY

Cradle-to-gate

DEMO 2

Tube for car coolant

FUNCTION UNIT

1 item (170.0g)

SYSTEM BOUNDARY

Cradle-to-gate

DEMO 3

Fridge inner lining

FUNCTION UNIT

1 item (50g)

SYSTEM BOUNDARY

Cradle-to-gate

DEMO 4

Fridge inner lining

FUNCTION UNIT

1 item (1240g)

SYSTEM BOUNDARY

Cradle-to-gate

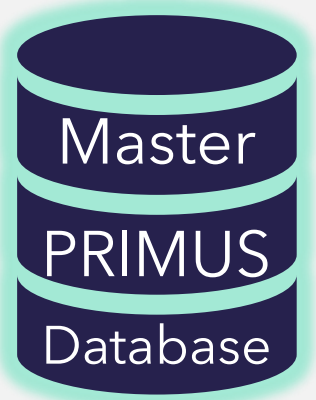
Methodology

PRIMUS master database

PLEX

Plastic littering risk

openLCA



ecoinvent

Environmental LCA

Circularity package

Circularity indicators

PSILCA

Social LCA

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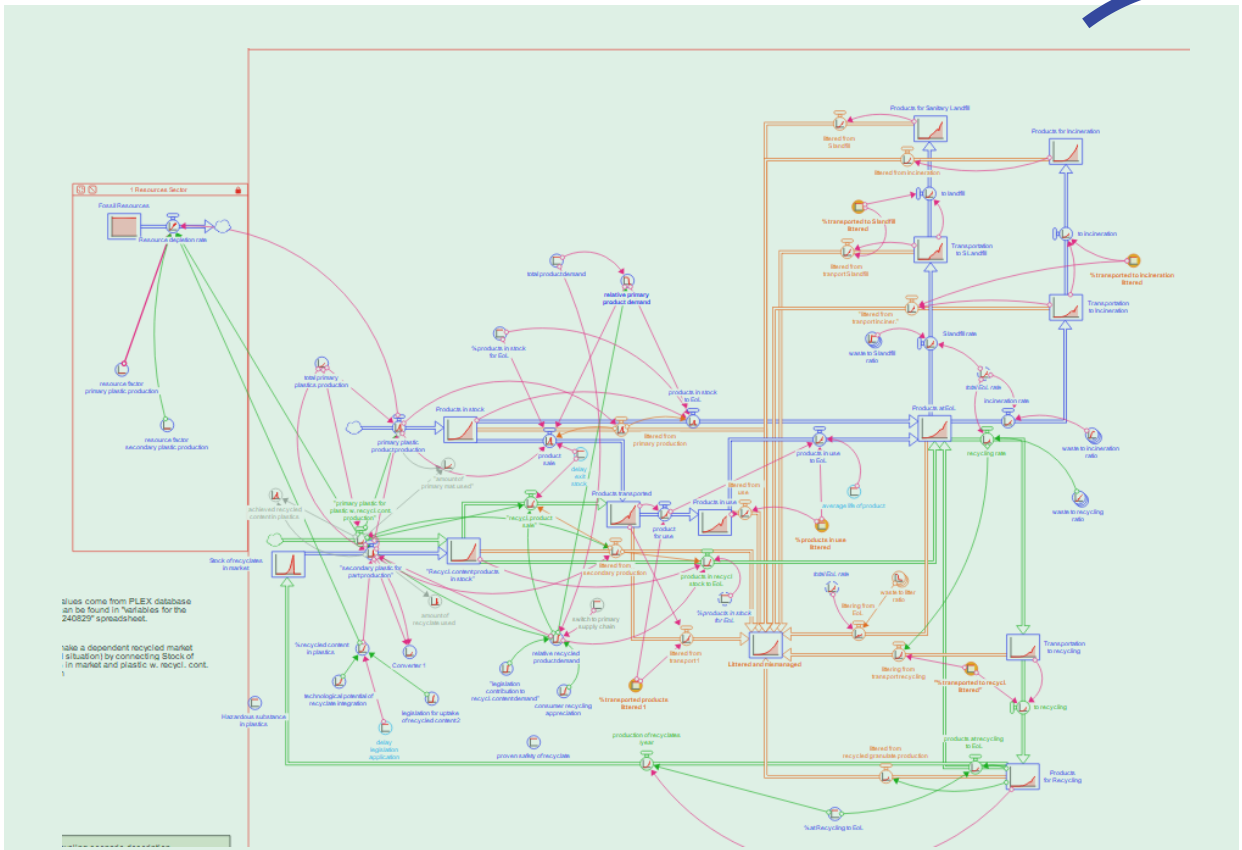
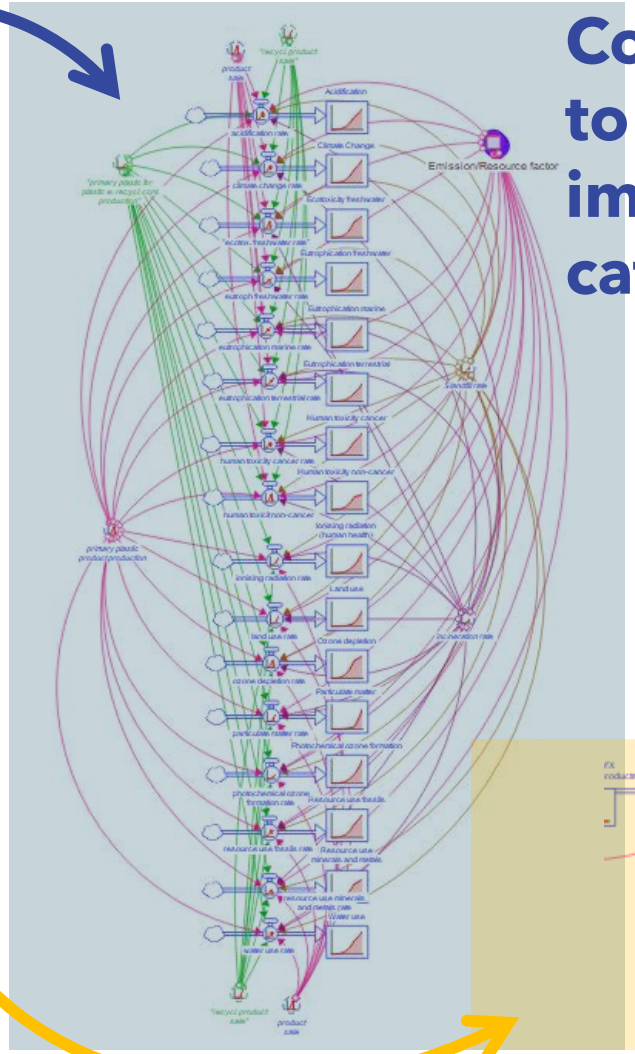
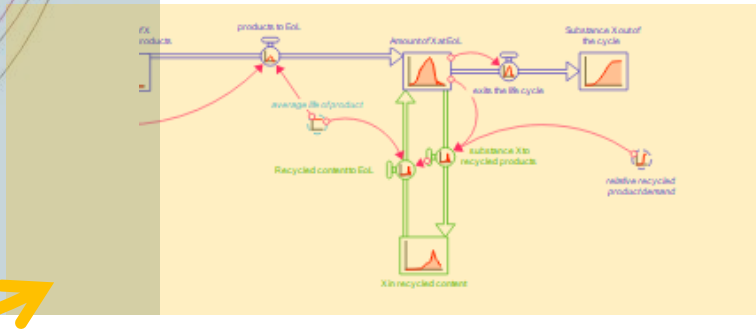
PRIMUS system dynamics model



