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sustainable thinking

The potential for plastic packaging to contribute to a circular and resource-efficient economy

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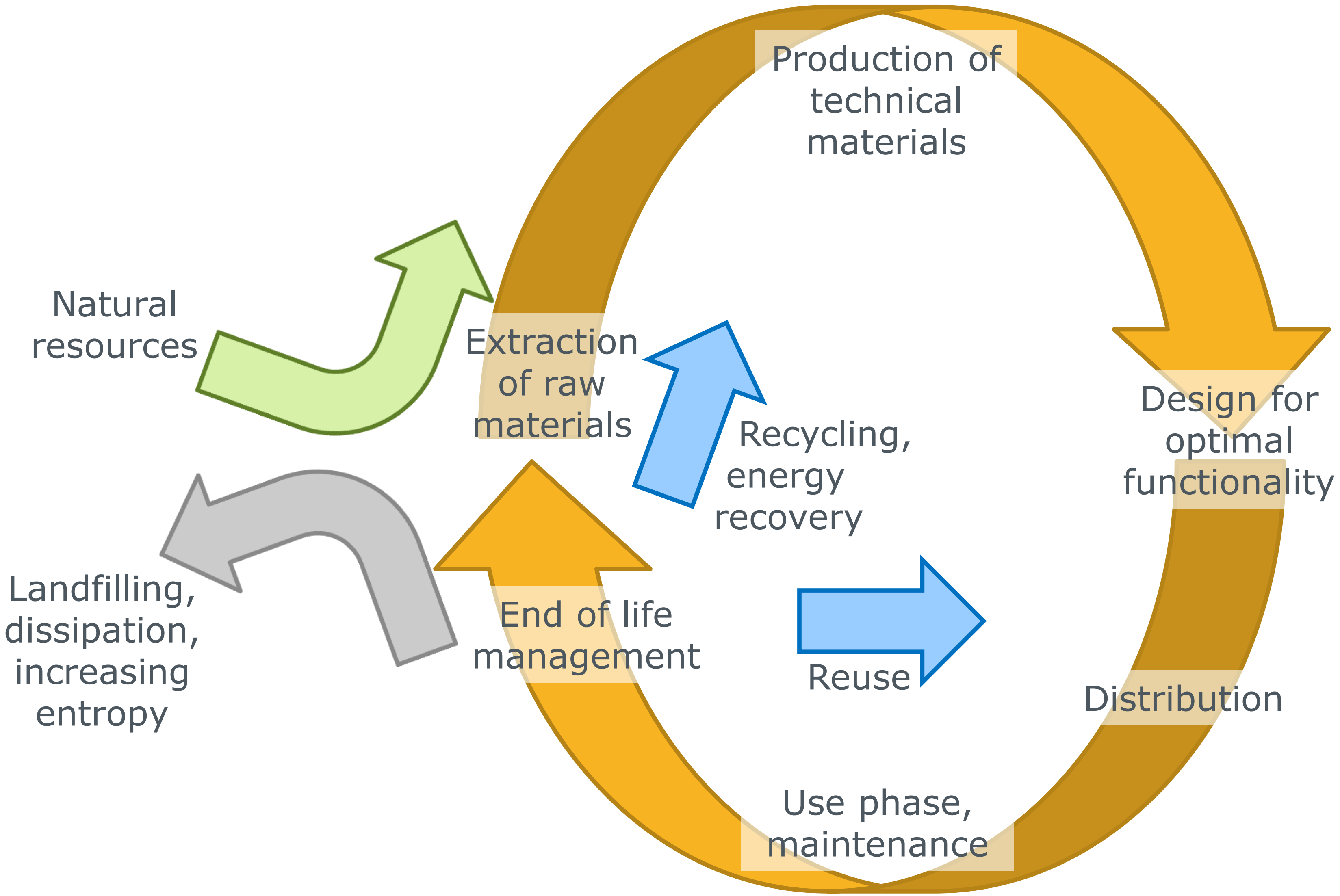
How to get maximum value from limited resources



Conditions for sustainable (eco-efficient) waste management

Apart from technical feasibility & society benefits, **two interlinked aspects of sustainability** should be considered to choose **optimal waste management** options:

- **Environmental benefits**

  Which recovery option provides the highest environmental benefit? Does a simple hierarchy of options exist?

  → Environmental impact evaluation through **LCA**

- **Economic aspects**

  Do benefits for society (monetised environmental benefits and economic benefits) justify recovery costs ?

