



How Packaging Contributes to Food Waste Prevention

Specific examples from Austrian stakeholder projects,
including carbon footprint assessments

Consumer's views of contributing to more sustainable environment

Figure 1: Consumers' view of contributing to more sustainable environment



Source: IPSOS MORI Packaging poll 2011

All packaging materials cause **ONLY 1,3 %** of the total carbon footprint of Austrian consumers

Source: PWC 2012 Sustainable Packaging

- About **30 percent of the carbon footprint** of an average European are linked to the production and distribution of food and to nutrition [European Commission 2006]
- **More than 100 Mill. tonnes of food are wasted** in Europe every year [European Commission 2014]
- **EU action plan for the Circular Economy** [European Commission Dec 2015]:

Plastics and **food waste** are priority areas

Development of a common **methodology and indicators to measure food waste** (2016)

Stakeholders platform to examine how to achieve SDGs goals on food waste, share best practice and evaluate progress (2016)

Explore options for more effective use and understanding of **date marking on food**

Project "How Packaging Contributes to Food Waste Prevention" [denkstatt 2014/15]



Packaging
Recycling
Association



Retailers



Meat packer



Packaging producers



Polymer producer



Industry association



Research institute

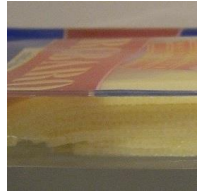
5 concrete examples as result of data collection within Austrian retailers

Recorded changes of food waste shares due to changes in packaging:

Sirloin steak: 12 % ➡ 3 %



“Bergbaron” cheese: 5 % ➡ 0.14 %



Yeast bun: 11 % ➡ 0.8 %



Garden cress: 42 % ➡ 3.4 %



Cucumber: 9.4 % ➡ 4.6 %



Packed Food	Previous Version	Improved Version
Sirloin steak (and similar cuts of beef steak), 330 g	EPS Top seal tray with modified atmosphere, 12 % waste	PS/EVA/PE based skin packaging, 3 % waste
Bergbaron cheese, 150 g in slices	Cut from a 5 kg bar and sold at counter, 5 % waste	Slices in APET/PE/PSA tray + film packaging, 0.14 % waste
Plaited yeast bun, 400 g	Paper bag with plastic strip window, 11 % waste	OPP film packaging, 0.8 % waste
Garden cress growing on substrate, 100 g	In PS tray, 42 % waste	Additional PP film, 3.4 % waste
Cucumber, 350 g	Without packaging, 9.4 % waste	PE film, 4.6 % waste
Chicken meat, 350 g	PP tray plus lidding, 14 % waste at home	PP tray plus lidding, meat separated into two pieces, 5 % less waste at home

