23.03.2016

Studienamiddag Steunpunt SuMMa

"DUURZAAM MATERIALENBEHEER VOOR EEN CIRCULAIR ECONOMIE"

Parallelsessie

"INDICATOREN VOOR HET EVALUEREN VAN DUURZAAM MATERIALENBEHEER"

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POLICY QUESTIONS RELATED TO PROGRESS TOWARDS A CIRCULAR ECONOMY FROM A MATERIALS PERSPECTIVE

Source: EEA (2016). Circular economy in Europe. Developing the knowledge base. Report No 2/2016

"In parallel with the need to increase understanding of the circular economy, it will also be important to chart progress and identify where more work is needed to achieve this."

"A monitoring framework, as well as individual indicators, across multiple levels would facilitate policy development, measure environmental performance and policy effectiveness, benchmark products, sectors and countries, and improve business investment decisions."

"Indictors have clear limits for giving directions. Qualitative assessments are therefor needed to complement them in the process of monitoring progress towards a circular economy."

POLICY QUESTIONS RELATED TO PROGRESS TOWARDS A CIRCULAR ECONOMY FROM A MATERIALS PERSPECTIVE

Source: EEA (2016). Circular economy in Europe. Developing the knowledge base. Report No 2/2016

Table 3.1 Policy questions related to progress towards a circular economy from a materials perspective

Material input	Are Europe's primary material inputs decreasing?
	Are material losses in Europe decreasing?
	Is the share of recycled materials in material input increasing?
	Are the materials used in Europe sustainably sourced?
Eco-design	Are products designed to last longer?
	Are products designed for disassembly?
	Are recycled materials included in product design?
	Are materials designed to be recycled, avoiding pollution from recycling loops?
Production	Is Europe using fewer materials in production?
	Is Europe using a lower volume and number of environmentally hazardous substances in production?
	Is Europe generating less waste in production?
	Are business strategies shifting towards circular concepts such as remanufacture and service-based offers?
Consumption	Are Europeans switching consumption patterns to less environmentally intensive types of goods and services?
	Are Europeans using products for longer?
	Is European consumption generating less waste?
Waste recycling	Is waste increasingly recycled?
	How far do materials keep their value in recycling processes, avoiding down-cycling?
	How far is the recycling system optimised for environmental and economic sustainability?

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DOMESTIC MATERIAL CONSUMPTION & RAW MATERIAL CONSUMPTION

Domestic Material Consumption

» DMC

» = domestic extraction used (DEU) + import - export

Raw Material Consumption

» RMC

» = domestic extraction used (DEU) + import_rme - export_rme

» **Raw material equivalents** (rme) represent the weight of the economic output and the material rucksack thereof.

» **Material rucksack** is the sum of all materials which are not physically included in the economic output under consideration, but which were necessary for production, use, recycling and disposal.

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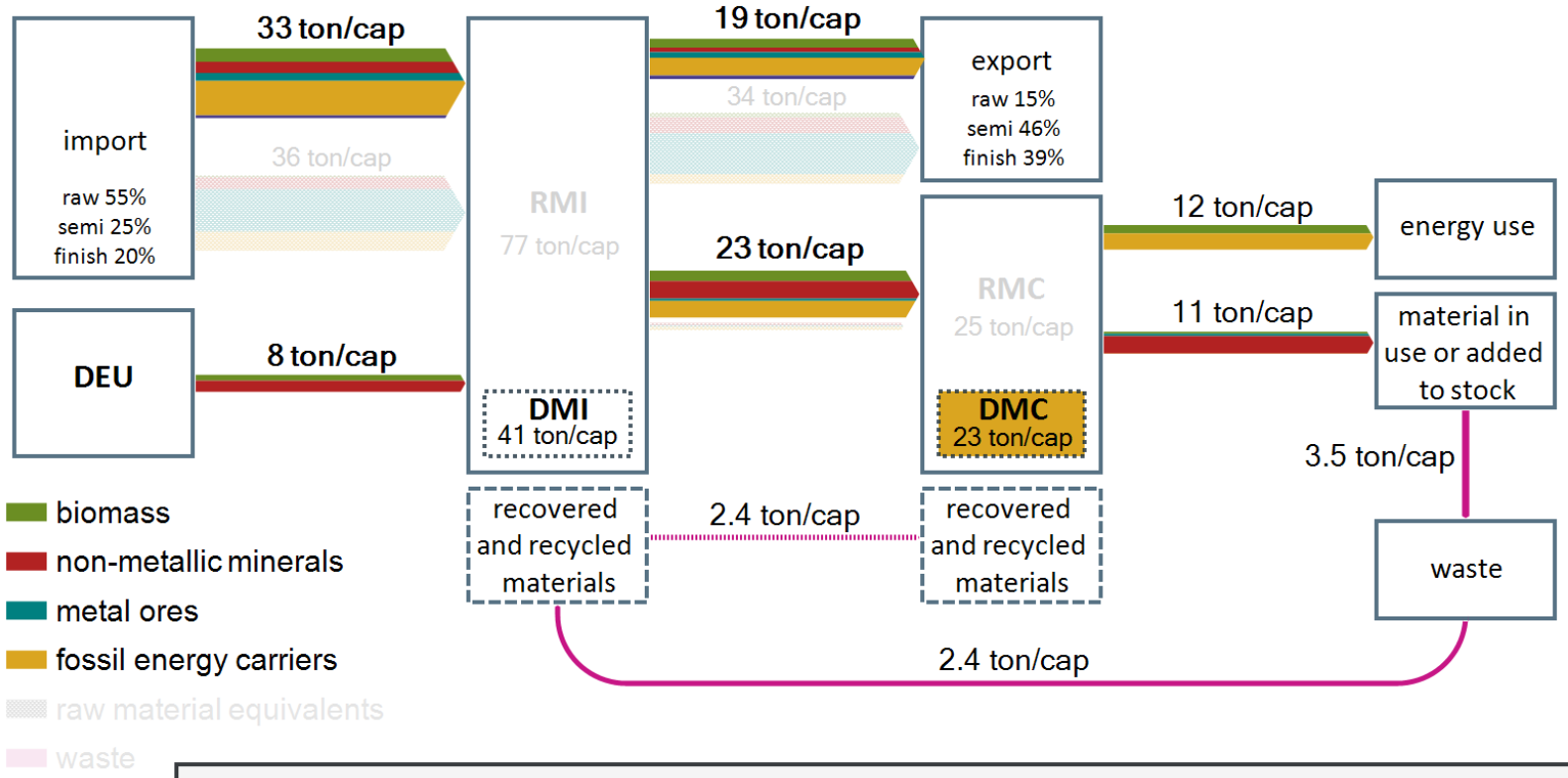
DMC DOMESTIC MATERIAL CONSUMPTION