  → Cost-benefit analysis (**CBA**)

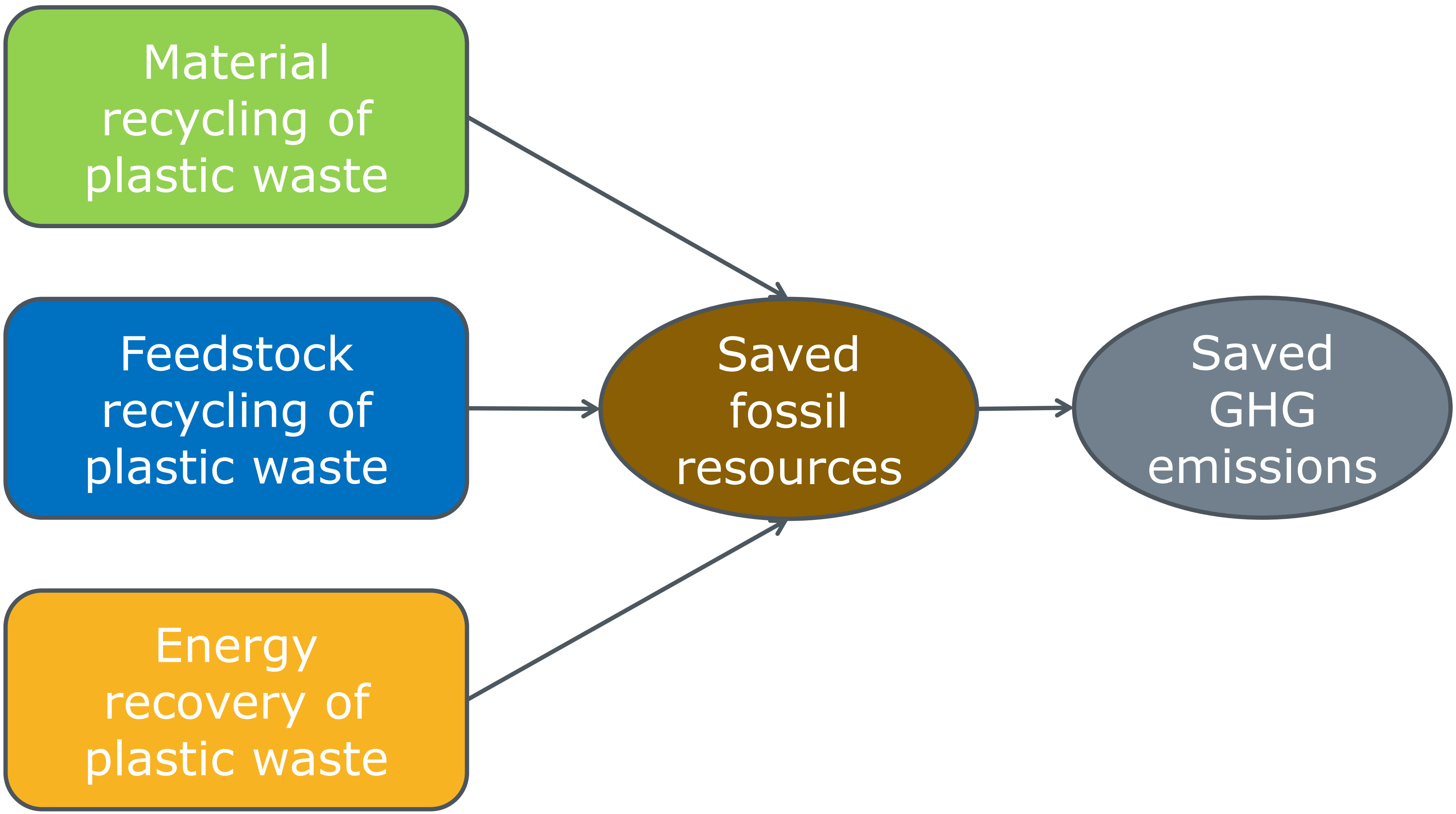
Eco-efficient waste management = relevant environmental benefits AND positive cost-benefit-balance

LCA and CBA in EU-Legislation

- Packaging Directive:
  - Member States shall, where appropriate, encourage energy recovery, where it is preferable to material-recycling for **environmental and cost-benefit reasons**.
  - **… fix recycling targets … based on** the practical experience gained, calculation methodology … and the **findings of scientific research and evaluation techniques** such as **life-cycle assessments and cost-benefit analysis**. This process shall be repeated every five years.
  - The Commission shall present a report … covering … encouragement of reuse and, in particular, **comparison of the costs and benefits of reuse and those of recycling**

