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Assessing Carbon-based Materials of Belo Horizonte Municipal Solid Waste Management

Maryegli Fuss
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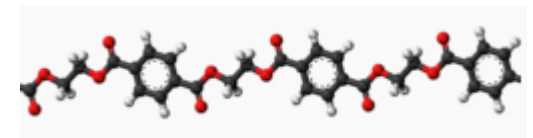
Life Cycle Assessment and Other Assessment Tools for Waste Management and Resource Optimization – An ECI Conference

INSTITUTE OF TECHNOLOGY ASSESSMENT AND SYSTEMS ANALYSIS – Department of energy - resources, technologies, systems



Outline

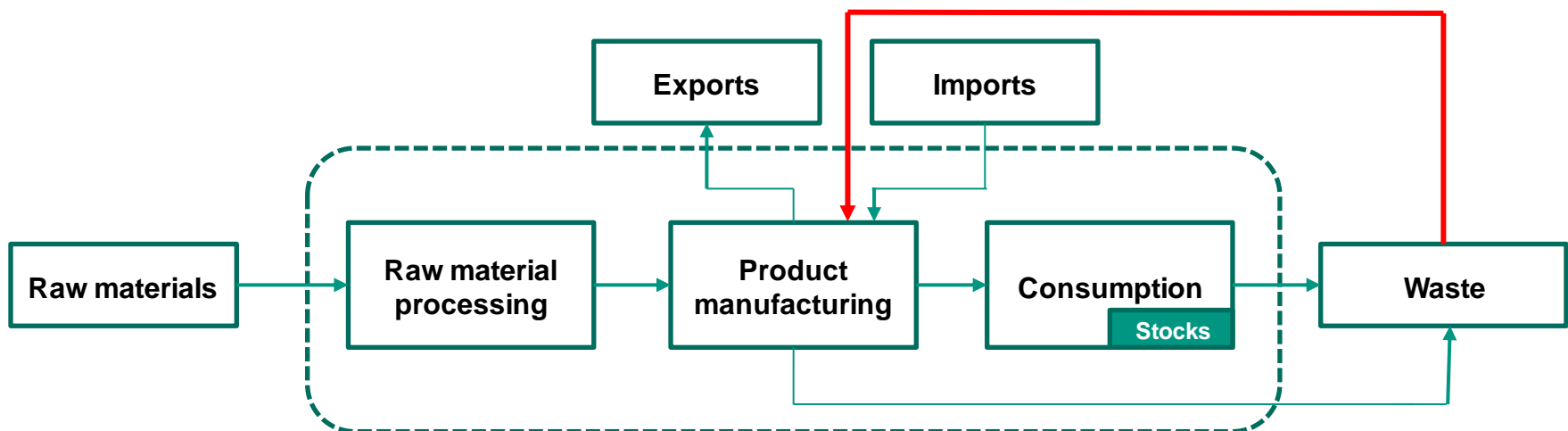
- Background
- Belo Horizonte case
- System definition - Method
- Outcomes
- Outlook