DEU: domestic extraction used

DMI: direct material input (= DEU + import)

DMC: domestic material consumption (= DEU + import - export)

RMI: raw material input (= DEU + import_rme)

RMC: raw material consumption (= DEU + import_rme - export_rme)

Flows of primary resources and waste in Flanders (2010).

Own calculations based on EEA & Eurostat's methodological guide on EW-MFA.

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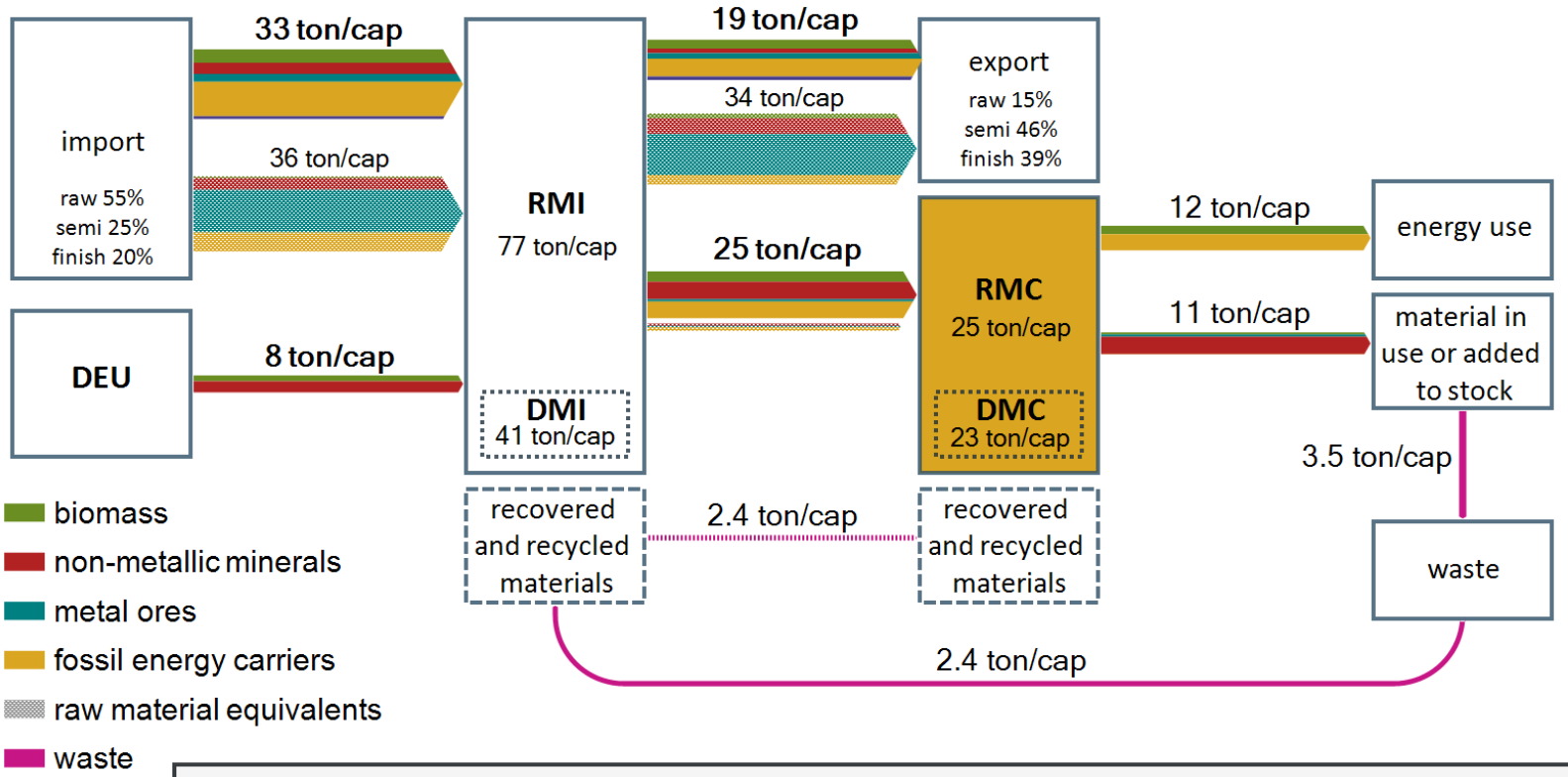
RMC RAW MATERIAL CONSUMPTION