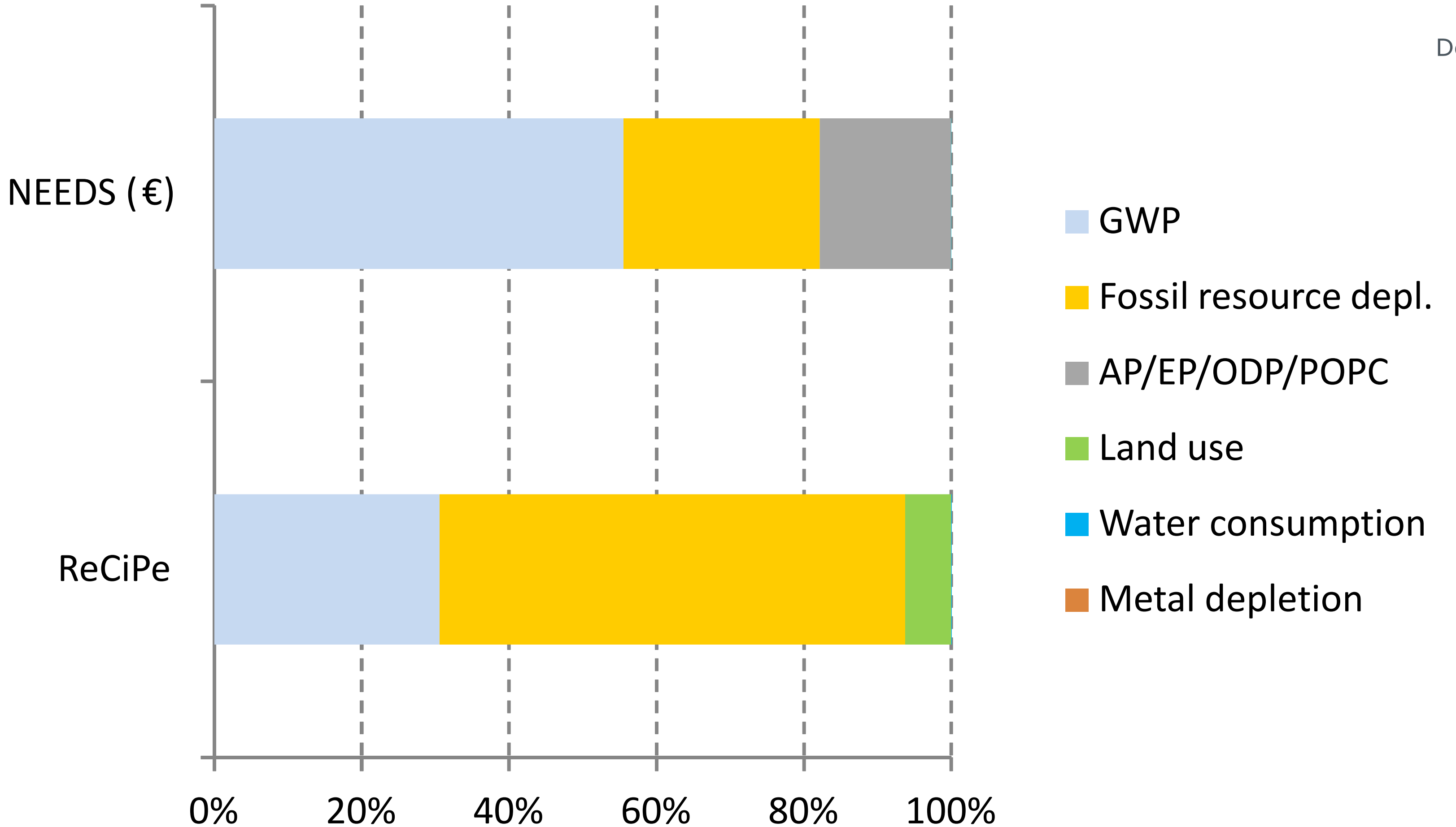
- WEEE Directive and Waste Framework Directive
  - Further references to LCA and CBA