Background

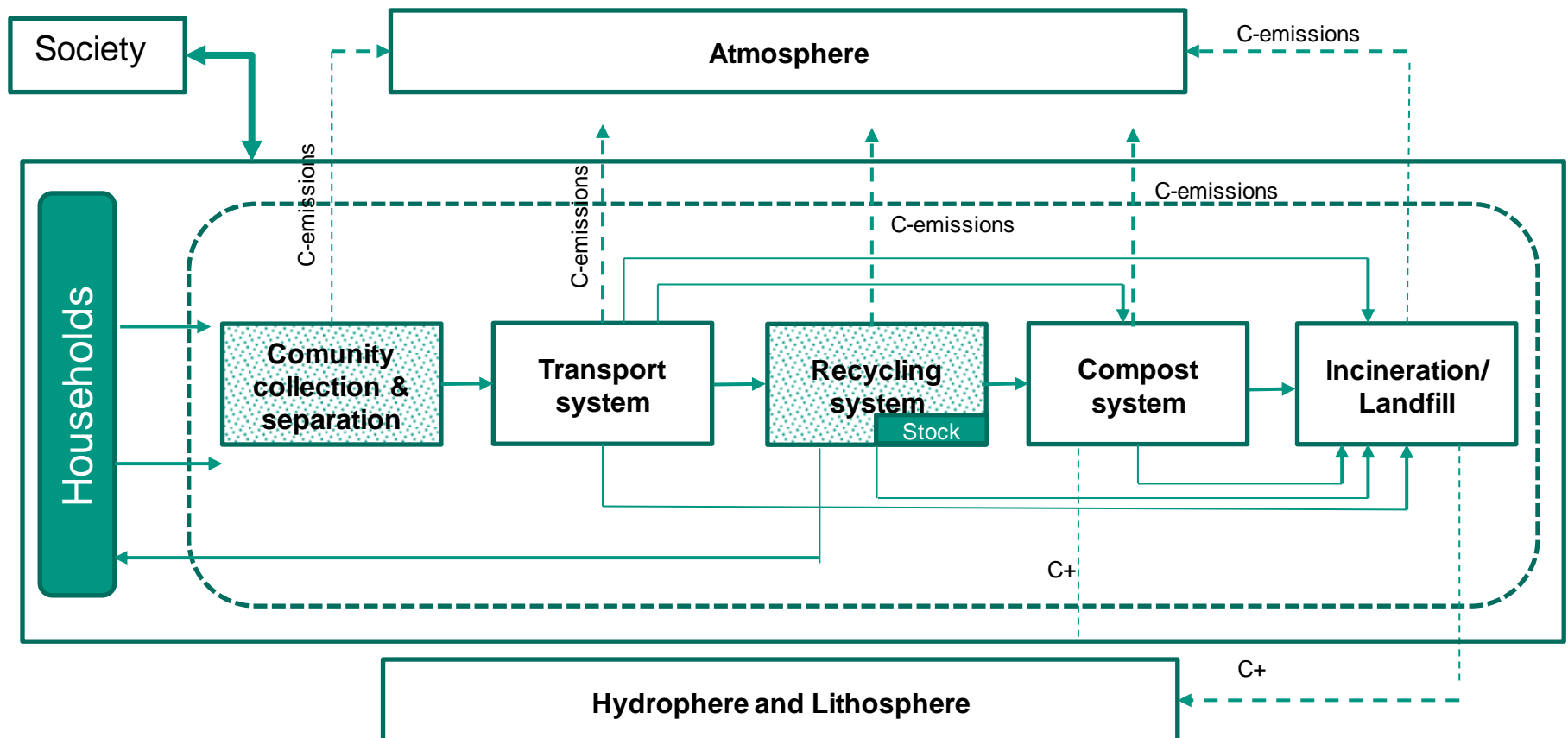
- Primary material are became scarce. The increase demand for secondary raw materials requires a proper understanding of **waste (materials) flows, recycling** and their **impacts** in the **society**.

$$\sum_{material} input = \sum_{material} output$$



Background

- A lack of research on **carbon flows**, **stocks** of municipal solid waste, **secondary raw materials** and their sustainability **relationship** into **society** are perceived.



