carbotech
Environmental Projects and Consulting

Recycling and LCA: Choices and results

How can LCA support the creation of a Circular Economy? How can LCA be used to ensure a positive balance of efforts and benefits?

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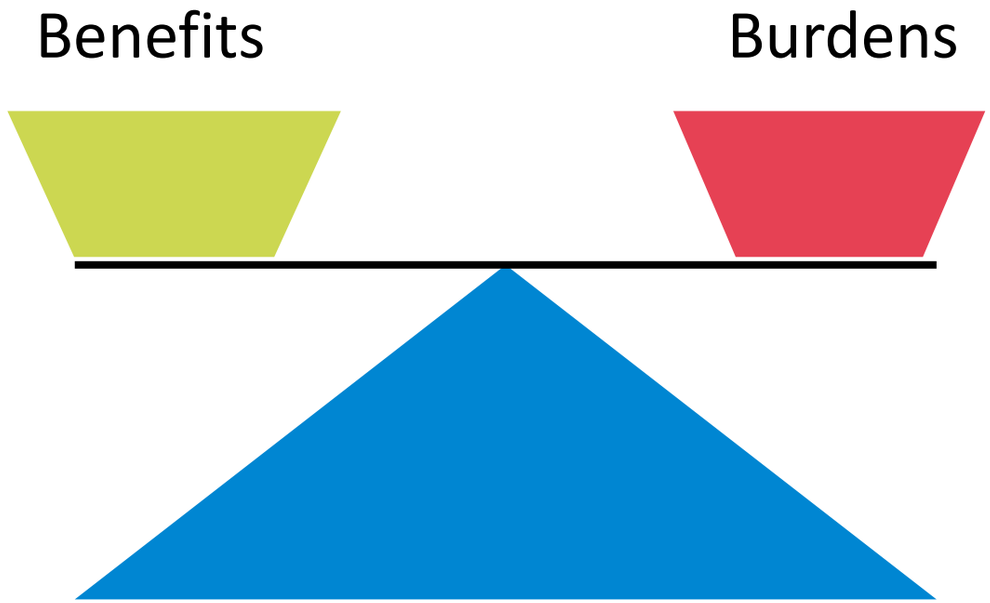
Carbotech and LCA

Recycling studies

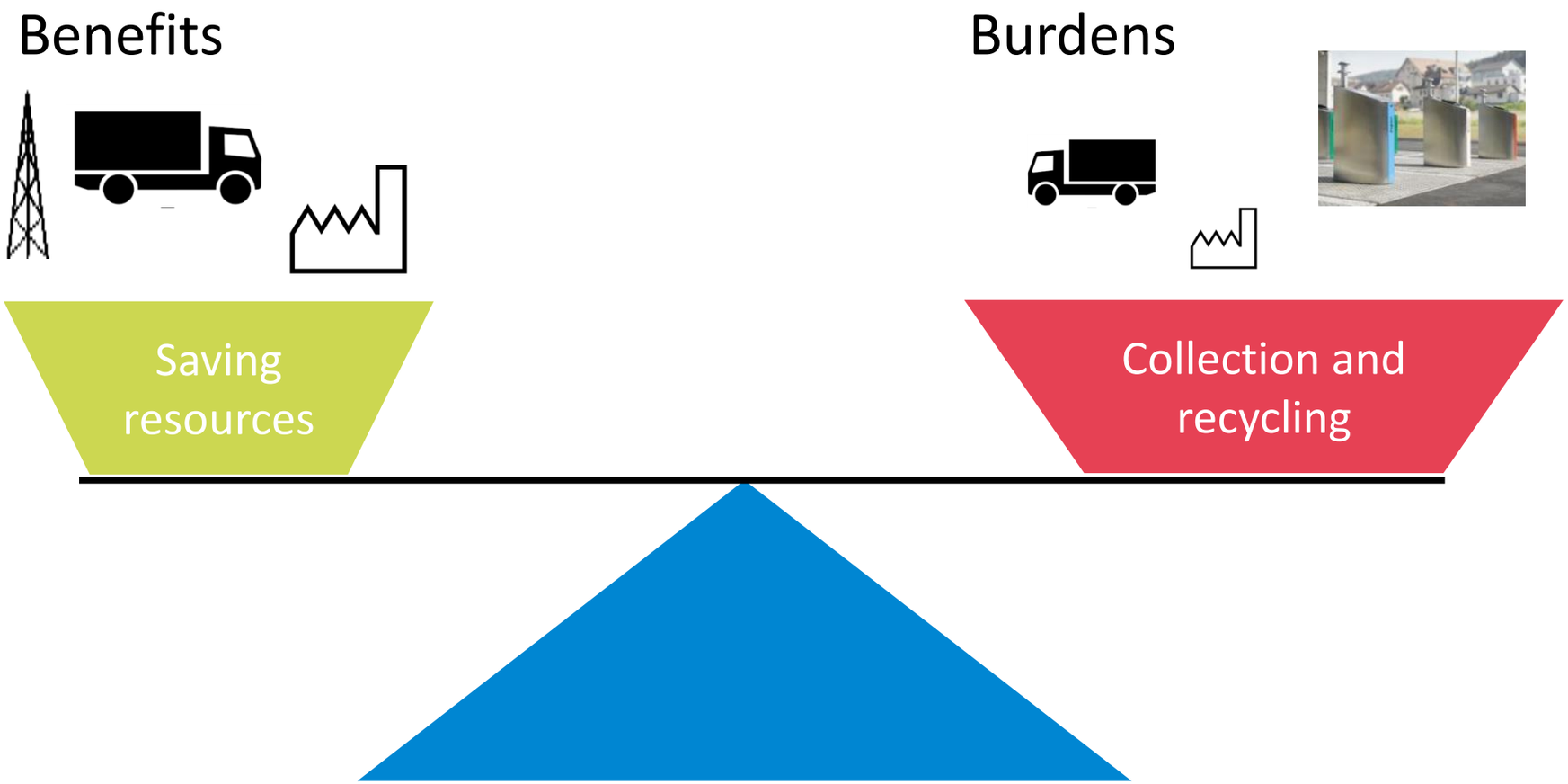
- Over 25 years LCA experience
- Various recycling studies comparing impacts and recycling benefits: Paper, Tetra, PET, PE , Alu, Glass
- Balance of overall benefits obtained from recycling systems in CH
- Eco-design and system optimization: role of recycling

Recycling balance



Carbotech and LCA

Recycling studies



To recycle or not to recycle?