Main environmental benefits of plastic recycling and recovery



Relevance of GWP & CED in total "eco-footprint" of recovery mix

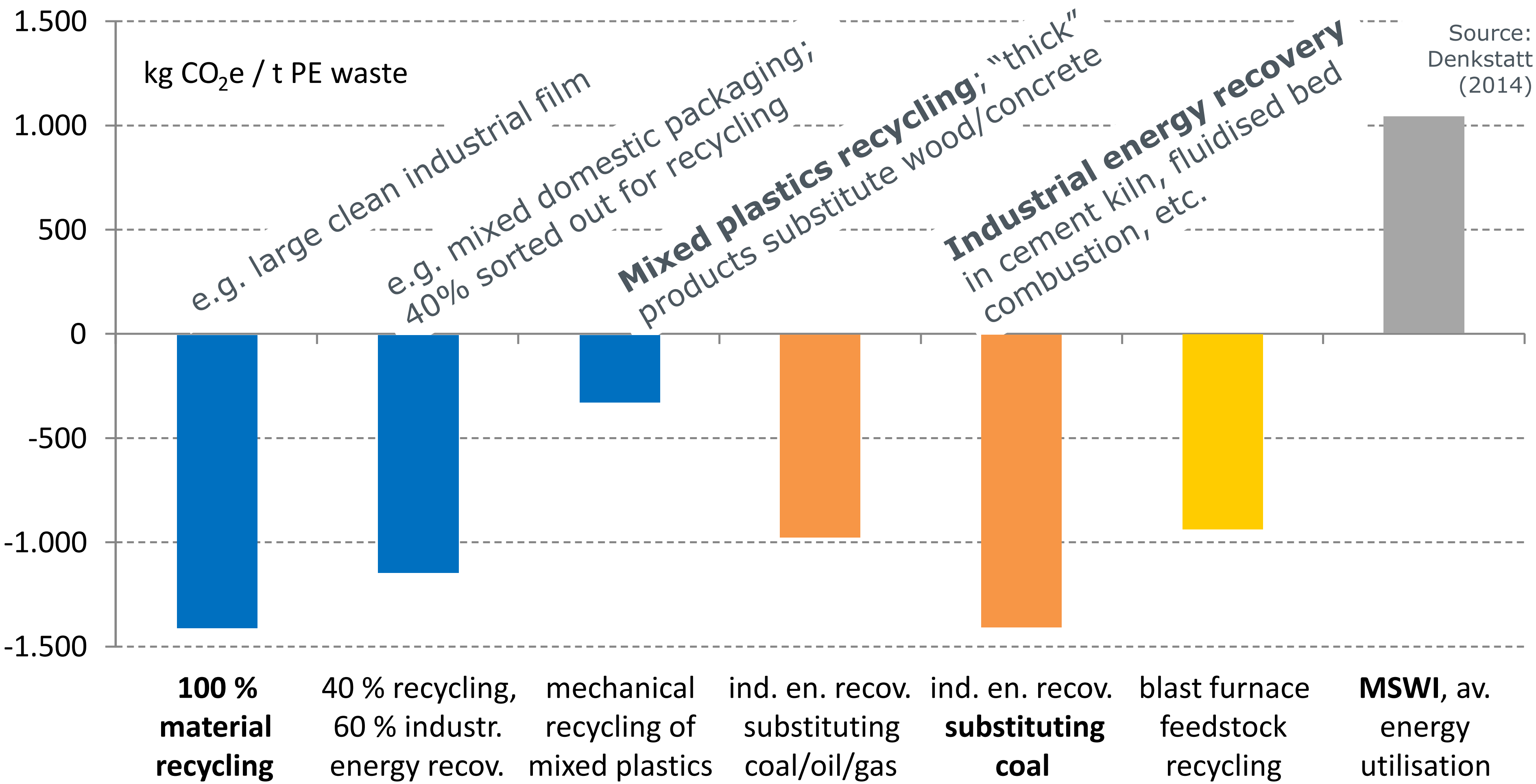
Source: Denkstatt (2014)



Weighted LCA impacts, two exemplary advanced methods

➔ GWP + fossil resources cover 82 – 94 % of total footprint

GHG net benefit (impact) of various recycling and recovery options for PE



No simple hierarchy can be derived
Industrial energy recovery better than mixed plastic recycling