Belo Horizonte – study analysis

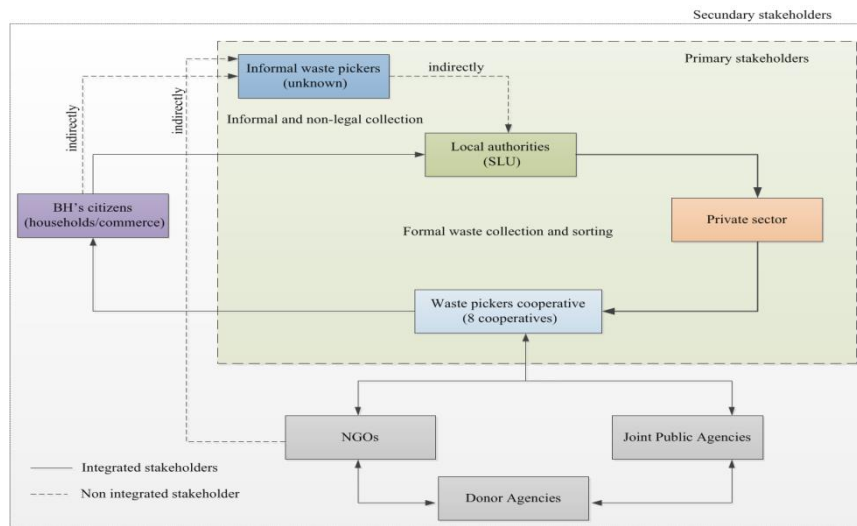
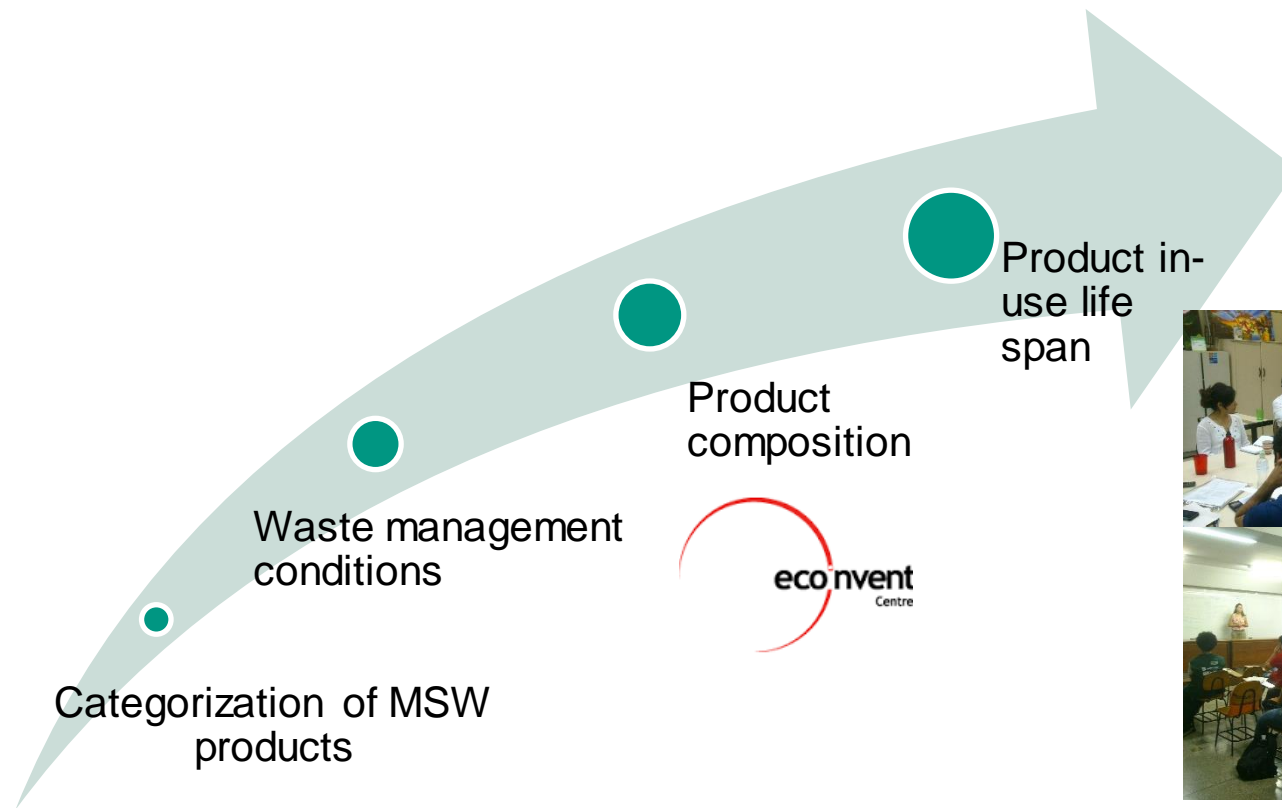