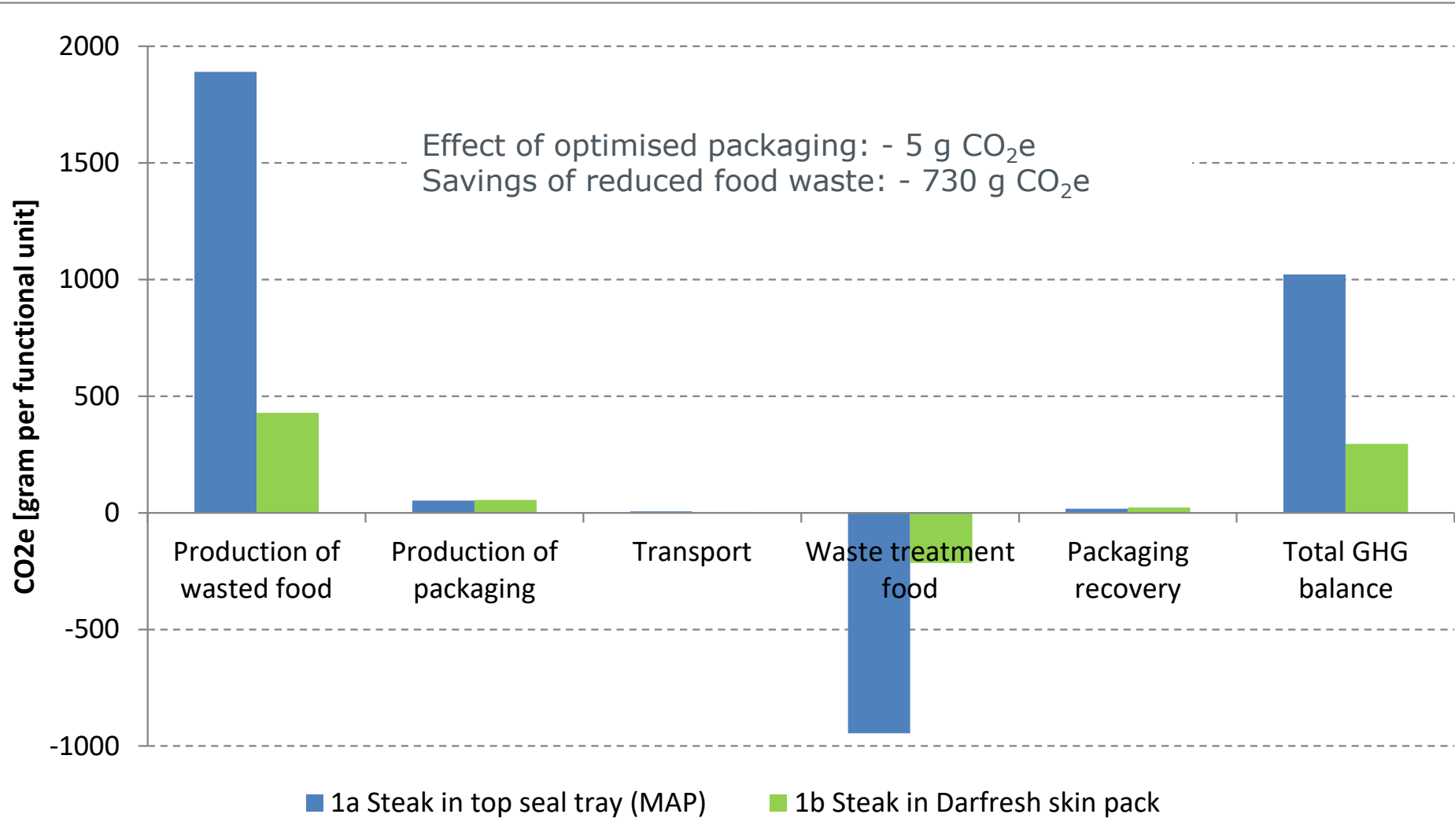
Example 1 – Sirloin steak

Darfresh skin packaging extends the shelf life from 6 to 16 days; enables steaks to be cut and aged in pack, eliminating separate packaging for aging; reduction of food waste by 9 percentage points



Example 1 – Sirloin steak: results

Carbon Footprint, excluding consumed food



functional unit = consumed amount = 330 g Sirloin steak

Example 2 – “Bergbaron” cheese



Photo: denkstatt

Basic input data

2a: distribution via delicatessen counter

- 16.8 g PE/EVA+PE/PVdC/EVA+PE shrink bag for 5 kg of cheese, plus transport packaging
- 150 g sliced cheese sold at the delicatessen counter in 6.9 g wrapping paper & “1/3” paper bag (3 products per bag)
- **Food waste: 5 %**
- Net load on the transport truck: about 22 t