In the last years, we had many questions from the government and companies about the environmental impact and benefit of existing and planned recycling systems.

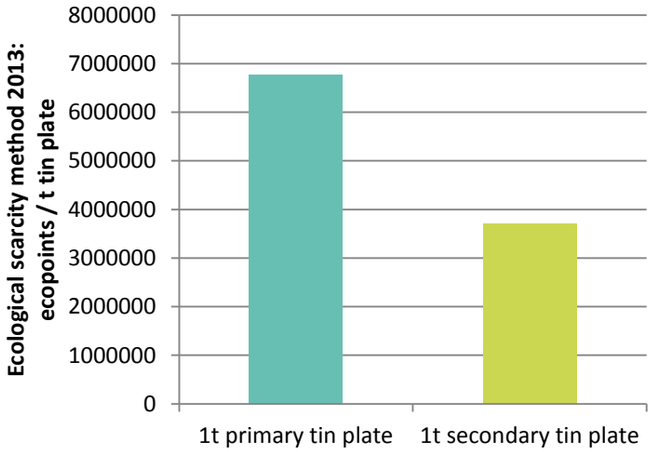
LCA played a crucial role in answering them.

Communication of results highlight the benefits of existing recycling systems. The positive examples are in the focus of communication.

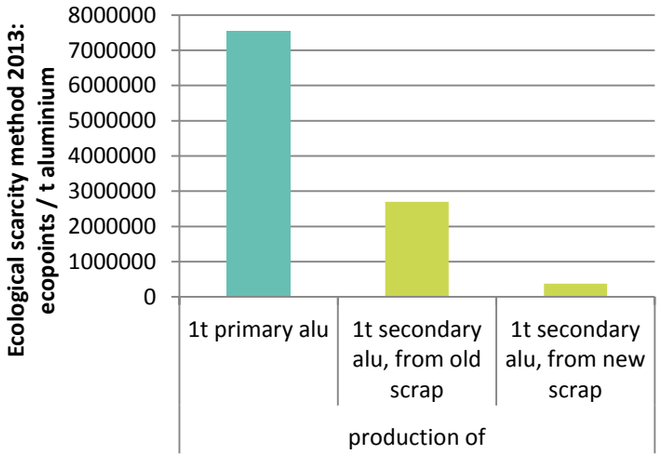
Production of primary vs secondary materials