Methodology of Calculating a Cost-Benefit Balance for Recovery Systems

– **Costs of separate collection and sorting**

– Net costs of mechanical recycling and energy recovery

\+ Savings on costs of residual waste collection

\+ Savings on net costs of residual waste treatment and disposal

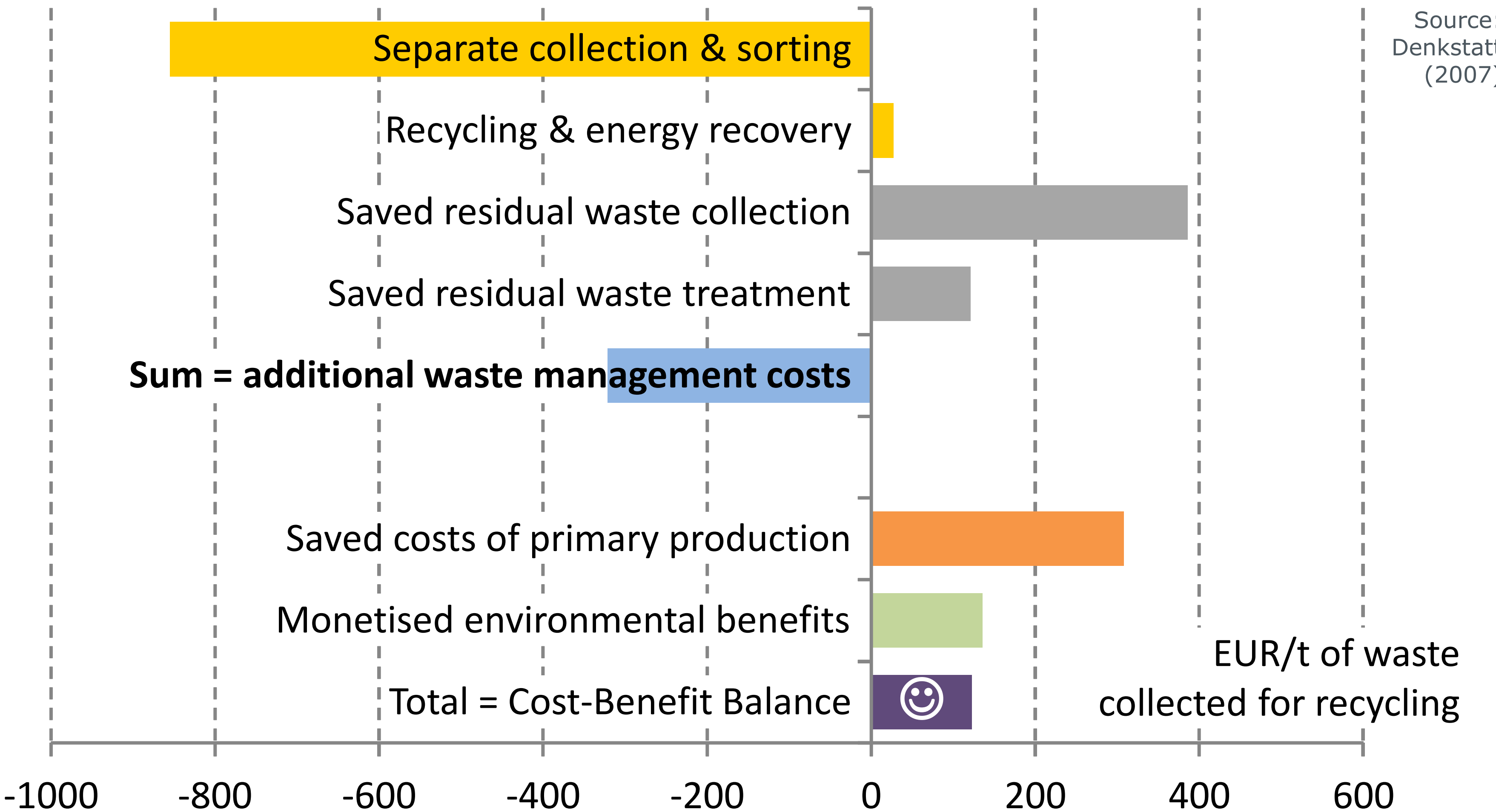
= Result of Net Cost Analysis of Waste Management (A)

\+ Savings on costs of primary production
& conventional energy conversion; recovery revenues excluded before (B)

\+ Savings on environmental (= external) costs
(either "damage costs" or "avoidance costs") (C)

= **Cost-Benefit Balance** (A+B+C)

Example 1: Cost-benefit balance for recycling of PET bottles



Benefits of PET recycling outweigh additional costs

→ positive cost-benefit balance

Example 2: Cost-benefit balance for recycling of domestic films

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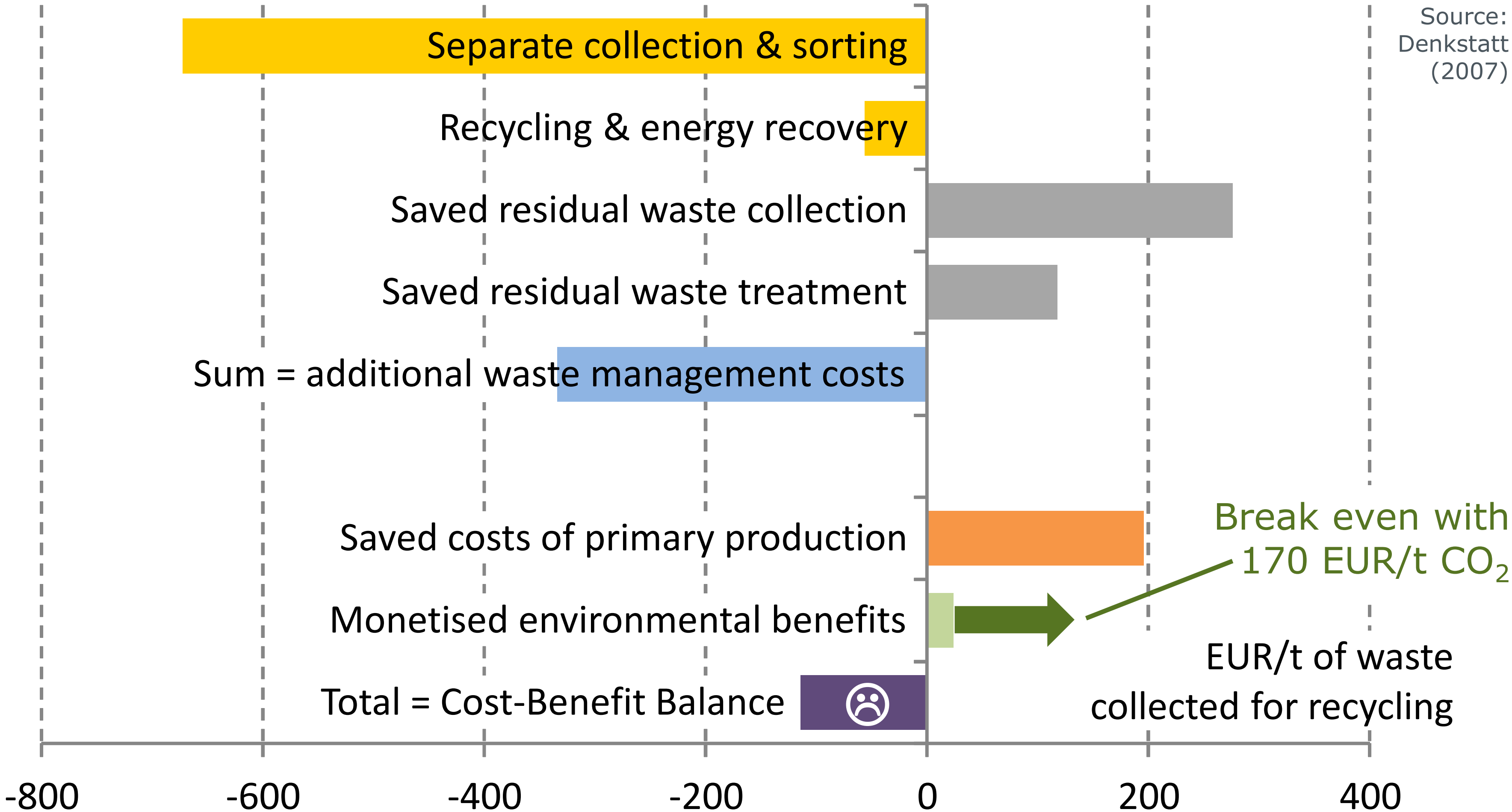