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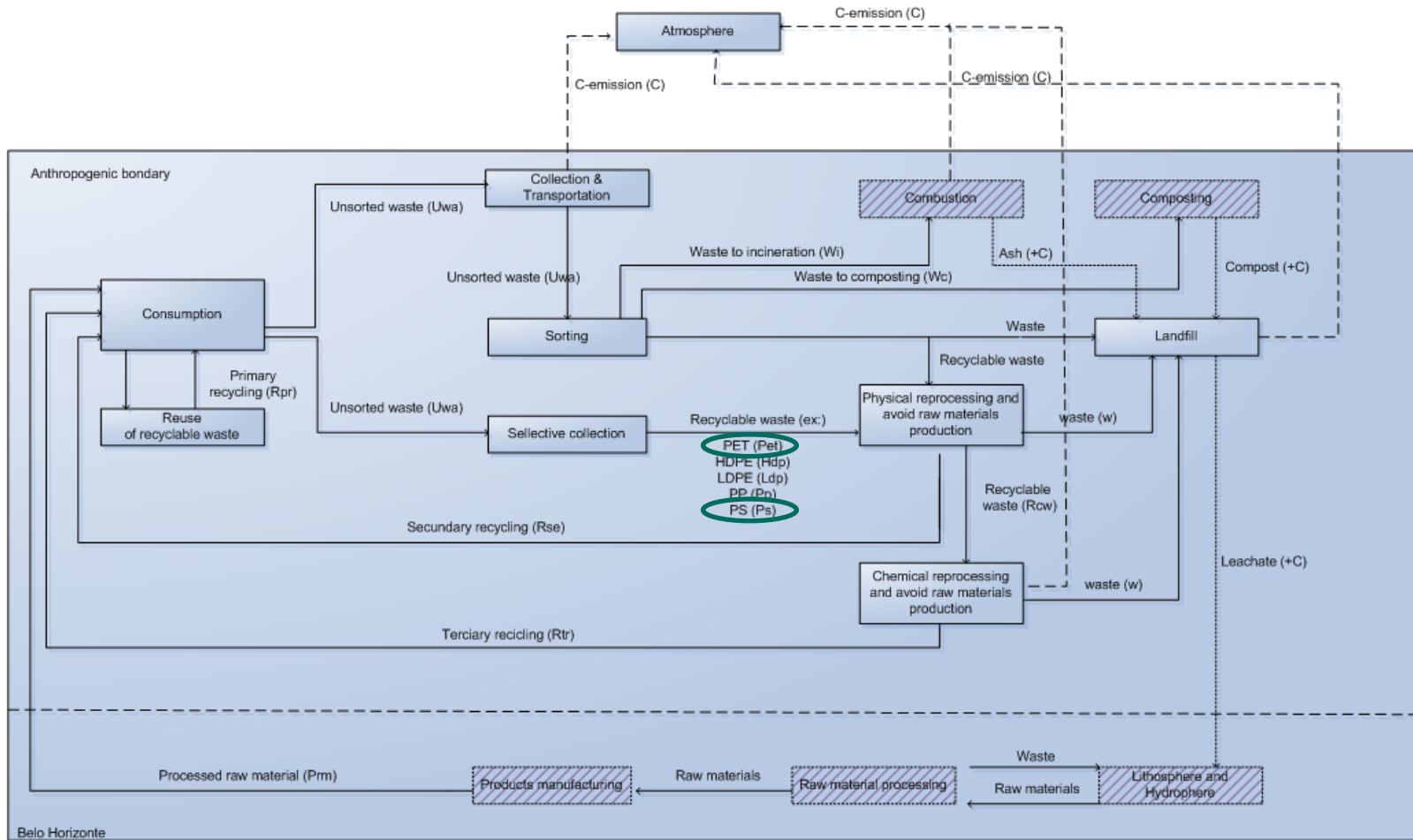
Stakeholders integration in Belo Horizonte

System definition



- Five different type of plastic flows (polyethylene terephthalate (**PET**), high-density polyethylene (**HDPE**), low-density polyethylene (**LDPE**), polypropylene (**PP**) and polystyrene (**PS**) are found in Belo Horizonte MSWM.