Approval of recycling benefits of specific systems

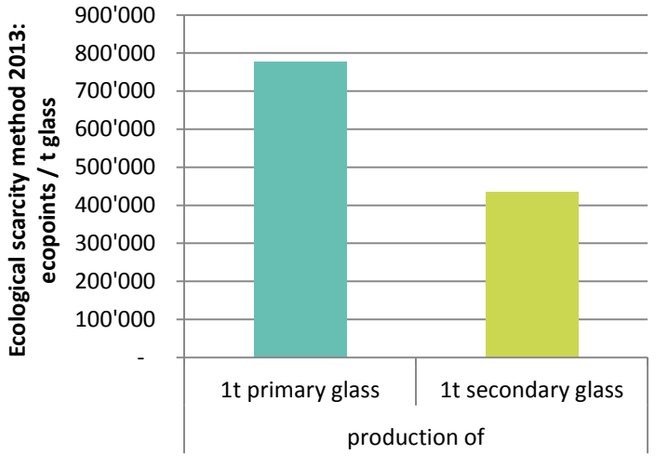
Tin plate



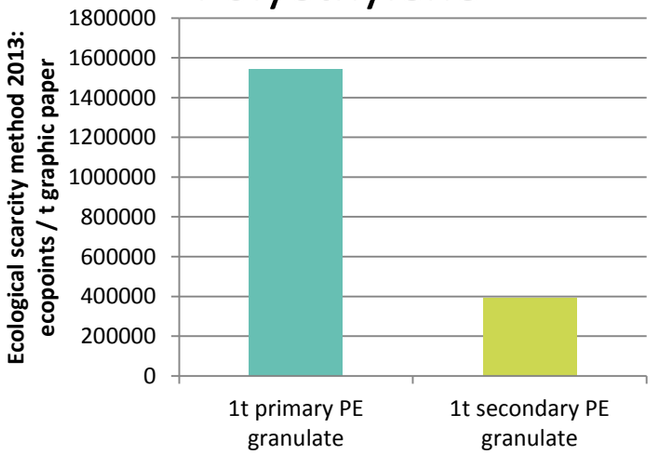
Aluminium



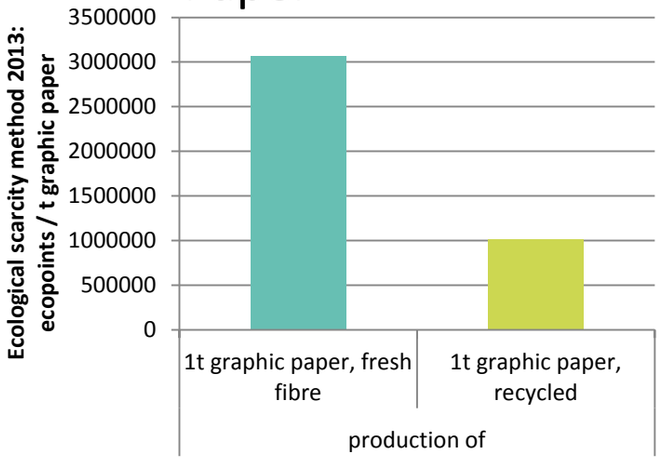
Glass



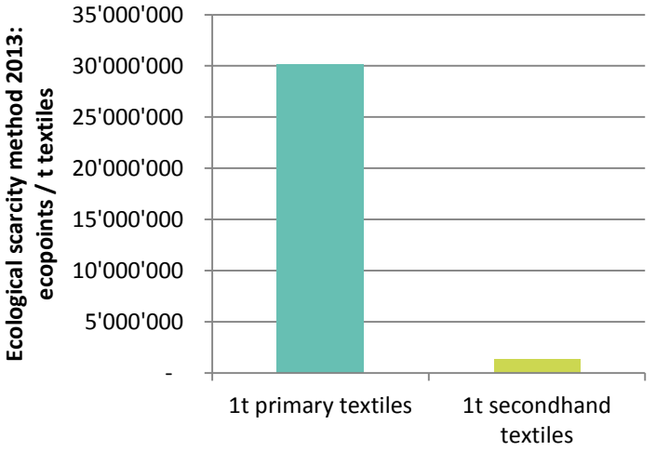
Polyethylene



Paper

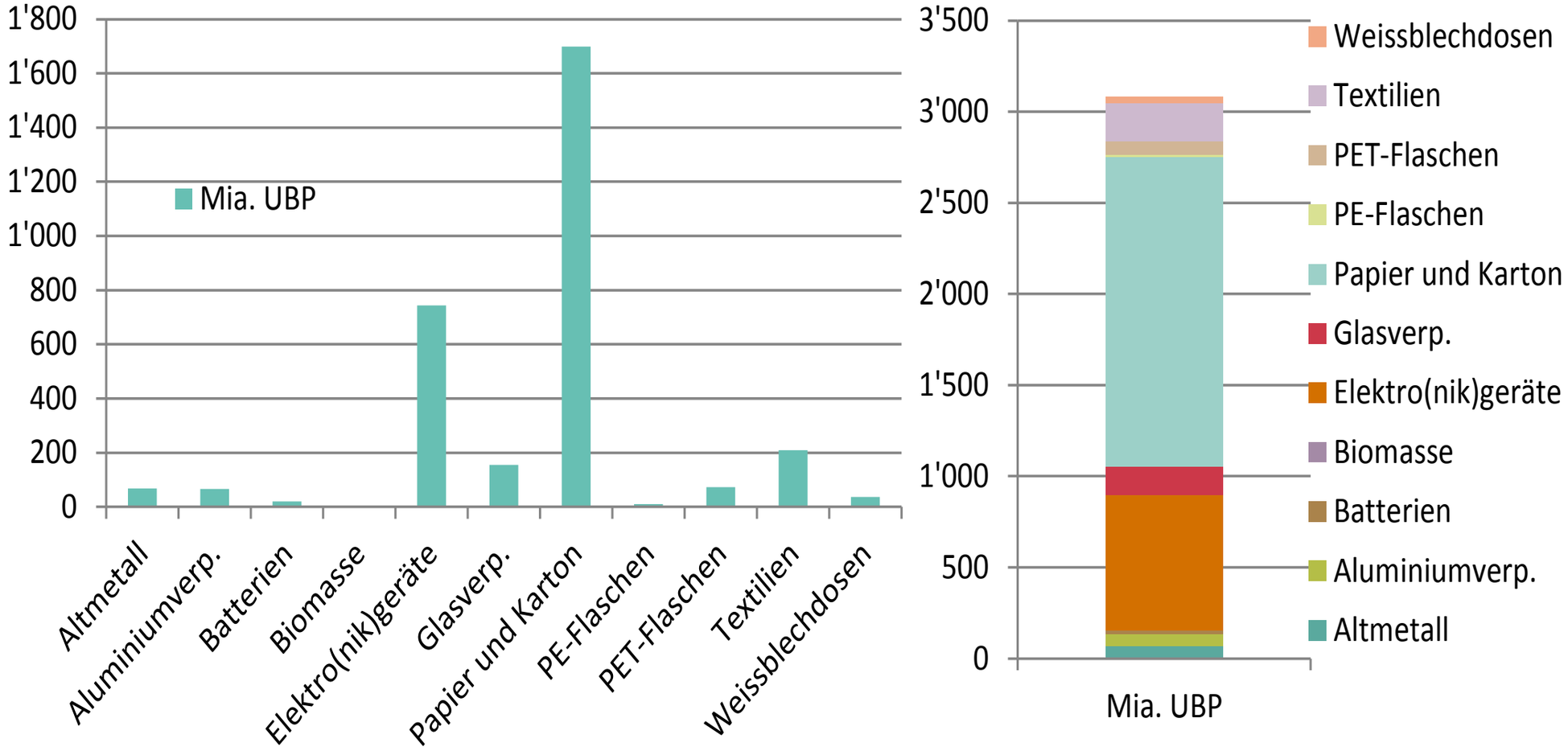


Textiles



Production of primary vs secondary materials

Approval of Swiss recycling system benefits



To recycle or not to recycle?

There are many documented positive examples. However there is no general yes to the question. A simple rule cannot been derived.

Some people say the typical answer of a LCA expert is:
“It depends”

The following illustration of LCA results explain the limits of recycling benefits and help to answer from what kind of factors the answer depends.

FOEN study on beverage packaging

The goal of the study was to give an answer on the following question:

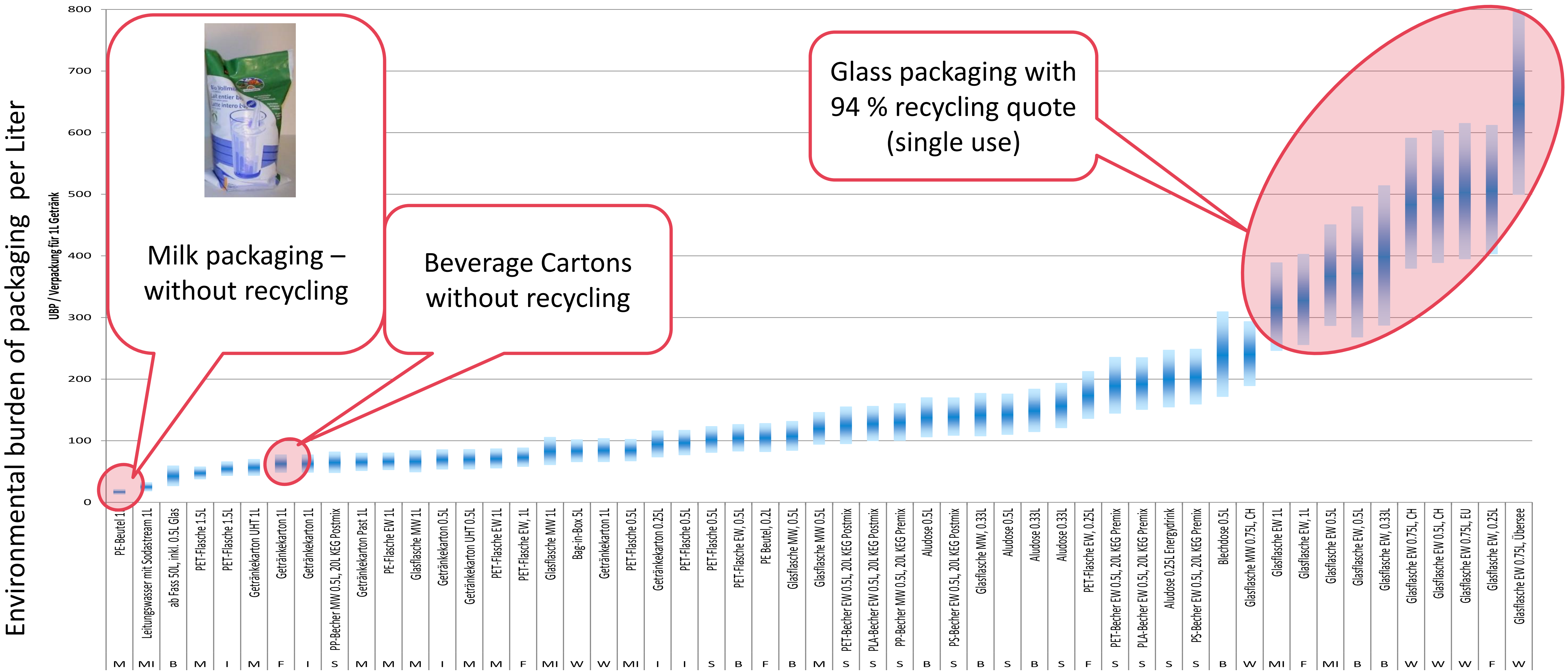
What type of packaging is the ecological best option for a specific type of product?

A comparison was carried out for

- 54 packaging types
- 7 products (milk, beer, juice, wine, ice tea, mineral water, lemonade)

Simple rules are not sufficient

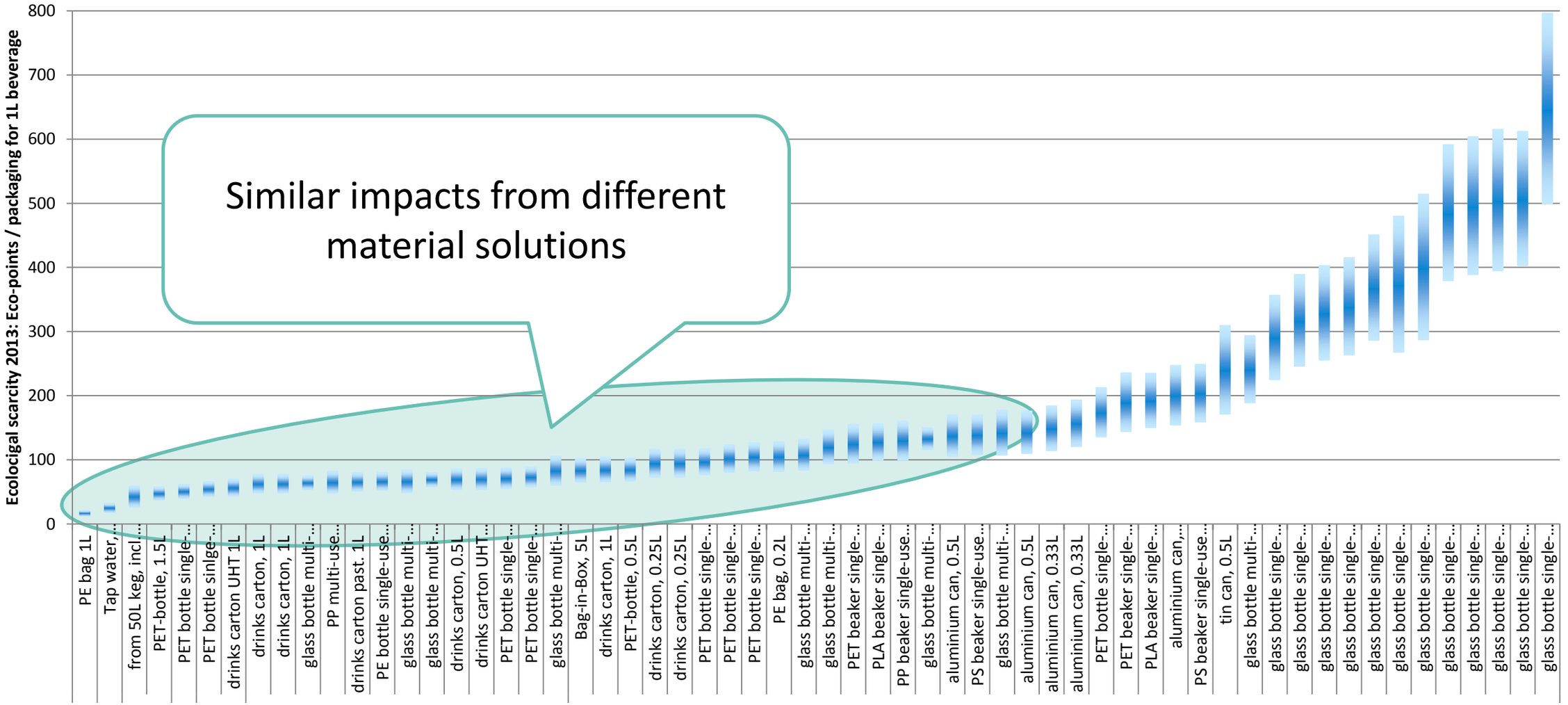
Recycling as main focus



Getränketyp - B: Bier, F: Fruchtsaft, I: Ice Tea, M: Milch, MI: Mineralwasser, S: Süssgetränk, W: Wein