Benefits of domestic film recycling do NOT outweigh additional costs

→ negative cost-benefit balance

Estimated cost-benefit balances for recycling of plastic packaging waste streams

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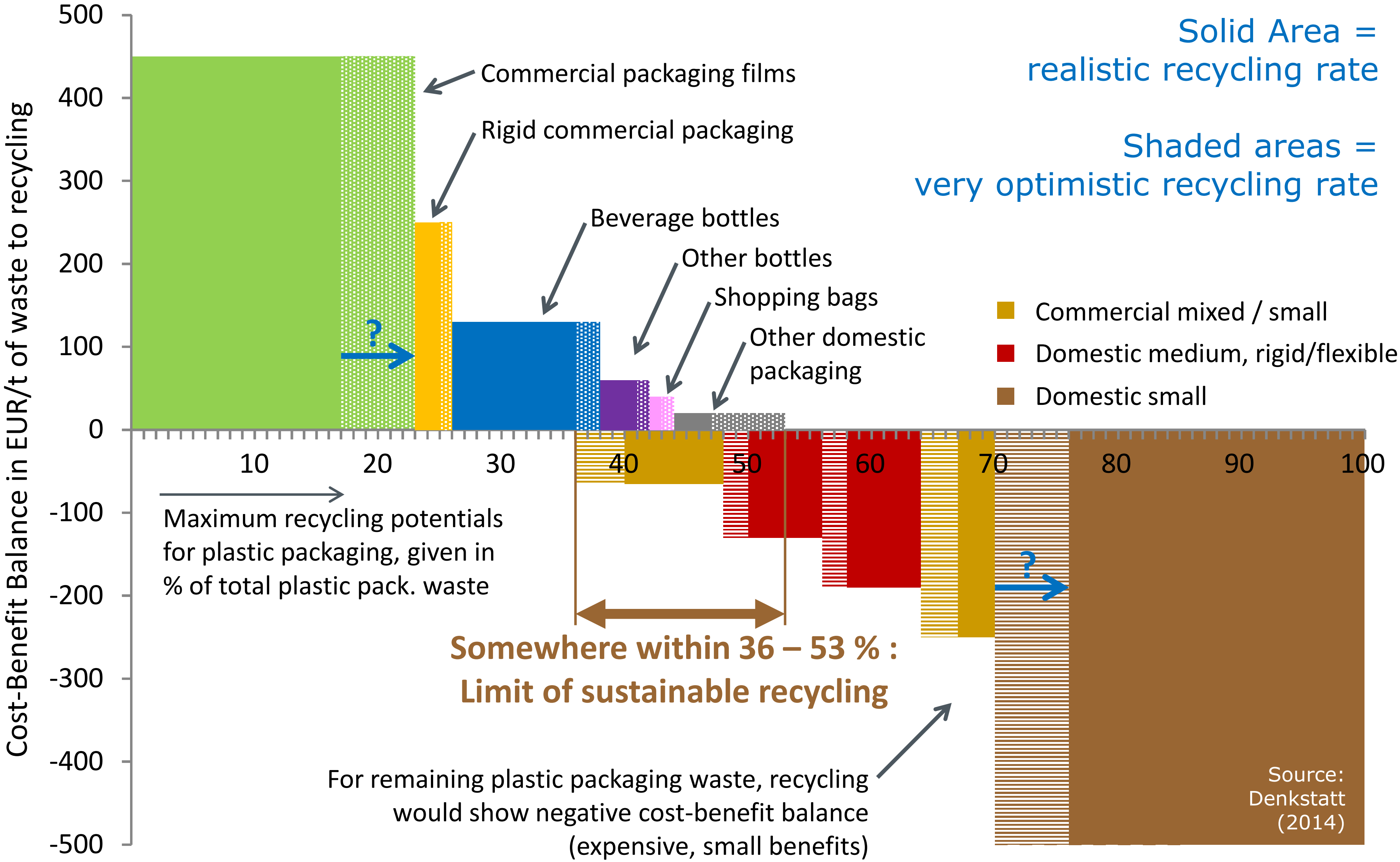