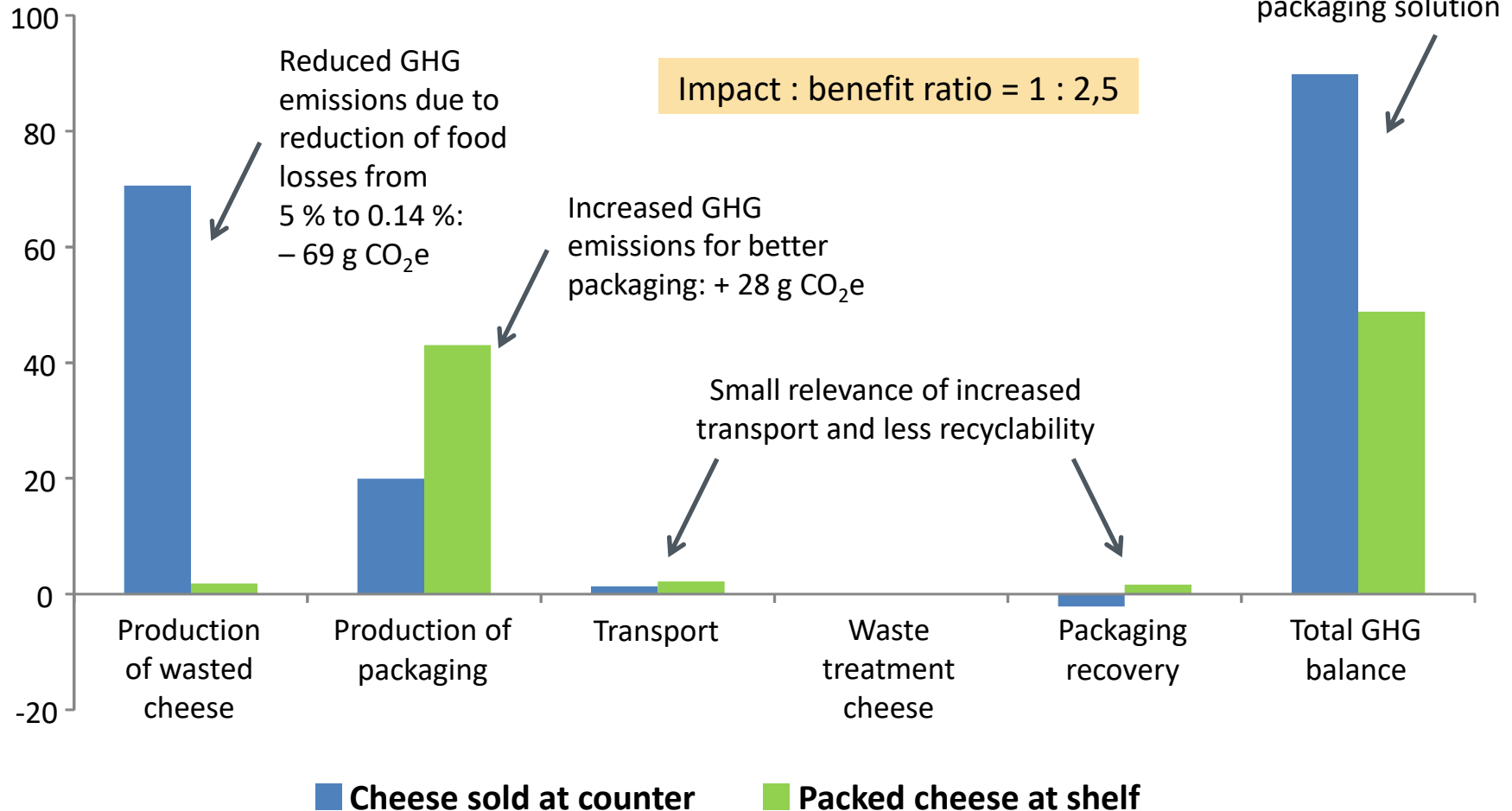
2b: distribution via self service shelf

- 150 g sliced packed cheese in self service shelf. Packaging: 11.9 g APET/PE tray with PET/PE/PSA/PE lidding film, plus transport packaging
- **Food waste: 0,14 %**
- Net load of the transport truck: about 14 t

Data provided by REWE, Berglandmilch, OFI

Example 2 – “Bergbaron” cheese: results Carbon Footprint, excluding consumed food