Life Cycle of plastics
+ Recycling
+ Litter



Connection to LCA impact categories



Unwanted substances

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Results

System Dynamics

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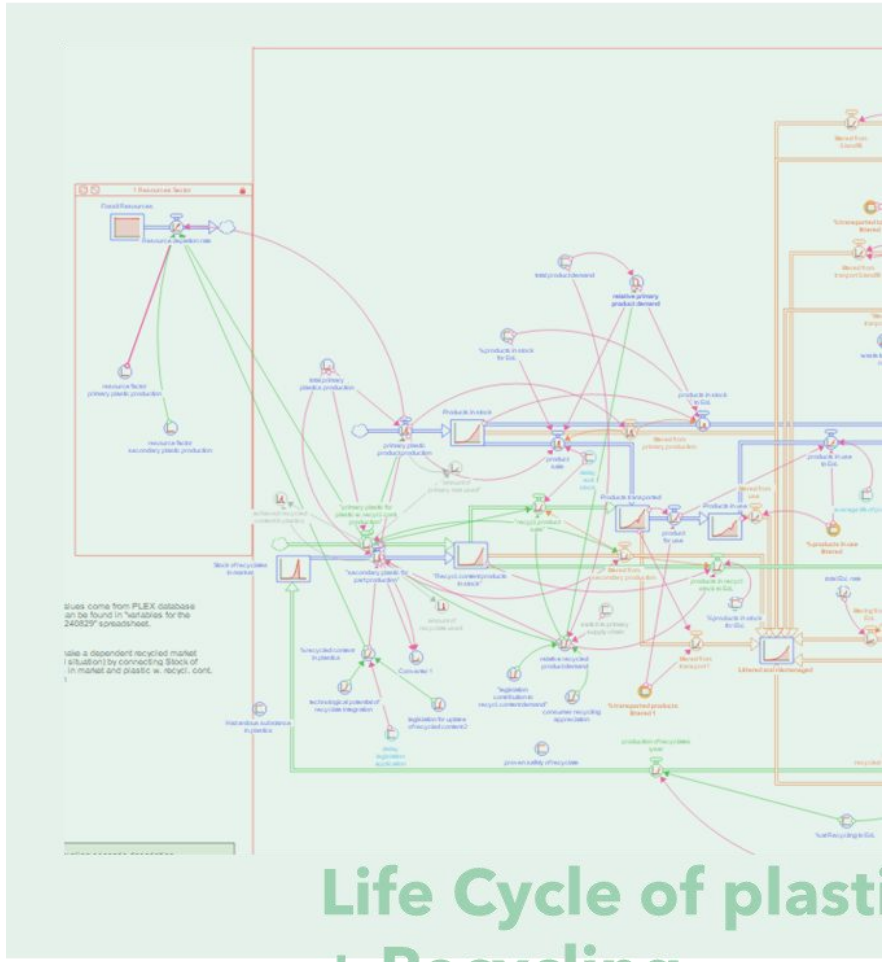
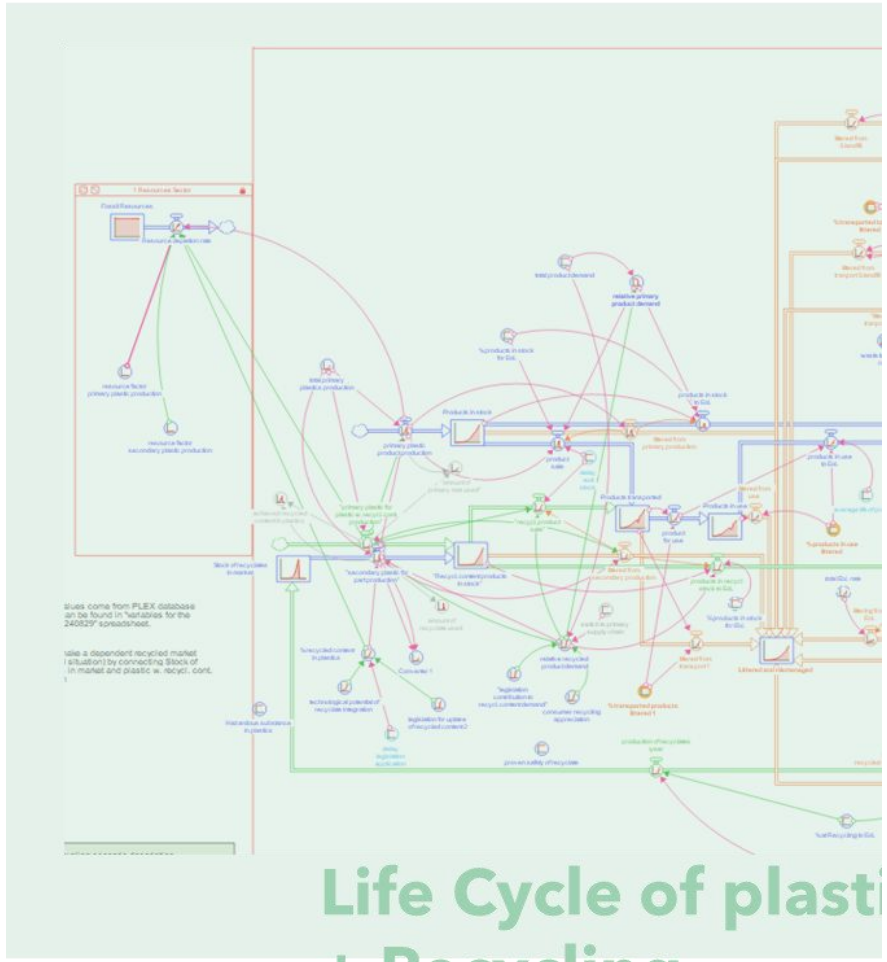
System Dynamics main conclusions I