System definition



System definition - Method

Socio-economic indicators				Waste inflow					Waste outflow						
Number of waste pickers	Market price of recyclables	Work training hours/year	Annual collection index (ton/pickers)	Plastic	Metal	Glass	Paper	Organic	Rejects	Primary recycling (t/yr)	Secondary recycling (t/yr)	Tertiary recycling (t/yr)	Composting	Combustion	Landfill
Socio-economic activities															
				Inputs				Outputs							
N.	Process	N.	Product	Input	Input	Input	Input	Output	Output	Output	Output	Output	Output	Output	Output
Technology matrix															
CO2eq	SO2eq	N2Oeq	COeq	NOxeq	NL	NL	NL	NL	NL	NL	NL	NL	Fertilizer	NMHC	
LCA of processes															

Working matrix

Outcomes

■ General accounting: determining carbon fluxes

$$CF_{waste} = \sum M_i \cdot c_{component \cdot ij} \cdot (1 - c_{moisture \cdot j}) \cdot c_{carbon \cdot j}$$

M_i = weight of municipal solid waste management per year

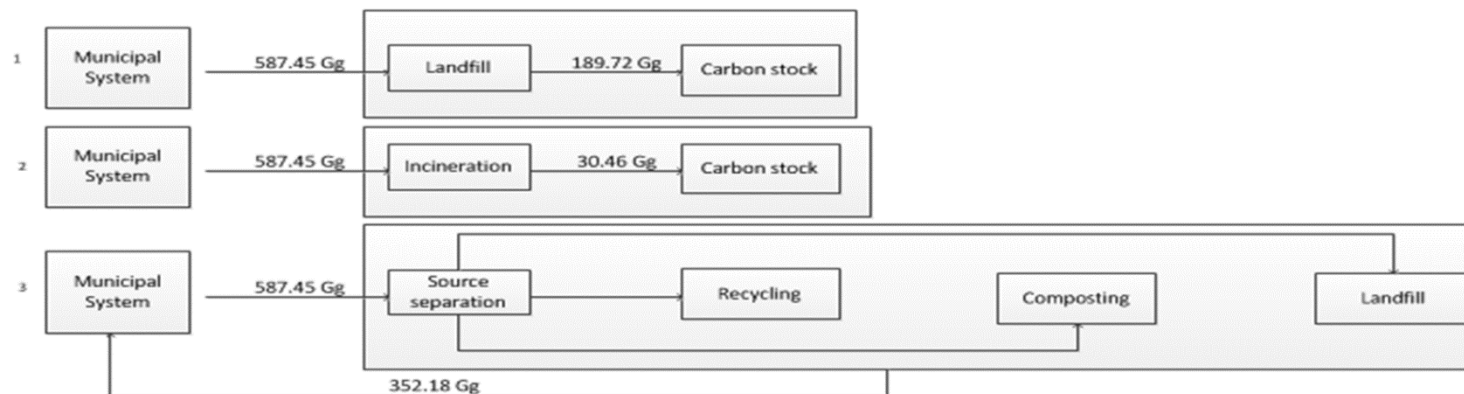
$c_{component}$ = annual average ratio of different waste composition