Gram CO₂e per 150 g of sliced cheese



functional unit = consumed amount = 150 g Bergbaron cheese

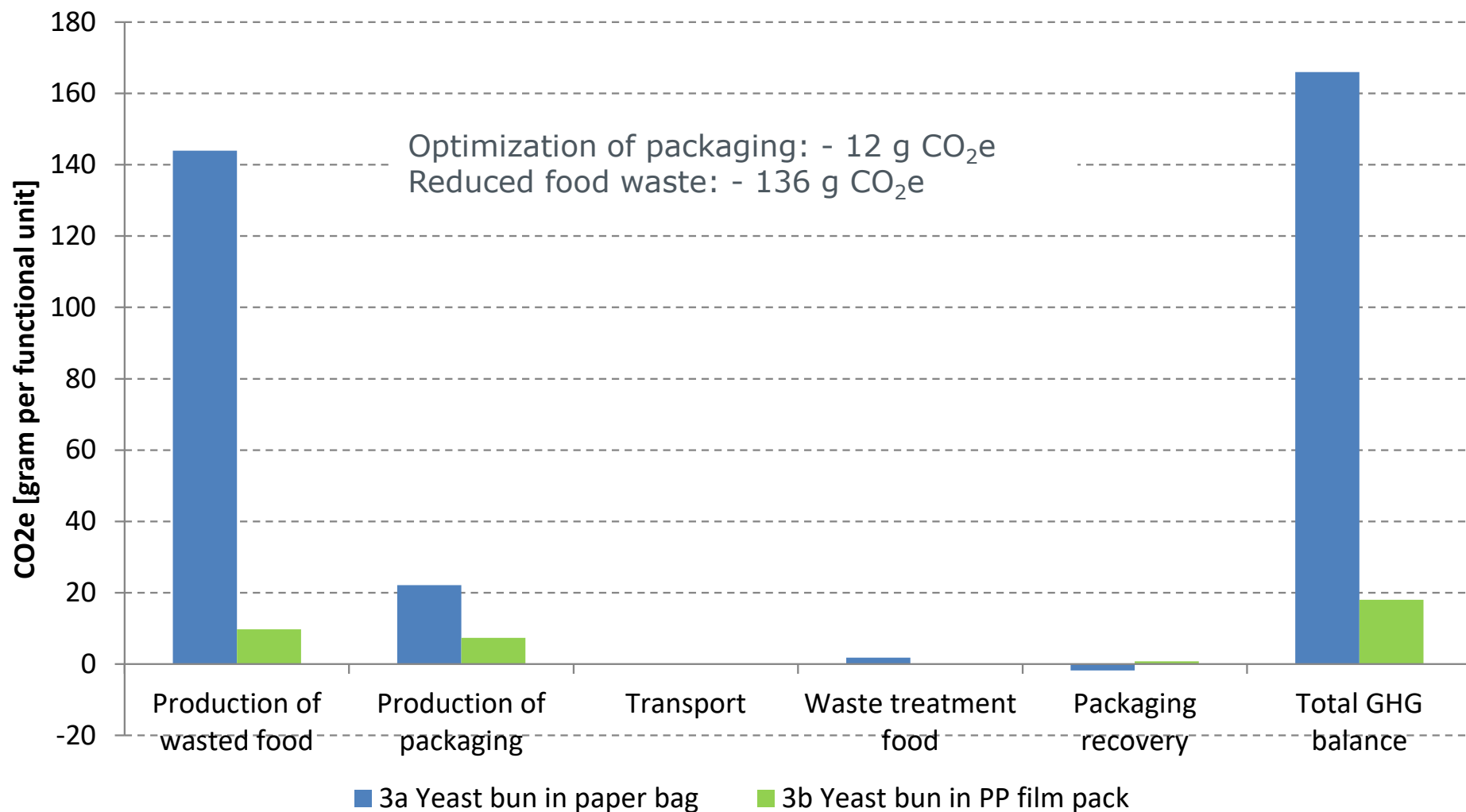
PP film bag instead of paper bag – less dehydration
0,8 % food waste instead of 11 %