DEU: domestic extraction used

DMI: direct material input (= DEU + import)

DMC: domestic material consumption (= DEU + import - export)

RMI: raw material input (= DEU + import_rme)

RMC: raw material consumption (= DEU + import_rme - export_rme)

Flows of primary resources and waste in Flanders (2010).
Own calculations based on EEA & Eurostat's methodological guide on EW-MFA.

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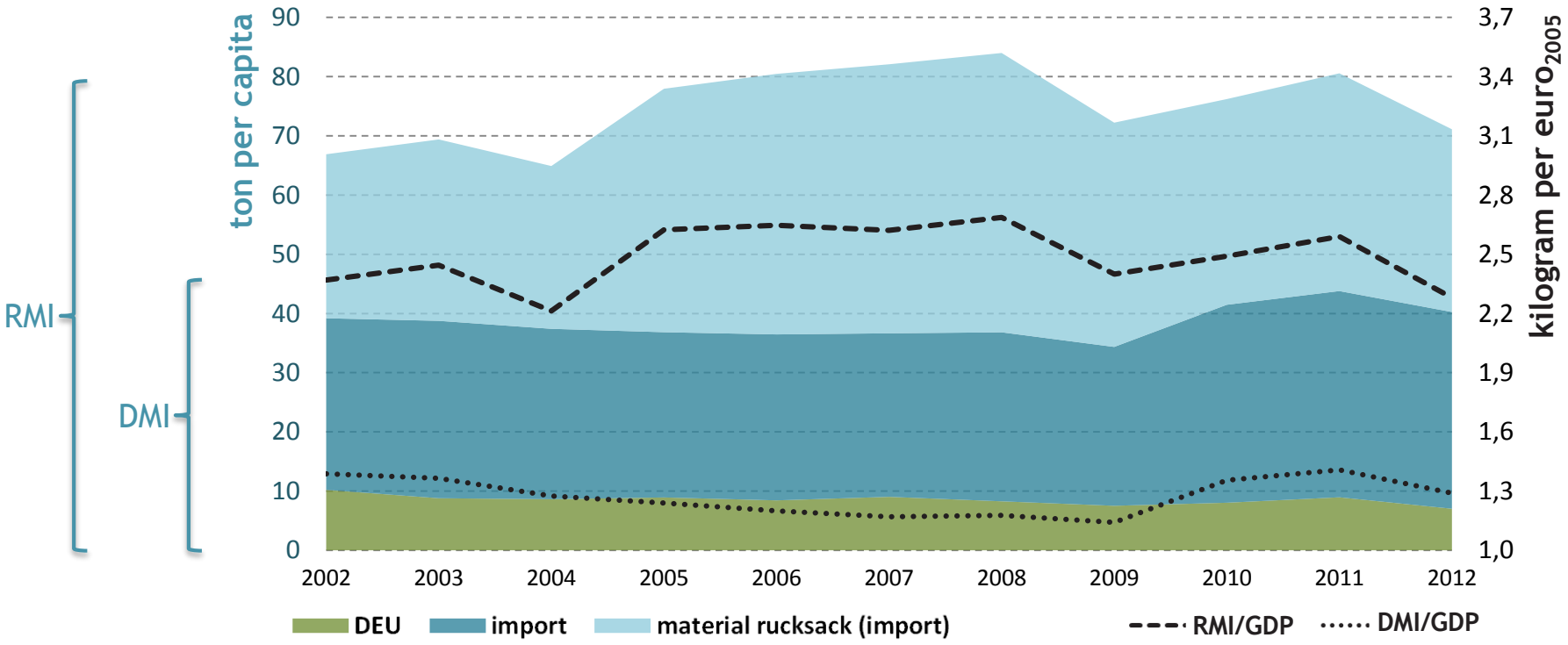
MATERIAL INPUT

Are Flemish primary material inputs decreasing?
Is Flanders using fewer materials in production?