Conclusions from LCA+CBA results

- **No simple general waste hierarchy** can be derived from LCA facts for plastic waste streams. Individual LCA and CBA studies are needed to find eco-efficient solutions.
- The maximum eco-efficient recycling level for plastic packaging is somewhere between 36 % and 53% ➡ not yet entirely utilised
- Recycling beyond this limit
  - will either be low quality recycling (no environmental benefits)
  - or will not be eco-efficient due to very high costs
- Future innovation can help to improve cost-benefit balance
- Optimal European plastic packaging waste recovery (recycling + industrial energy recovery) will save approx. **25 Mill tonnes of CO_2e per year** (compared to 100 % MSWI)
  - equiv. to 138 billion car km or 9 million cars less on the road

A reflection on recycling vs. packaging **resource efficiency** in total life-cycle

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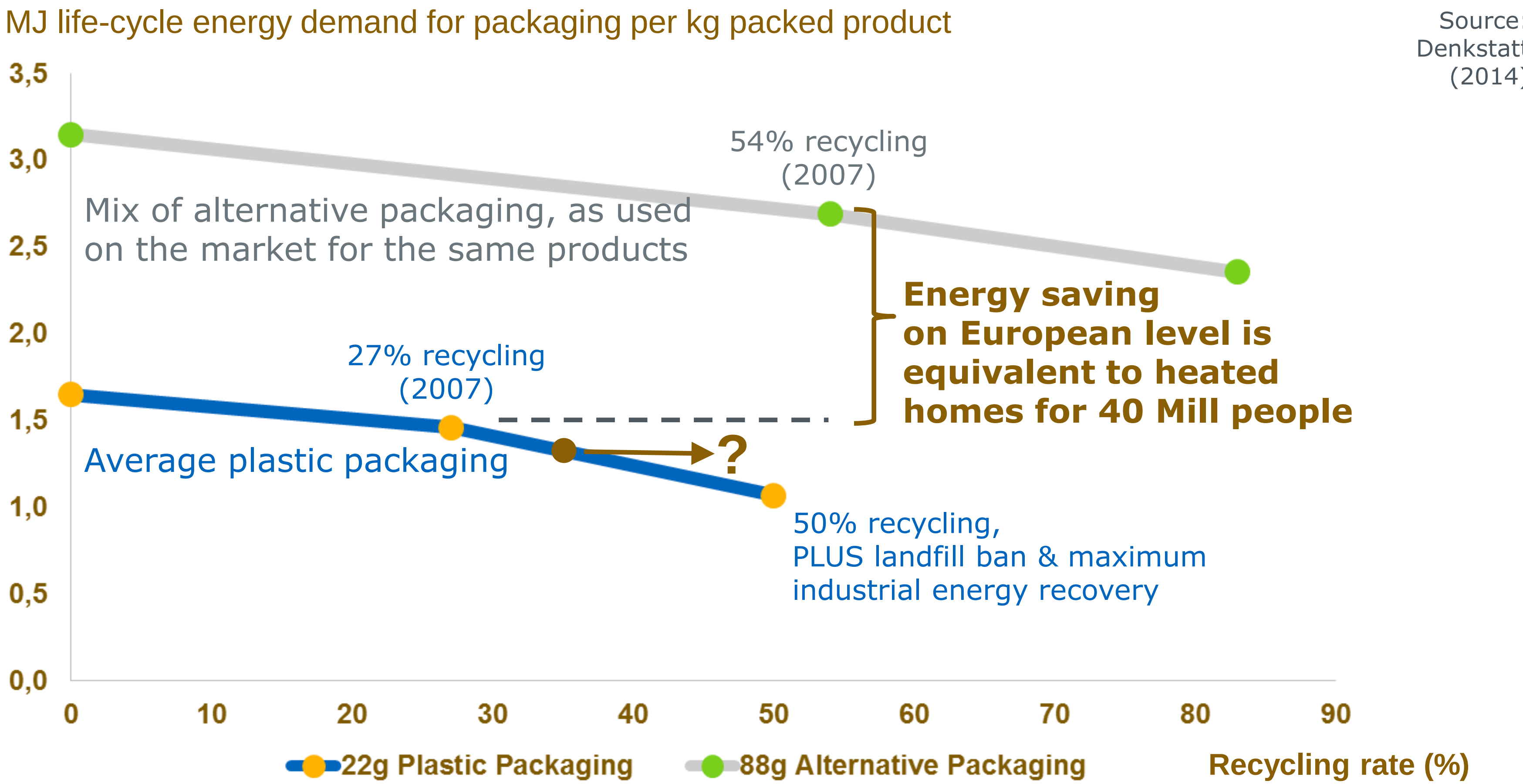

Despite common belief, plastics contribute significantly to increased resource efficiency, even when recycled at a lower rate than other materials.