Photo: denkstatt

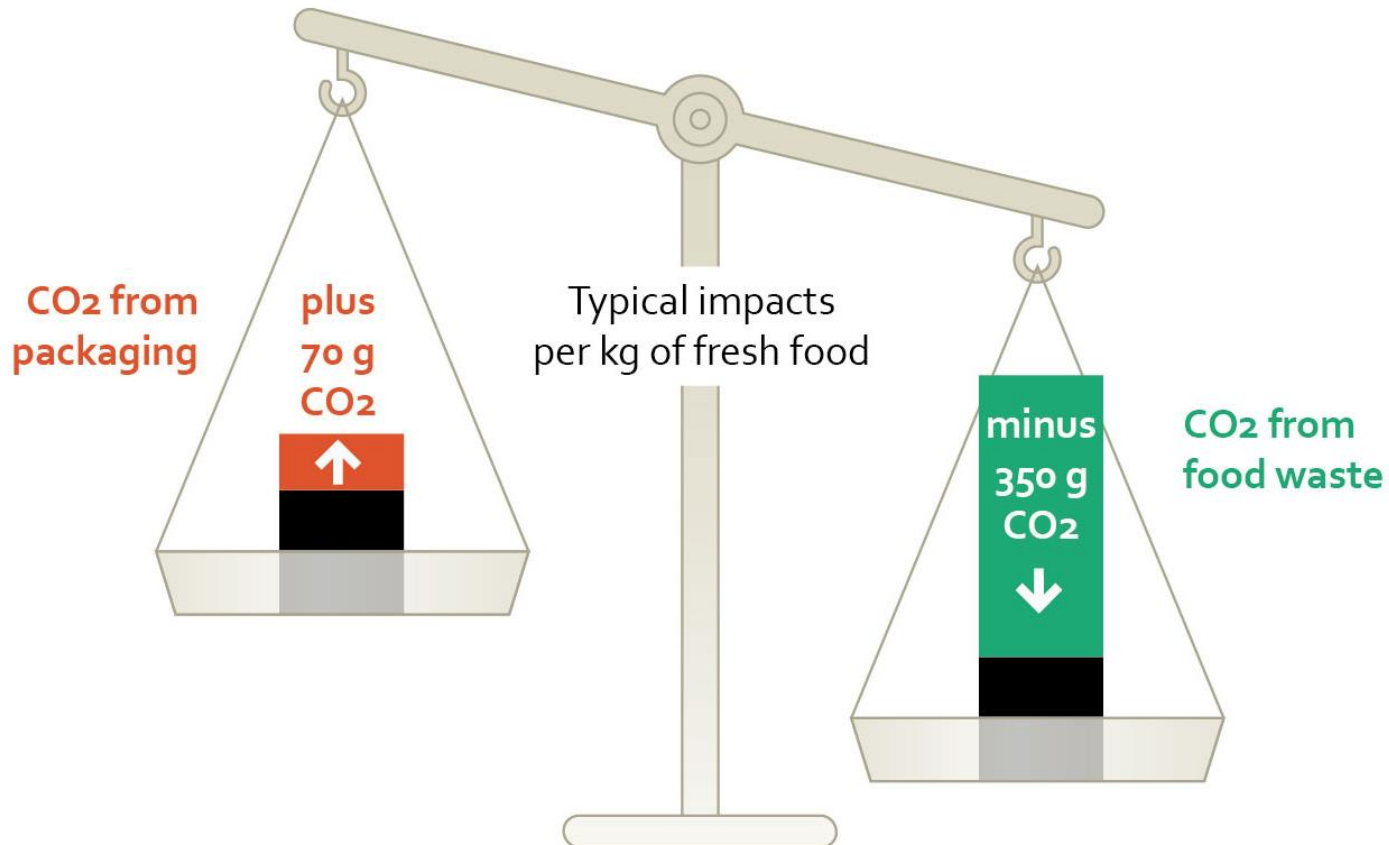
Example 3 – plaited yeast bun: results

Carbon Footprint, excluding consumed food



functional unit = consumed amount = 400 g plaited bun

1. Optimized packaging often provides environmental advantages. The reason is that benefits of prevented food waste are usually much higher than environmental impacts of production or optimization of the packaging involved.



2. In most cases the **protective function** of food packaging is more important than the impact of different packaging materials, also regarding their recyclability.
3. A **high value of the product** should be complemented by a high standard of packaging to ensure optimal product protection.



4. Advantages of improved packaging solutions should be **communicated along the value chain** in a transparent way.
5. Intense **communication and cooperation within all stakeholders** in the value chain will support future optimization.
6. In **follow-up projects** additional examples shall be identified and assessed.

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**

STOP Waste- SAVE Food

Quantitative assessment of the impacts
of improved processing and packaging
on food waste reduction

A 3 year multi stakeholder project
October 2016 – September 2019



FFG

Abfallvermeidungs-Förderung
der österreichischen
Sammel- & Verwertungssysteme
für Verpackungen

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Europäische Union Investitionen in Wachstum & Beschäftigung. Österreich.