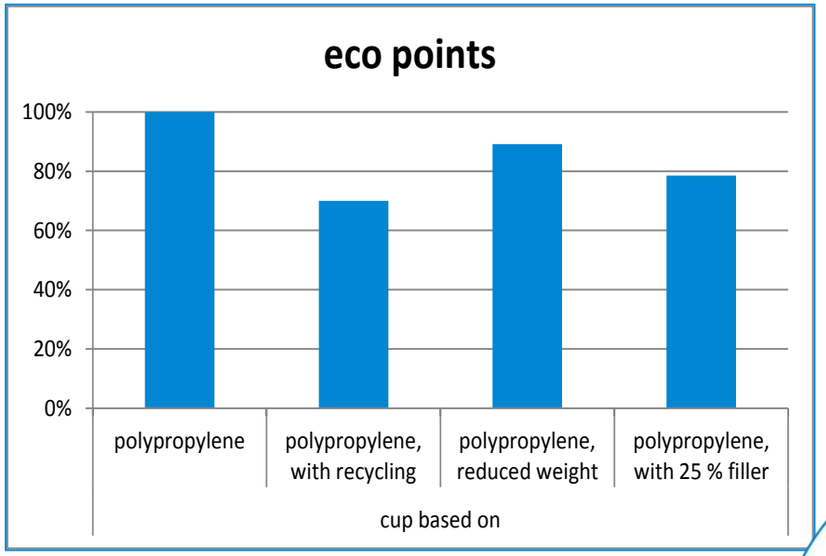
Simple rules are not sufficient

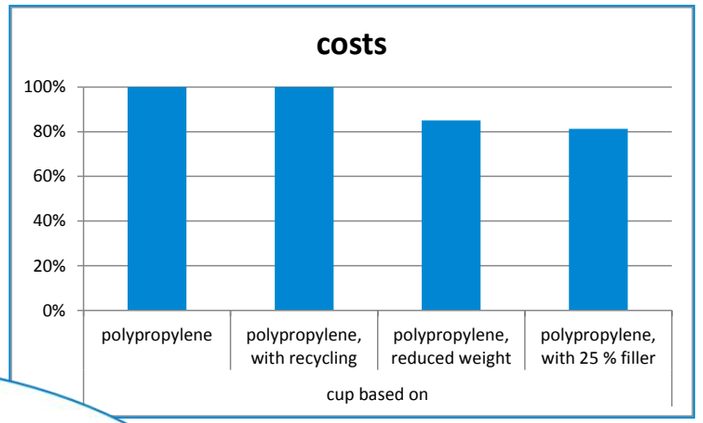
General result for “optimal material choice”



Simple rules are not sufficient

Eco-design of PP cup, fillers versus recycling





Life cycle thinking over time:

- The best strategy today may be the wrong strategy in the near future
- Eco-desing can help to stay on the right track

Recycling:

- PP containing fillers are sorted out and lost to recycling but do not disturb recycling process
- Unless sorting technology would change
- Then, the fillers may disturb the recycling process

End of Life Treatment:

- Products based on PP containing fillers are normally not recycled but incinerated
- There is no recycling system implemented for such products so far

Simple rules are not sufficient

recycling benefits, what about thermal utilisation?

- For materials with a heating value, the answer is not that simple.
- Plastics, paper etc. can be thermally utilised
  - ➢ in an incineration plant producing electricity and heat which replaces fossil fuels indirectly or
  - ➢ in the cement industry replacing directly fossil fuels.
- If we recycle, the benefit of thermal utilisation is reduced
  - or maybe not?