Flemish direct material input and raw material input (2002-2012).
Own calculations based on Eurostat's methodological guide on EW-MFA.

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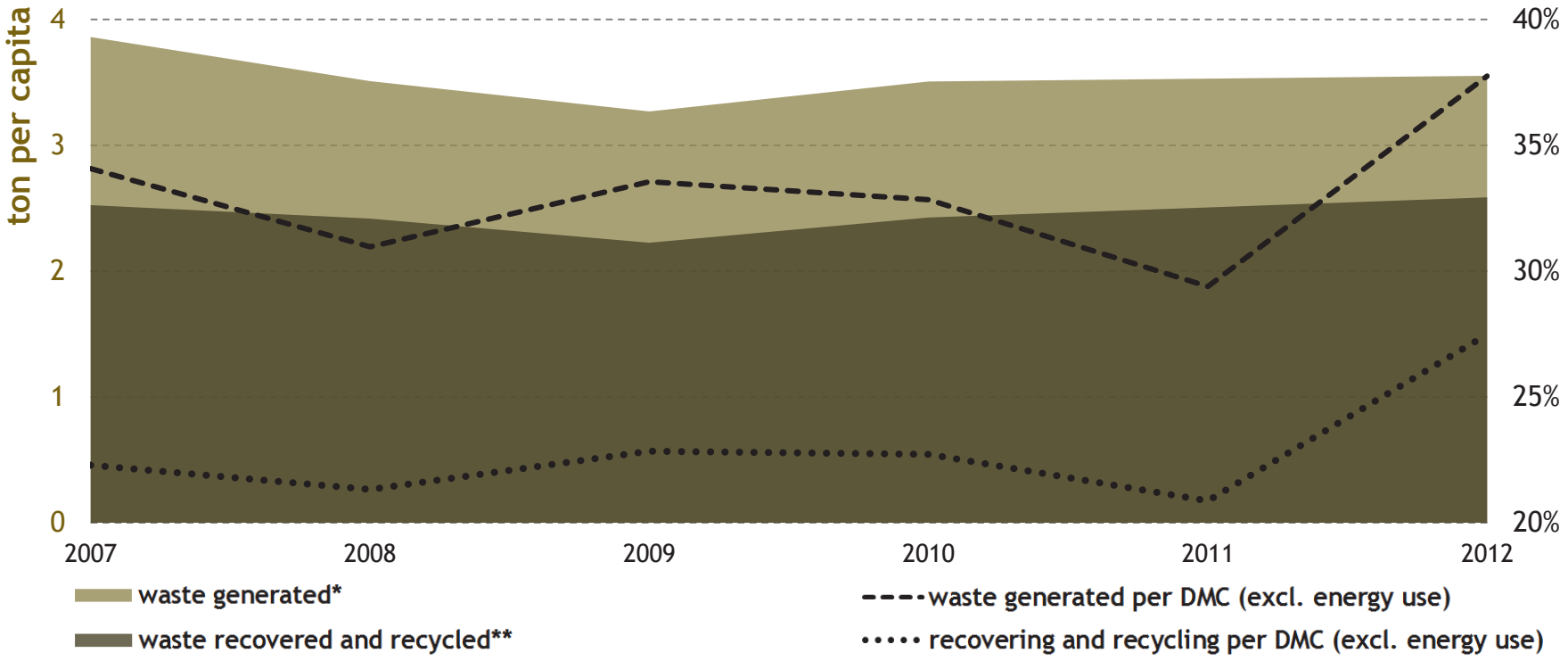
MATERIAL INPUT, PRODUCTION & WASTE RECYCLING

Is the share of recycled material in material input increasing?
Is waste increasingly recycled?



Flemish waste production and material recovery and recycle (2007-2012).
Own calculations. Waste and recycling statistics from OVAM & Milieurapport Vlaanderen.

* Productie van huishoudelijk afval en bedrijfsafval
** Afval dat na twee verwerkingstappen een nieuw leven kreeg via hergebruik, recyclage, compostering of gebruik als secundaire grondstof of nieuwe grondstof.