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Case studies

Meat packaging

- Vacuum packaging versus MAP (beef, pork; odour aspects)

Fruit and vegetables

- Tomatoes, strawberries, cut salad, etc.
(conventional vs. biodegradable films; gas mixtures and perforation; etc.)

Consumer level

- Influence of packaging on food waste; effects of portion size; awareness raising

Eggs

- Influence of different materials on fracture rate

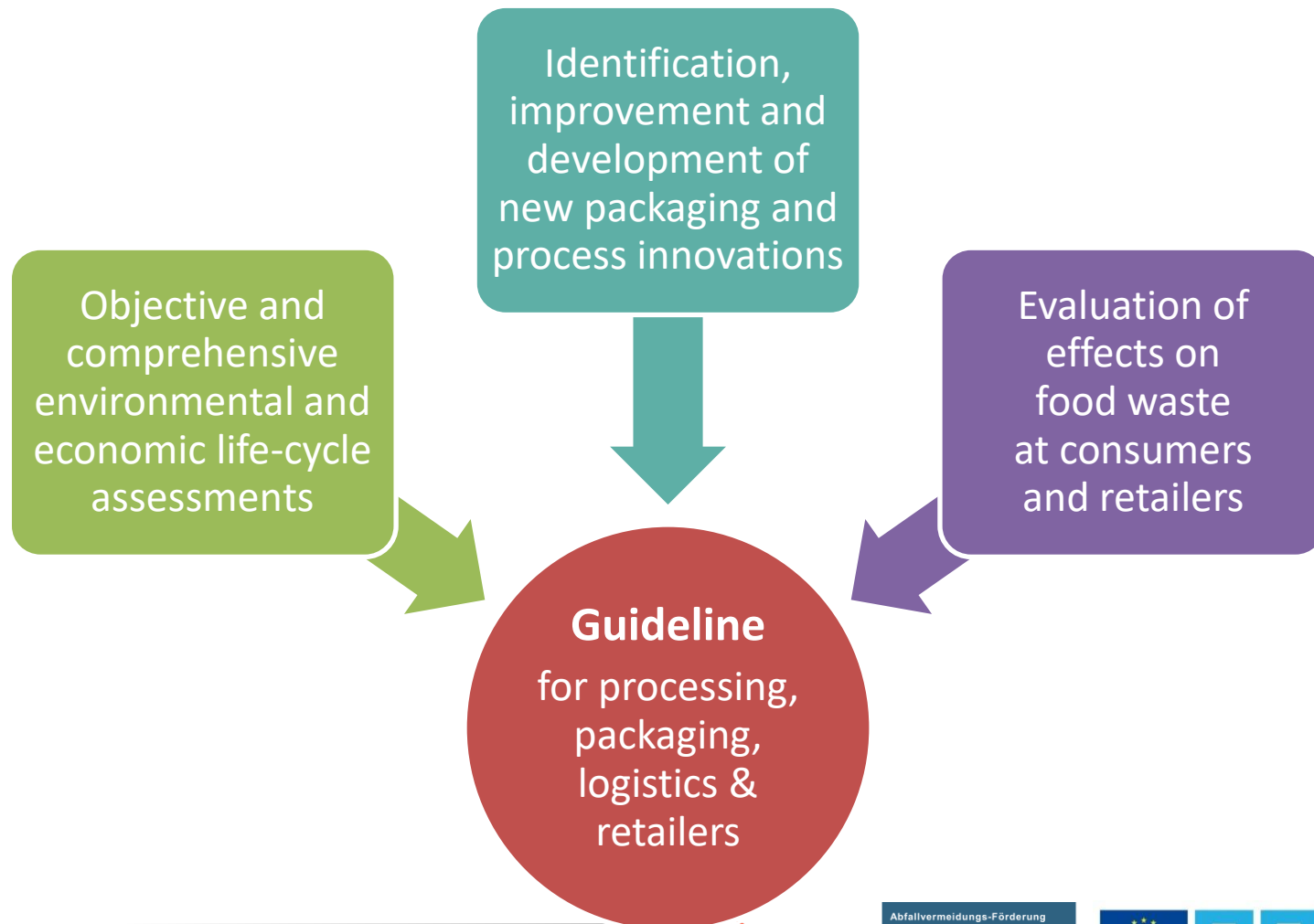
Barrier design

- Avoiding over-performance (example coffee capsule & fresh juices); recyclability versus protective function