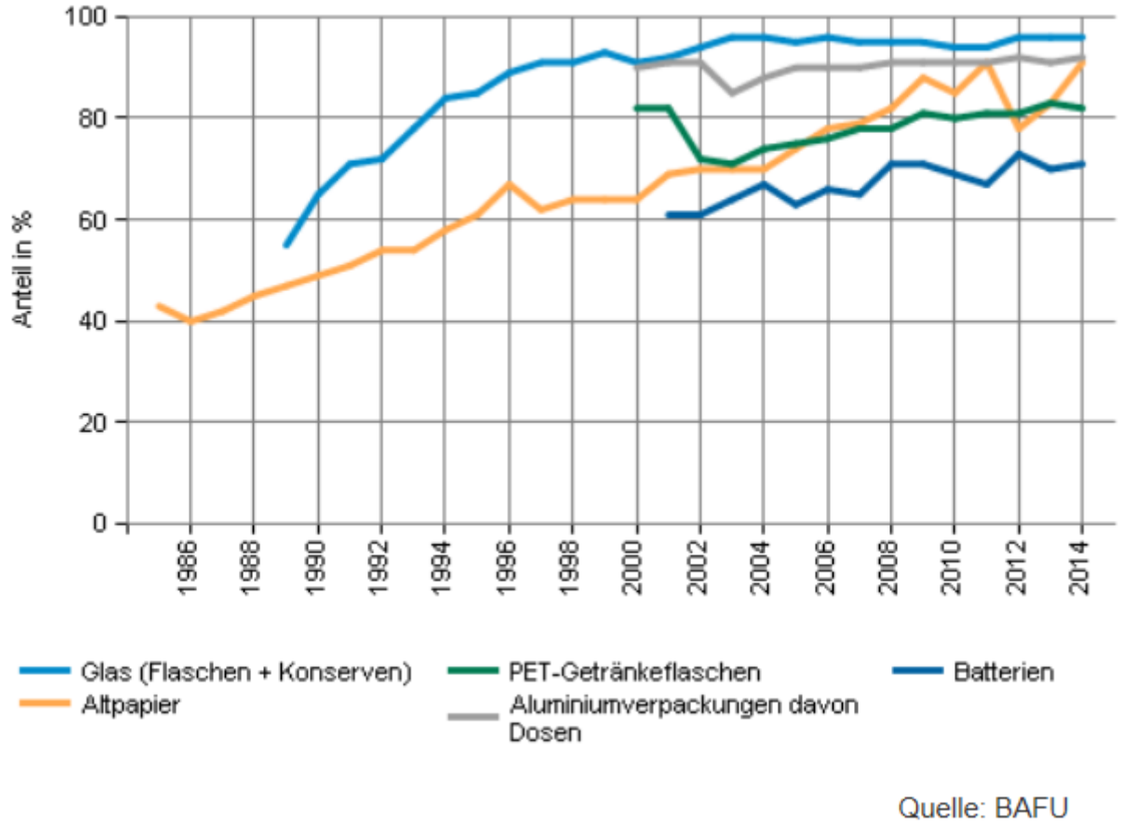
It depends on the point of view

Resource point of view:
how to use a certain amount of raw material as efficiently as possible (e.g. 1 ton of PE or 1 ton of paper)?
-> it appears that to recycle the material as often as possible is the best solution. In the end, it can be thermally utilised anyway.

Demand point of view:
how to fulfil the different demands in terms of material and energy? -> If we recycle as much as possible, we need other energy carriers to meet our energy demand. If we do not recycle, we need less energy carriers but more materials to fulfil our material demands.
-> the answer is now less clear.

Optimal choice of circularity below 100%

We are the champions – how far should we go?



Quelle: BAFU

Footnote, we are also champions in the consumption of those materials…

Optimal choice of circularity below 100%

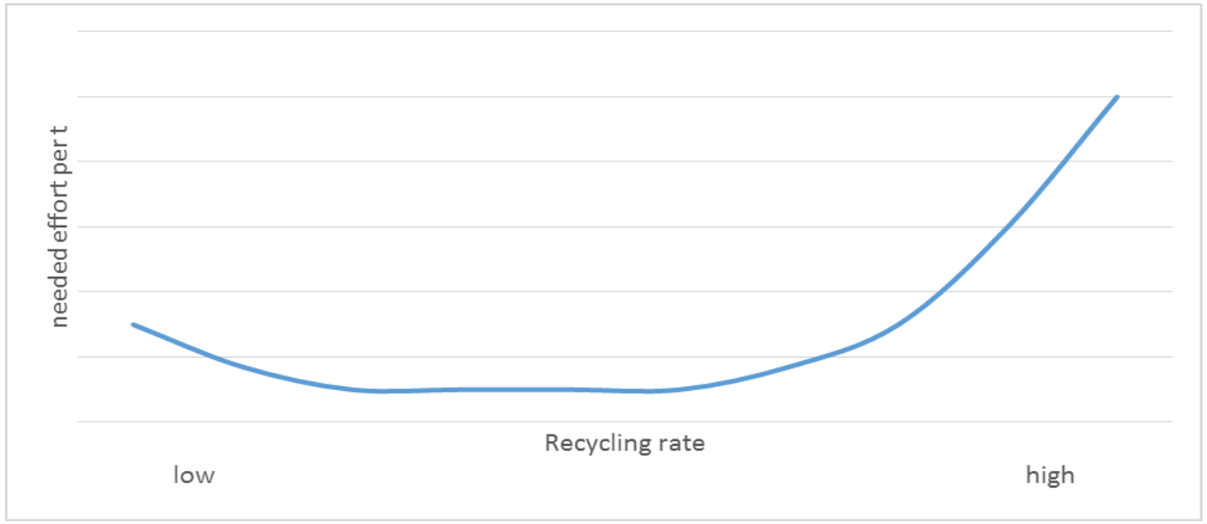
How circular is enough – optimal recycling rate

System loss:

- Collection rate
- Pollution
- Material quality

Additional efforts to obtain 100%:

- Recovery services, transports, etc.
- Cleaning, separation steps
- Treatment



The maximum is below 100%

Limited number of cycles

- Material degradation
- Limited type of application
- Systematic material losses
- Limited portion in new product

Circularity is the brand for the intention to improve systems. Cascades and partly circular systems are the real solutions.

System optimization, role of recycling

Is the recycling rate the right focus of priority?

Principle goal of sustainability:

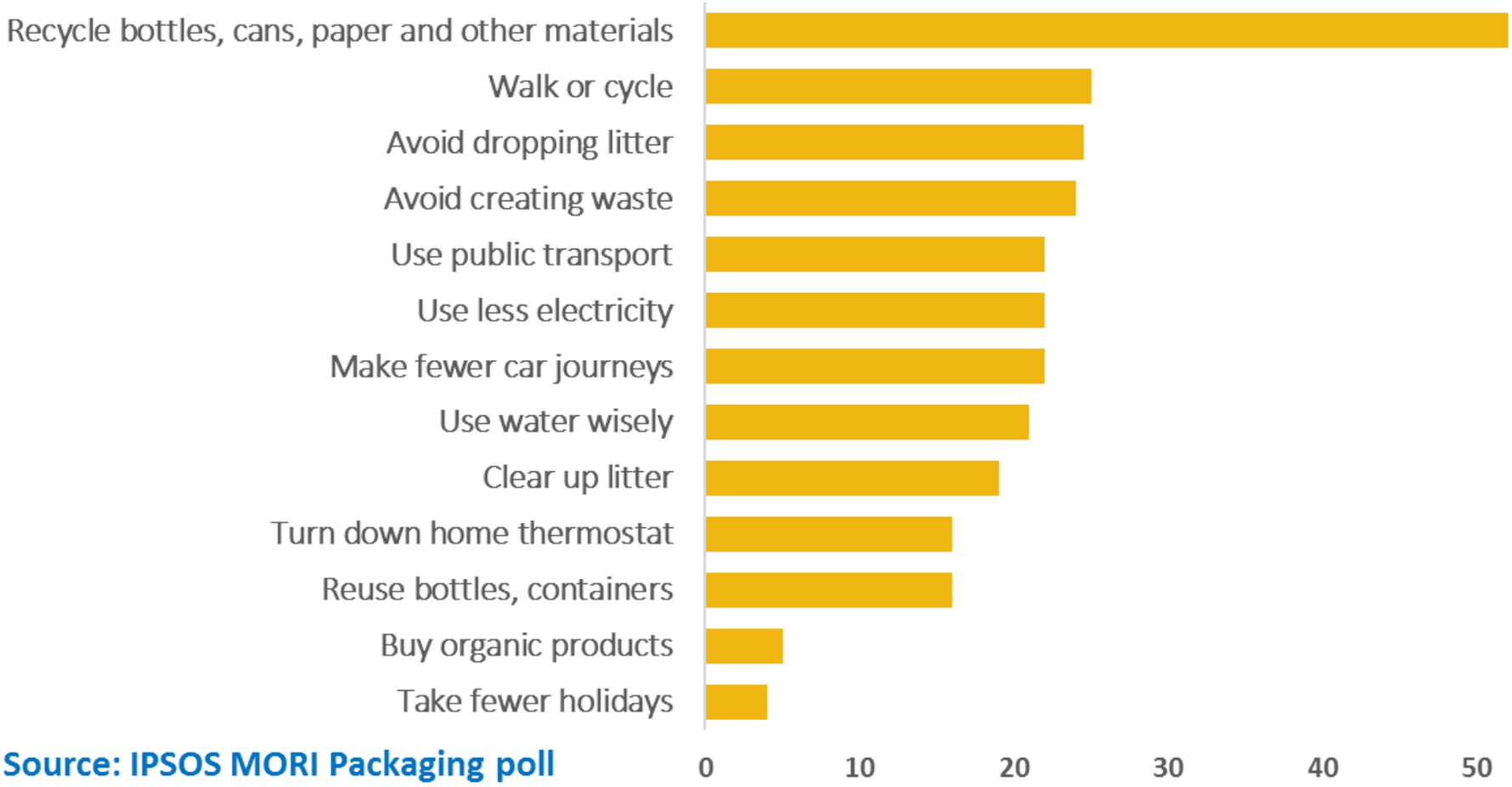
- Ecological aspects
  - Emissions
  - Land use
  - Waste
  - …
- Economy
- Society

Methods and indicators are required to measure and compare measures to optimize the systems. Recycling benefits need to be set in the context of the system optimization.

System optimization, role of recycling

Perception of the relevance

Figure1: Consumers view of contributing to more sustainable environment



Source: IPSOS MORI Packaging poll

System optimization, role of recycling

Recycling goals EU 2030

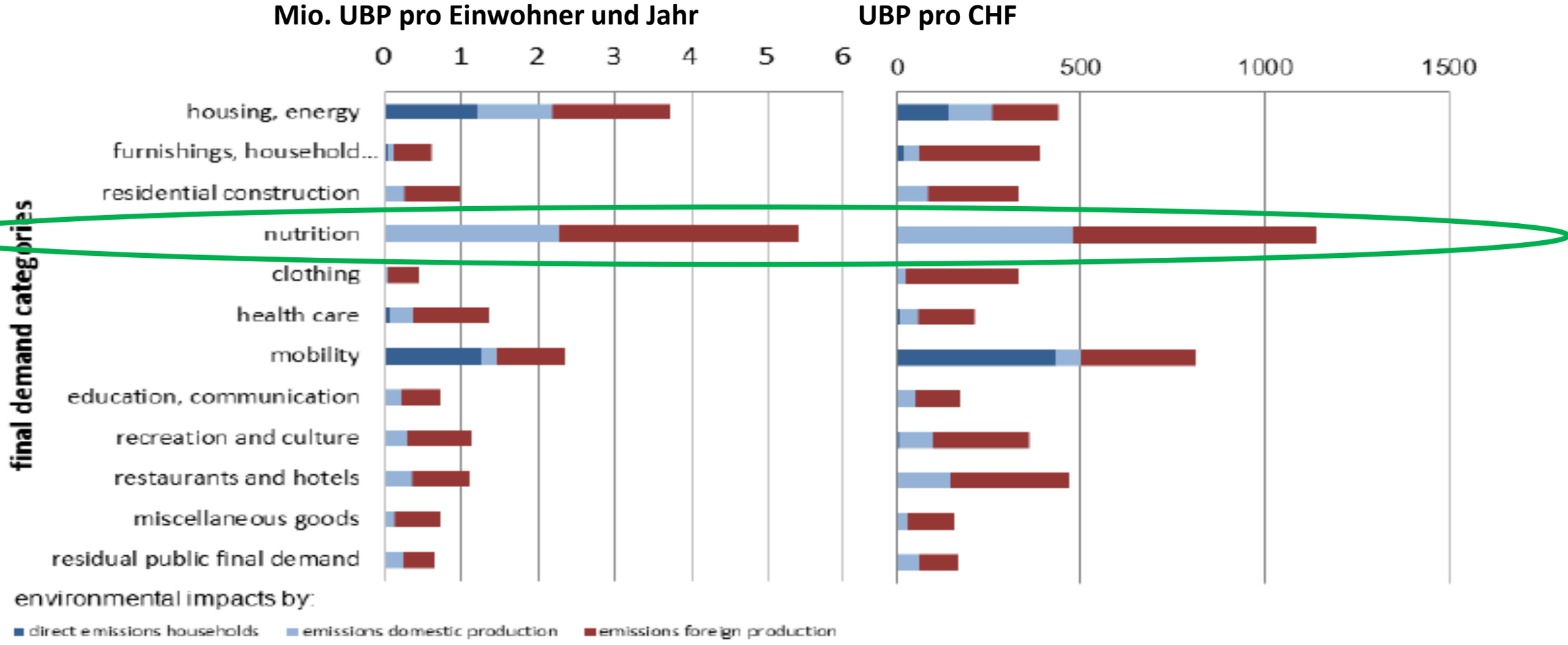
Overview of the new landfill, preparing for re-use and recycling targets*

	present	2020	2025	2030
Landfill		Reduce to a maximum of 10% of unsorted waste by 2025		
Municipal Waste*		50%	60%	65%
Food Waste		Contribute to UN 50% reduction target by 2030		
Construction and demolition		Re-use, recycling and backfilling to 70% by 2020		
Other waste streams		Consider the setting of targets in 2024		
Packaging Waste	55% - 80%		65%	75%
• Plastic	22,5%		55%	To be defined
• Wood	15%		60%	75%
• Metal	50%		Split targets ferrous metal (steel) and aluminium	
• Ferrous metal (steel)			75%	85%
• Aluminium			75%	85%
• Paper & cardboard	60%		75%	85%
• Glass	60%		75%	85%