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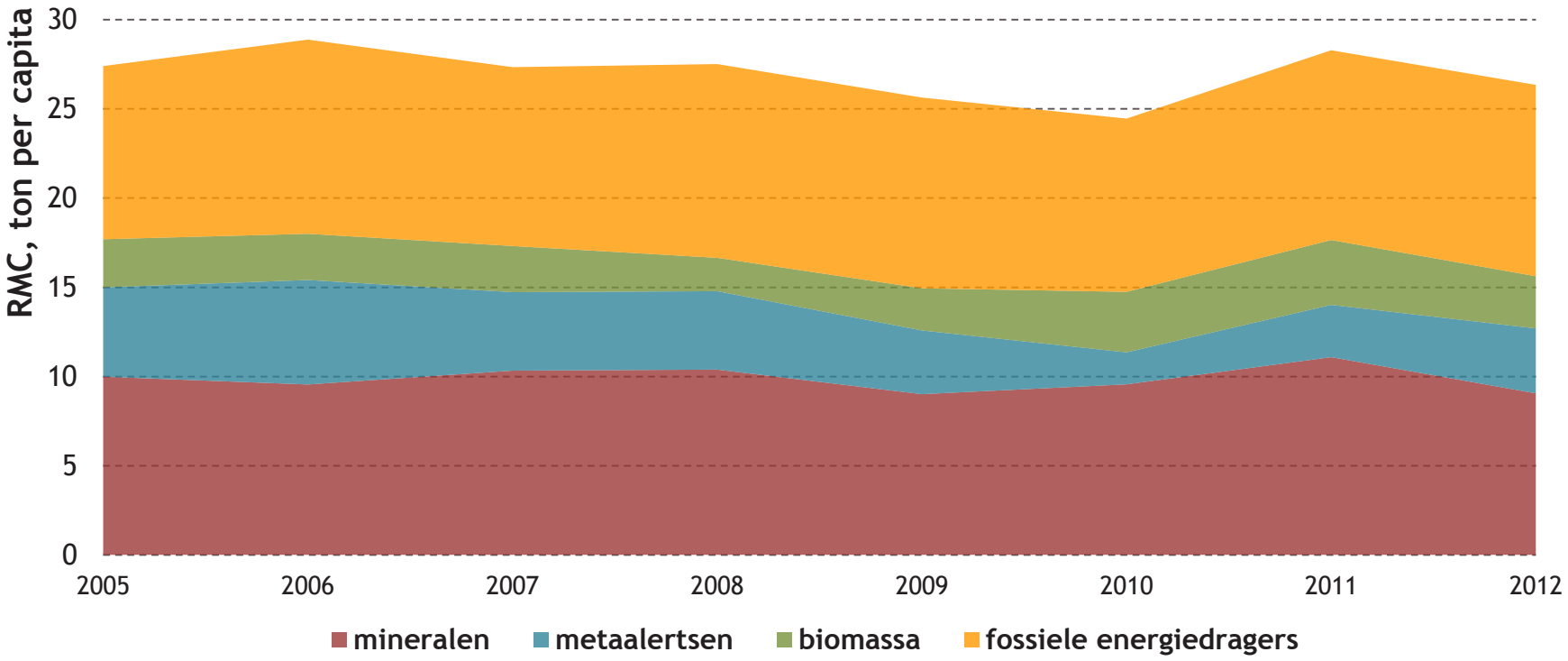
CONSUMPTION

Is Flanders switching consumption patterns to less environmentally intensive types of goods and services?



Flemish raw material consumption (2005-2012).
Own calculations based on Eurostat's methodological guide on EW-MFA.