$c_{moisture}$ = typical moisture component of different waste composition

c_{carbon} = carbon content of different waste composition

i = studied year

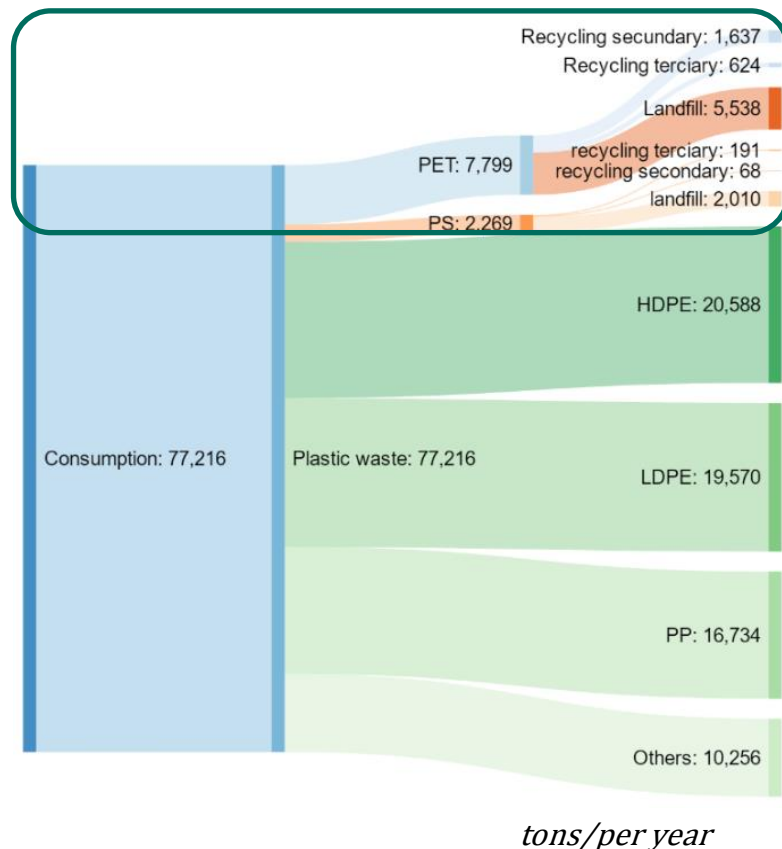
j = component of solid waste



Carbon cycle of Belo Horizonte solid waste (1: reference scenario / 2: Governmental and private company Plan / 3: integration of technologies)

Outcomes

- Analysis of PET and Polysterene waste products of Belo Horizonte MSWM:

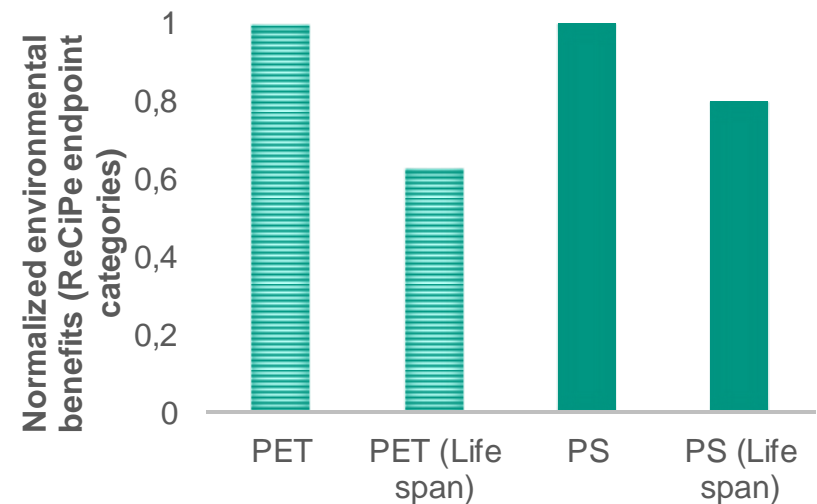


- Conditions:

- Product in-use lifespan:

$$L = T_r + T_s$$

$T_r = \text{Time of reuse}$ and $T_s = \text{time of storage}$



Outlook

- ❑ Model perspective:
 - ❑ Development of sustainable strategies through a model-based analysis.
- ❑ Relevance of the model:
 - ❑ Carbon cycling model that can quantify carbon stocks and flows of MSWM systems.
 - ❑ Environmental impacts which can support policy change in developing countries
- ❑ Important aspect of the model:
 - ❑ In-use lifespan of products (e.g. PET and PS plastics) is fundamental variable that affect carbon stock.
- ❑ Future work:
 - ❑ Inclusion of other recyclable materials as well as expansion of recyclable processes.

Thanks for your attention!

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