*The new target combines preparing for reuse and recycling. This might be okay for items such as furniture and electric appliances but is more difficult to apply on packaging. Moreover, it could favour refillables as each reuse trip might calculate for the recycling target.
*Time derogations of 5 years for Member States which today recycle less than 20% of their municipal waste (Estonia, Greece, Croatia, Latvia, Malta, Romania, Slovakia)

System optimization, role of recycling

A study on the environmental impact of the total consumption in Switzerland shows: Food plays a major role



Quelle: esu-services GmbH, Zürich

Nutrition and role of circular system

Role and recycling of packaging

Packaging is generally something
That we don‘t want anymore
As soon as we get it

This is why people often think it is useless and an ecological „nonsense“

What is the meaning of ecological

Many consumers consider a packaging to be ecological if it is:

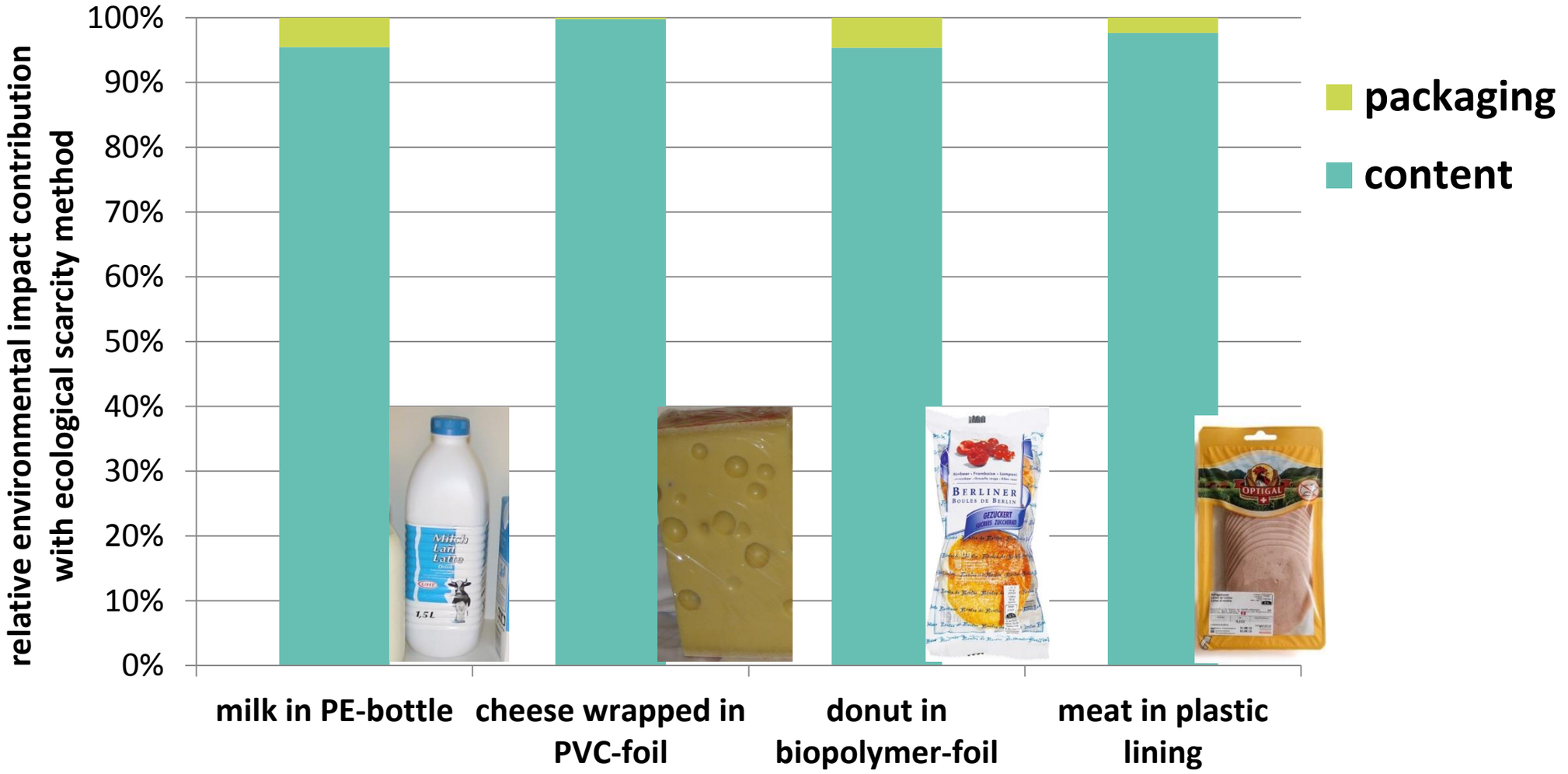
- recyclable
- made from renewable raw materials
- compostable
- Usable several times
- CO_2 neutral
- Not existing at all if possible

Are these criteria sufficient?
Does less negative environmental impact already means sustainable?

How to measure the „environmental compatibility“?

Packaging vs. product

Importance of protection



Recommendation – check on the priority
before focusing on circular systems

Optimization of system

- Influence of material on system function
- Influence of material on system lifetime
- Other material options with low impacts (light weight, material with lower impact, choice)
- Benefits obtained per investment, comparison of costs with costs of other measures

LCA to answer specific questions

Care for correct communication

Circular economy as a brand

Circular economy point of view:

- value of products, materials and resources is maintained in the economy for as long as possible
- the generation of waste minimised
- essential **contribution for a sustainable development**, low carbon, resource efficient and competitive economy

Result in perception:

- Reducing “solid waste” **means sustainable**, low carbon, resource efficient and competitive economy

Thank you
for your attention!

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