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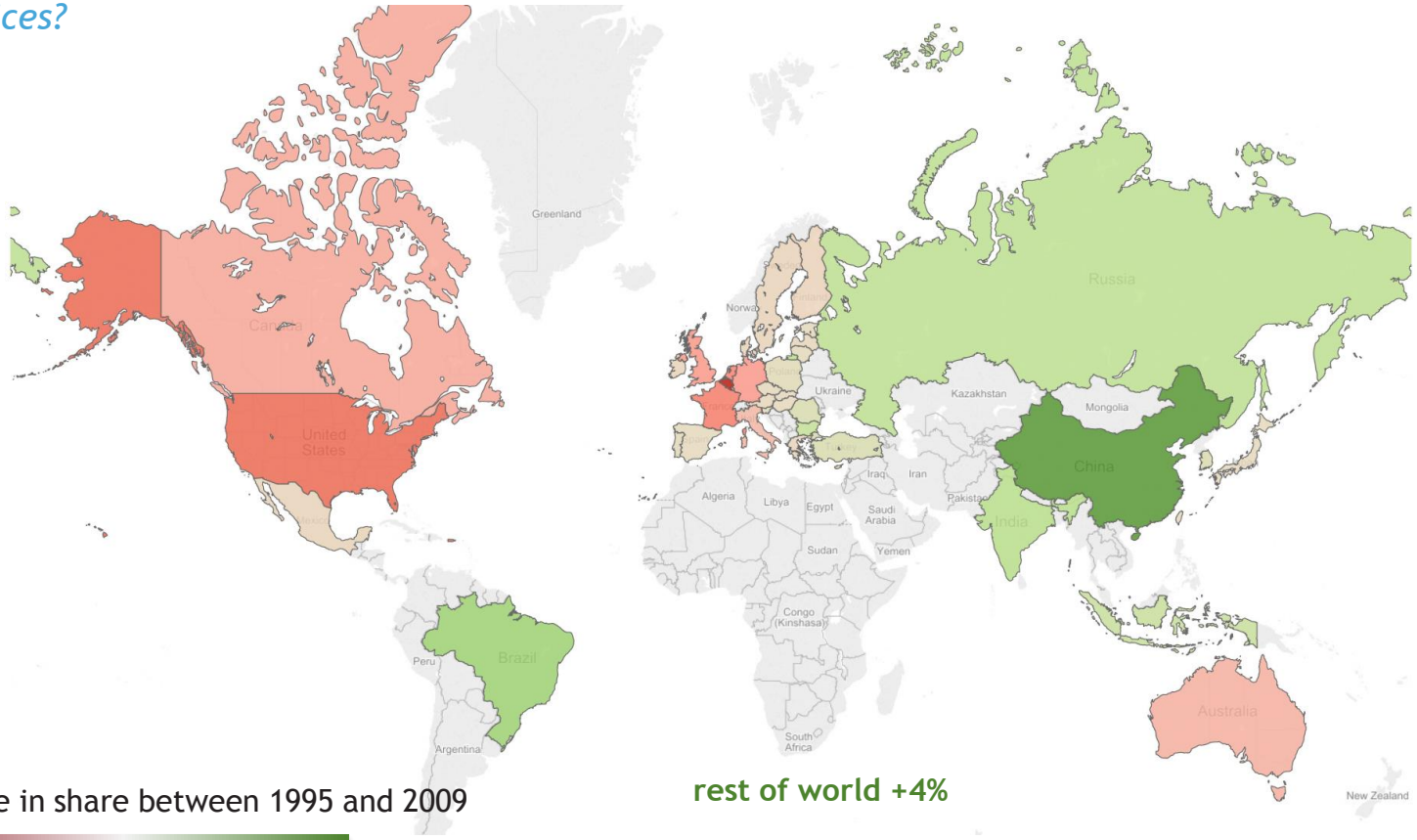
CONSUMPTION

Is Flanders switching consumption patterns to less environmentally intensive types of goods and services?



difference in share between 1995 and 2009

-6% +6%

Changing 'source dependency' on primary resources by Belgian households (1995-2009).
Own calculations based on World Input-Output database.

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CONCLUSIONS

Progress towards a circular economy…

Indicator framework

» Indicators versus qualitative assessment

DMC versus RMC

» DMC → regional available materials
  » waste statistics
» RMC → global primary material footprint
  » consumption perspective

Macro-economic indicators

» Goalsetting versus insights
» Number of influencing factors

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MEASURING RESOURCE FOOTPRINTS

Existing footprint indicators

Focus on emissions
- Carbon footprint (kg)

Focus on resources
- Ecological footprint (gha)
- Water footprint (m^3)
- Material footprint (kg)

Missing: overall resource footprint indicator which covers all resource types in an adequate way

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MEASURING RESOURCE FOOTPRINTS

Development of overall resource footprint based on thermodynamics:

- Fossil fuels
- Metals & minerals
- Nuclear resources
- Water resources
- Land resources
- Abiotic renewables