- A growing demand/production of plastics, and not enough recycling rates make a “circular economy” hard to reach.
- Recycled plastic market supply is a concern.

- Due to an increase in production expected over the years, environmental impacts become worse per year.
- However, LCA impact categories do show an improvement for the recycled product scenarios.

System Dynamics main conclusions II

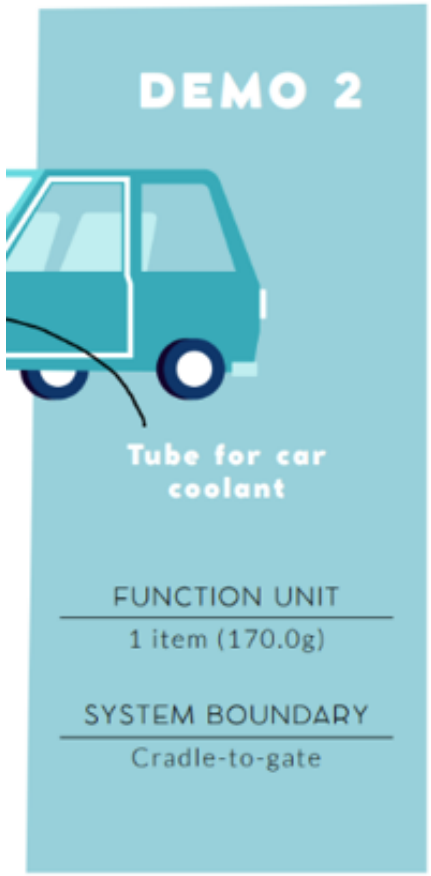


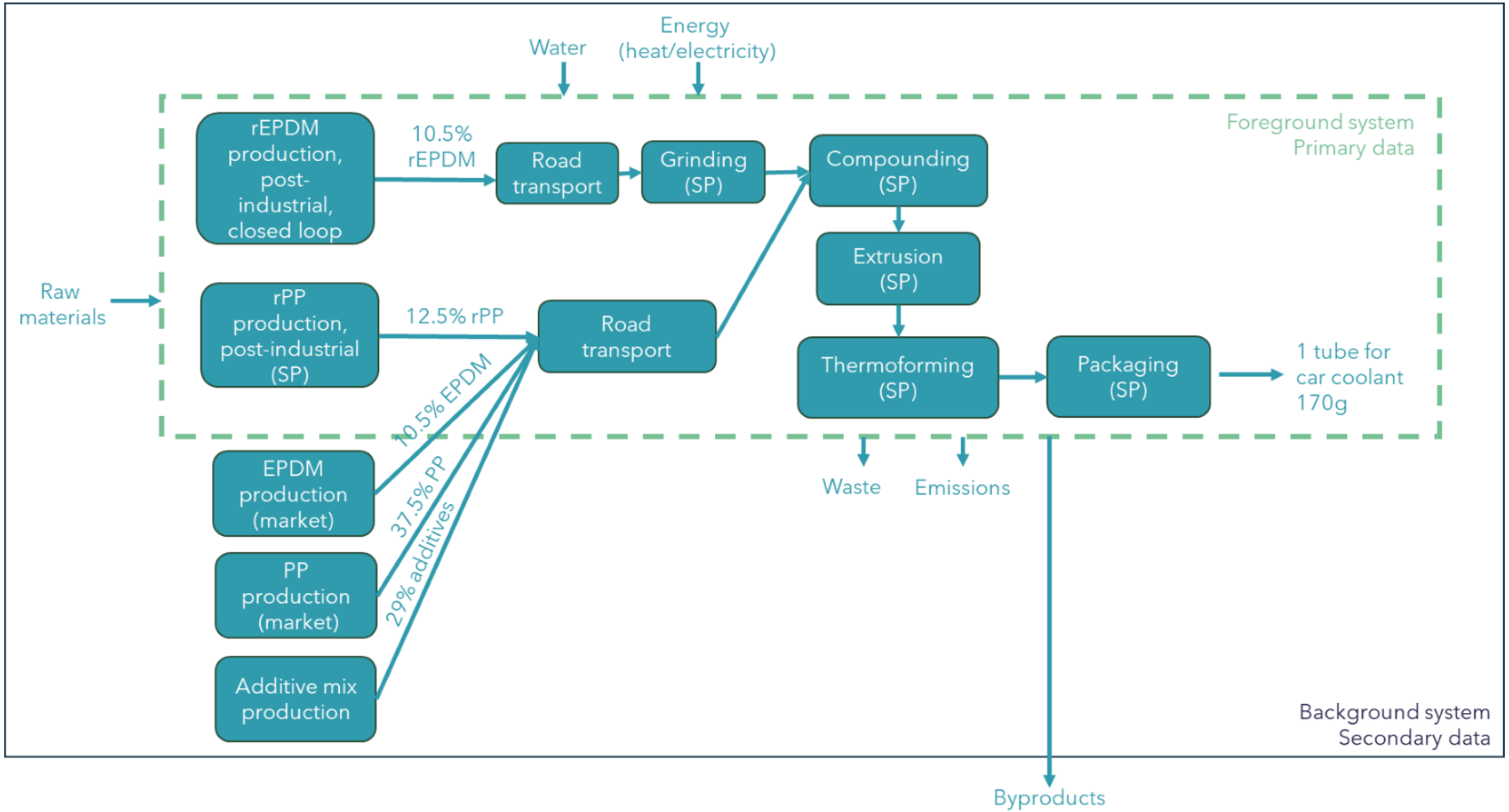
- Littering is the most common EoL fate and is often overseen in assessments. It doesn't show a decrease in the recycling scenarios.
- The most effective way to reduce overall littering of plastics is EoL alternatives to landfill.
- Unwanted substances in plastic products will be prolonged in the use phase if we recycle products.