Vegetable processing

- Reducing food losses by improved processing)

Optimized food packaging and processing are reducing food waste, which results in environmental and economic benefits





**We drive the change
to a sustainable society.**

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How many car kilometres are compensating the CO₂ benefit (per capita) of

- 1 year abstaining from plastic shopping bags
14 car km
- 1 year buying water in PET refillable bottles instead of PET one-way bottles
38 car km
- 1 year of separate collection & recycling/recovery of plastic packaging
70 – 100 car km

Source: denkstatt studies 2007 - 2011

- Comparison of total waste amounts and of Carbon Footprint (CO₂-equiv.) of previous and improved packaging solution
- Consideration of production, transport (displayed separately only for examples 1 and 2), use-phase, and waste treatment of food and packaging
- All results are based on the same functional unit = same amount of *consumed* food for each case study
- Food waste in households is not included (except in example 6 for chicken meat)
- Net greenhouse gas emissions of packaging recovery are calculated with an existing reviewed ARA/denkstatt-model
- No greenhouse gas emissions are assigned to treatment of food waste in waste incineration plants

Basic input data

1a: previous packaging

- 20 g PE/EVA+PE/PVdC/EVA+PE vacuum-bag (for 6 kg meat) = aging packaging
- 11 g EPS tray and 4 g EVOH/PE/PA film – final packaging (absorbent pad not considered)
- 358 g of packed food (scaled down to 330 g)
- Food waste: 12 %

1b: improved packaging (shelf life of 16 days instead of 6 days; no separate aging packaging needed)

- 19 g PS/EVA/PE based “Darfresh” skin packaging (absorbent pad not considered); aging takes place in final packaging
- 300 g of packed food (scaled up to 330 g)
- Food waste: 3 %

Data provided by REWE, Sealed Air, OFI, Köhrer

- Total waste (product and packaging) reduced by 50 %
- The high environmental impact of top quality beef results in high environmental benefit of reduced food waste
- The differences concerning production and recovery of packaging are comparably small
- As a general rule: the more valuable / expensive the product, the more important is a robust protection of the product by high quality packaging

- Amount of packaging material per consumed food amount increases. Small increase of the total waste amount (product plus packaging)
- High environmental impact of cheese production results in high environmental benefit related to prevention of 5 % cheese waste
- This benefit is 2.5 times higher than the sum of the additional environmental impacts of
 - the production of an increased amount of packaging material
 - increased impact of transport (less load on truck)
 - higher emissions related to recovery of packaging
- Remark: Limited comparability of the two distribution methods “delicatessen counter” and “self service shelf”, which provide different offers, address different needs and target groups,

No packaging versus PE film
(prolonged shelf life, less moisture loss)
4,6 % food waste instead of 9,4 % (at the retailer)



Example 5 – cucumber

Basic input data

5a: previous situation

- No packaging
- Average weight of the cucumber: 480 g (own measurements, 11 products)
- Food waste: 9.4 %

5b: cucumber with packaging (prolonged shelf life, less moisture loss)