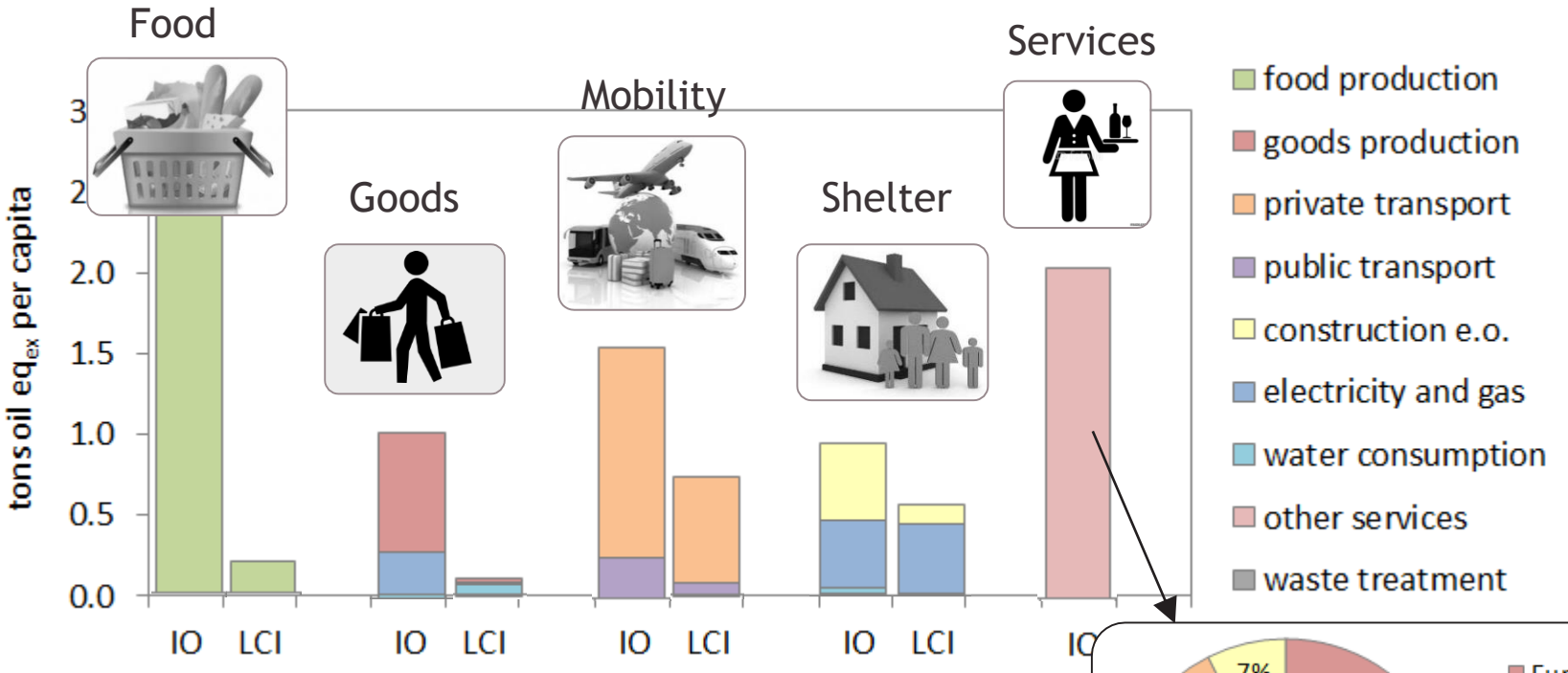


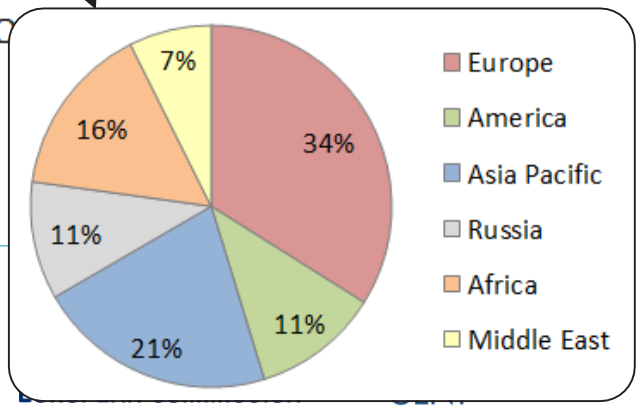

At macro-level → based on input-output (IO) database: Exiobase

At micro-level → based on life cycle inventory (LCI) database: Ecoinvent

CASE STUDY

Overall resource footprint of an EU citizen in 2007





IO-approach more complete than LCA-approach

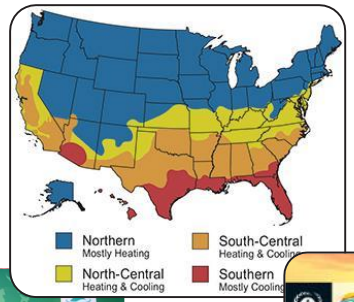
MEASURING RESOURCE EFFICIENCY

Diversity of resource efficiency indicators has been developed over the last years

Confusion about the actual meaning of these indicators: need for classification!

Roadmap of EU

Energy star program in USA



Resource Panel of the United Nations

3R principle in Japan & China

MEASURING RESOURCE EFFICIENCY

How can efficiency indicators be classified?