Results

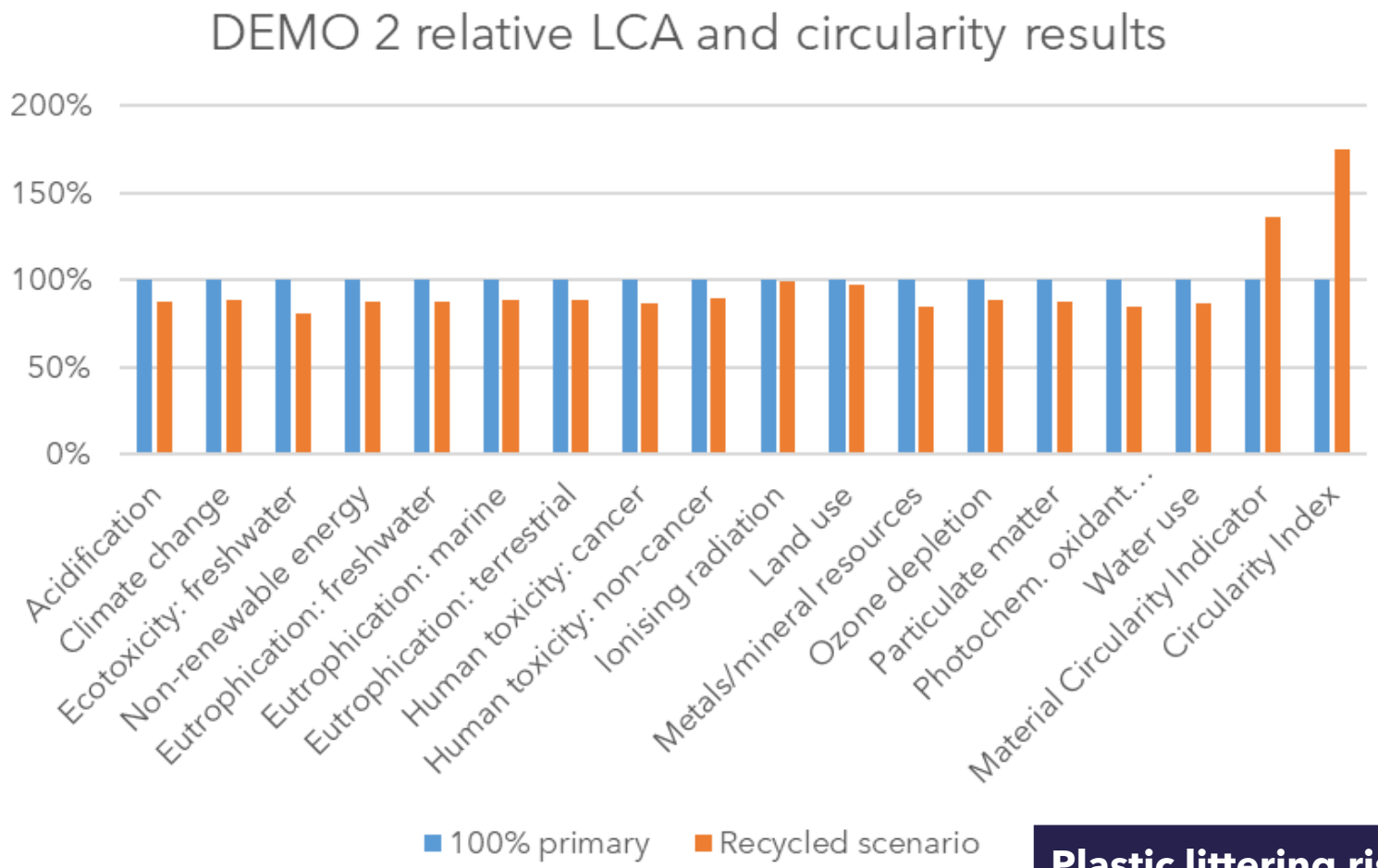
Demonstrator Cases

DEMO 2 results





DEMO 2 results – tube car coolant

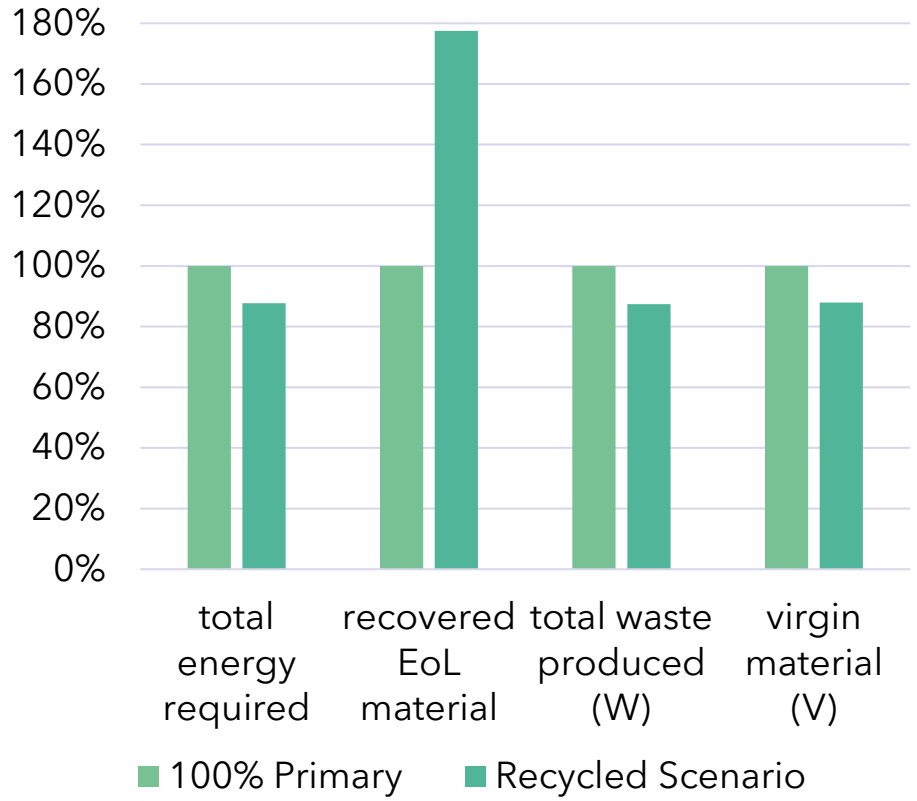


Hotspots

- Plastic material
- Carboard box (packaging)
- Natural gas (thermoforming)

Plastic littering risk	**0.00917**	**0.00906**	**kg**

DEMO 2 results – tube car coolant



More on Circularity

Around 13% less

- Total energy required
- Total primary material required

⚠ A 10% decrease in performance would give a worse MCI circularity score compared to the 100% primary counterpart.

Conclusions

Conclusions I

- A **full sustainability framework** was developed as part of the PRIMUS Sustainability Methodology involving Life Cycle Assessment (LCA), Social LCA, Circularity, plastic littering risk and System Dynamics.
- The methodology was applied to the **4 PRIMUS demonstrator cases**.
- Sustainability assessments show **general improvements** when using recycling content, where impacts like Climate Change always show a decrease in emissions.

Conclusions II

- Only **Demo 3** shows a mix between improvements and worse results, mainly due to the large transportation distance of recycled content and intensive energy and nitrogen use in the specific demo recycling process.
- Furthermore, a higher plastic littering risk is generally seen in the recycled plastic scenarios.
- However, results would change if a full cradle-to-grave rather than cradle-to-gate analysis was considered, as e.g. landfilling plastic products is considered to have higher plastic littering risk than recycling them.

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Thank you!

ANY QUESTIONS?

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