How plastic packaging help to reduce food waste; example cheese packaging

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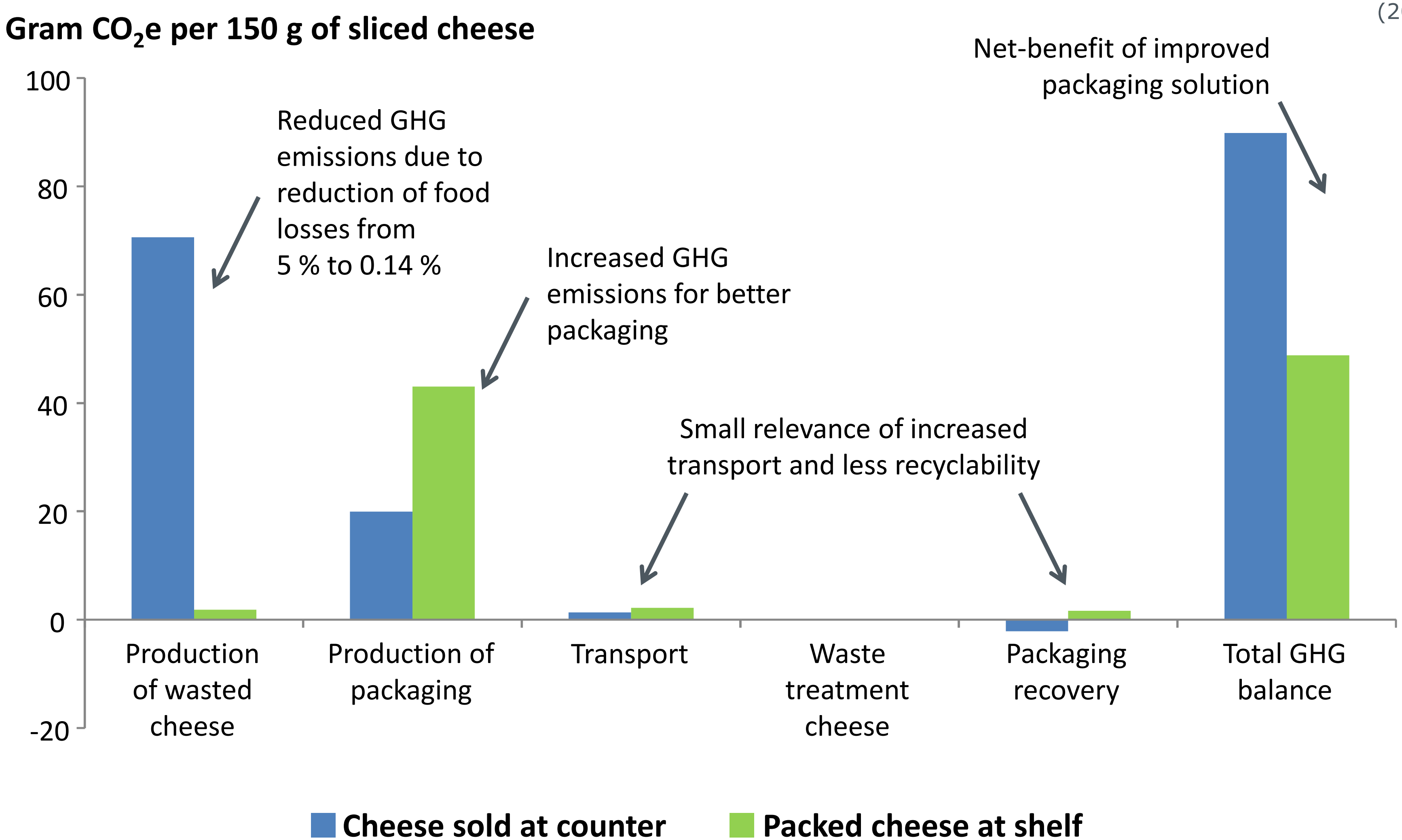
Source: Denkstatt (2014)



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Sustainable design "formula":

\+ optimised material production
x **small material demand per functional unit**

\+ **high functionality / quality / use-benefits**

\+ optimal recovery/recycling-mix **(determined by CBAs!)**

= **Low eco-footprint, economic & social impact**

Priority for functionality, then raw material and recycling aspects

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We drive the change to a sustainable society.

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