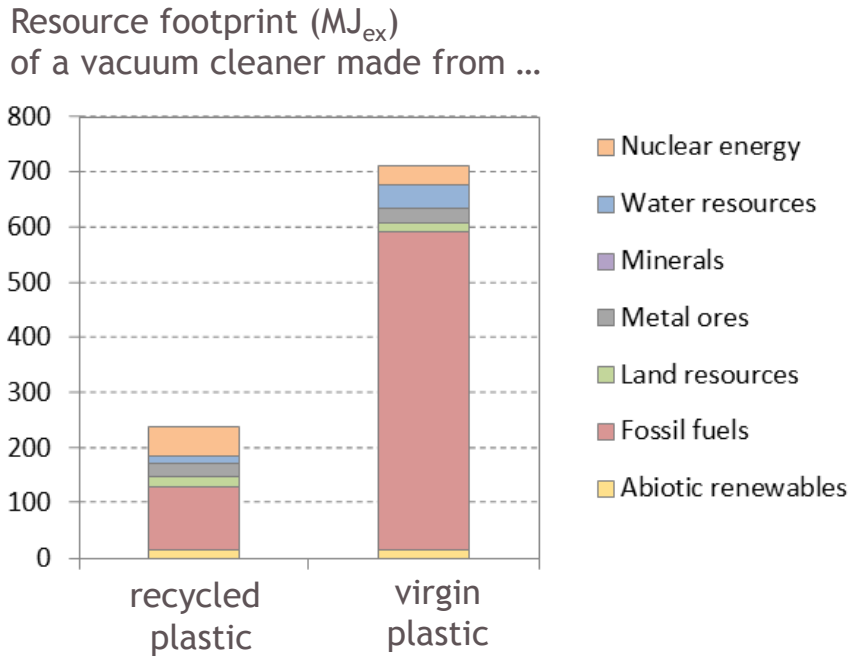
		Level 1		Level 2 (Eco-efficiency)		
		Resource flows	**Emission flows**	**Impacts based on resource flows**	**Impacts based on emission flows**	**Impacts based on both flows**
Micro-scale	**Gate-to-gate perspective**	*benefits over (kg) resources*	*benefits over (kg) emissions*	*benefits over (ADP) impact*	*benefits over (GWP) impact*	*benefits over single score impact*
	Life cycle Perspective	*benefits over (kg) resources in life cycle*	*benefits over (kg) emissions in life cycle*	*benefits over (ADP) impact in life cycle*	*benefits over (GWP) impact in life cycle*	*benefits over single score impact in life cycle*
Macro -scale	**Domestic perspective**	*GDP over (kg) domestic resources*	*GDP over (kg) domestic emissions*	*GDP over domestic (ADP) impact*	*GDP over domestic (GWP) impact*	*GDP over domestic single score impact*
	Global Perspective	*GDP over (kg) global resources*	*GDP over (kg) global emissions*	*GDP over global (ADP) impact*	*GDP over global (GWP) impact*	*GDP over global single score impact*

CASE STUDY

How to measure the benefits of a circular economy?

<u>Closed-loop recycling</u>

Recycling of plastics extracted from household appliances like vacuum cleaners. Recycled plastic is reused in similar products



$$\text{Recyclability benefit rate} = \frac{\text{impact avoided by recycling}}{\text{impact if there would be no recycling}} = 58\%$$

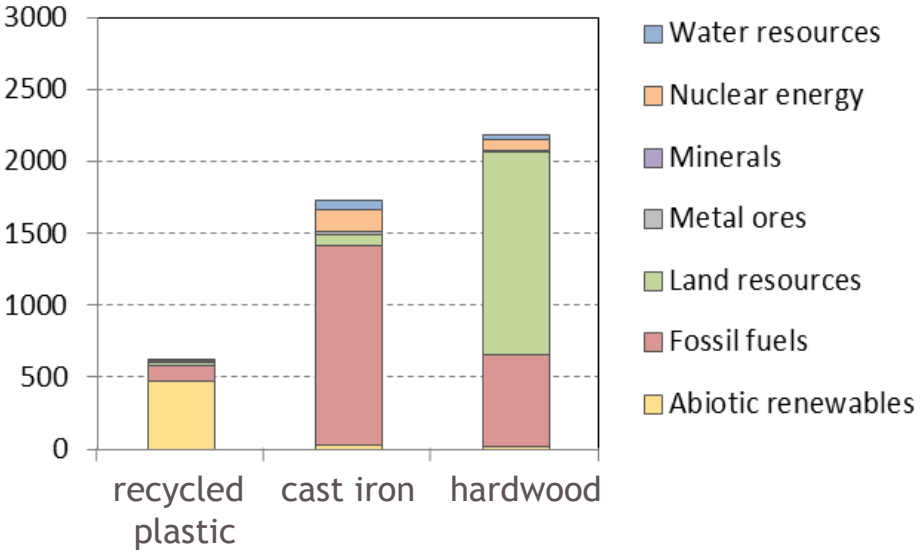
CASE STUDY

How to measure the benefits of a circular economy?

<u>Open-loop recycling</u>

Recycling of plastics from extracted household waste. Recycled plastic is reused in low-grade products

Resource footprint (MJ_{ex})
of a street bench made from …



$$\text{Recyclability benefit rate} = \frac{\text{impact avoided by recycling}}{\text{impact if there would be no recycling}} = 13\%$$

CONCLUSIONS

Why do we need indicators?

→ To measure how much we depend on resources
→ Resources are also the cause of emission problems

Starting point: material flows in kilgrams

- Economic perspective (value chain)
- Ecological perspective (environmental impact)

Valorisation of waste-as-resources

- Economic and ecological perspective
- Stimulates the circular economy

Quantitative indicators for policy makers
= objective measure to make decisions

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