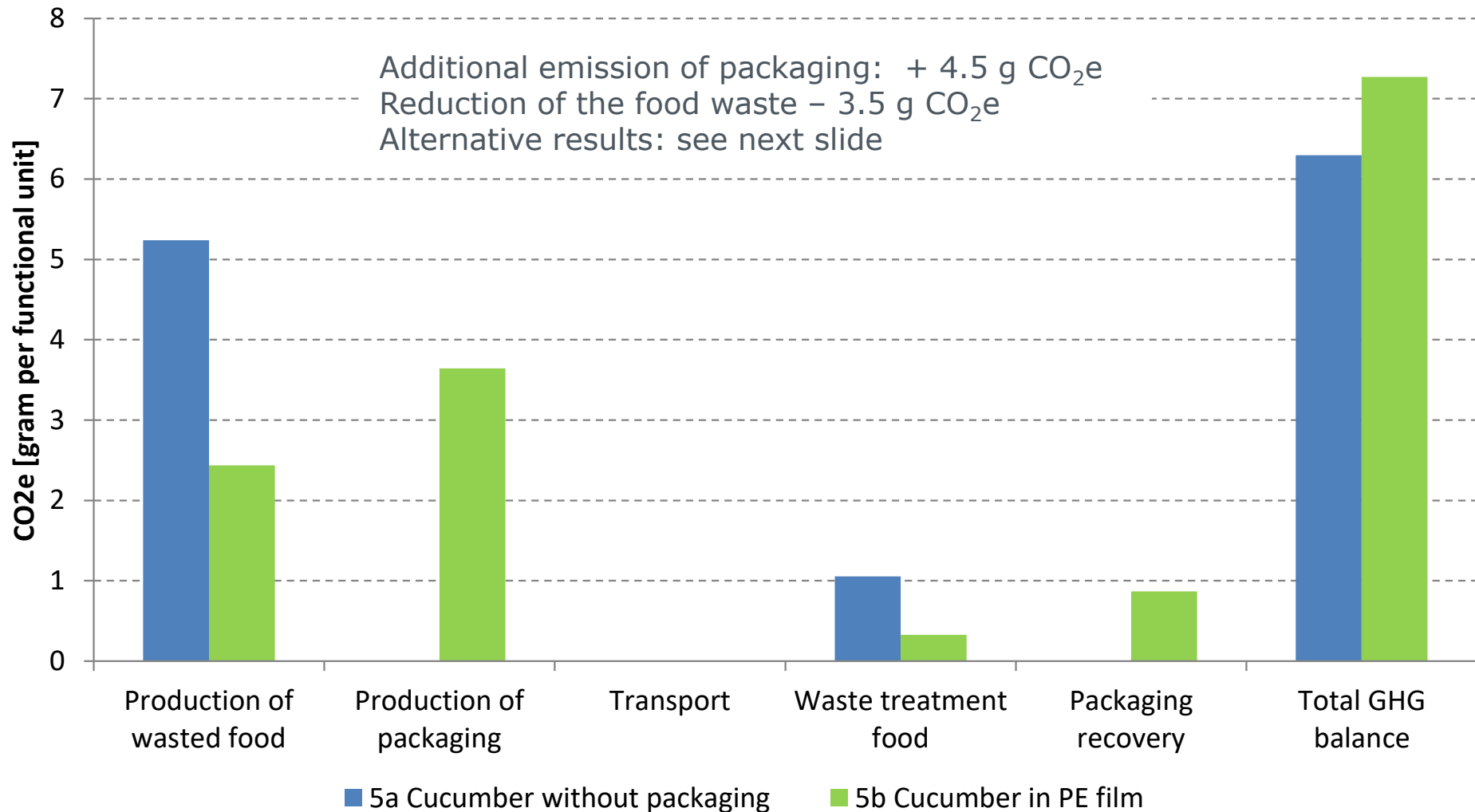
- Average weight of the film: 1.5 g (own measurements)
- Average weight of the cucumber: 480 g (own measurements)
- Food waste: 4.6 %

Data provided by MPREIS, OFI

Example 5 – cucumber: results

Carbon Footprint, excluding consumed food

“best case calculation” for cucumber without packaging



How the results for cucumber can change into net-benefits for the packed option

The environmental benefits of food waste reduction surpass the environmental impact of the film packaging, if ONE of the following conditions is fulfilled:

- The food waste is reduced by >6.3 percentage points (e.g. 3.7 % instead of 10 % food waste); in the example above the reduction is 4.8 % points (remark: the impact of food waste in households is not included in the calculation)
- The thickness of the film is reduced by 22 % (films with different thicknesses are used today, the calculation is based on an average value)
- The distance for transport is increased by 60 % (the calculation is based on local production)
- The cucumber is grown in a greenhouse (calculation: open field)
- 2/3 of film packaging is collected separately (calculation: 1/3)