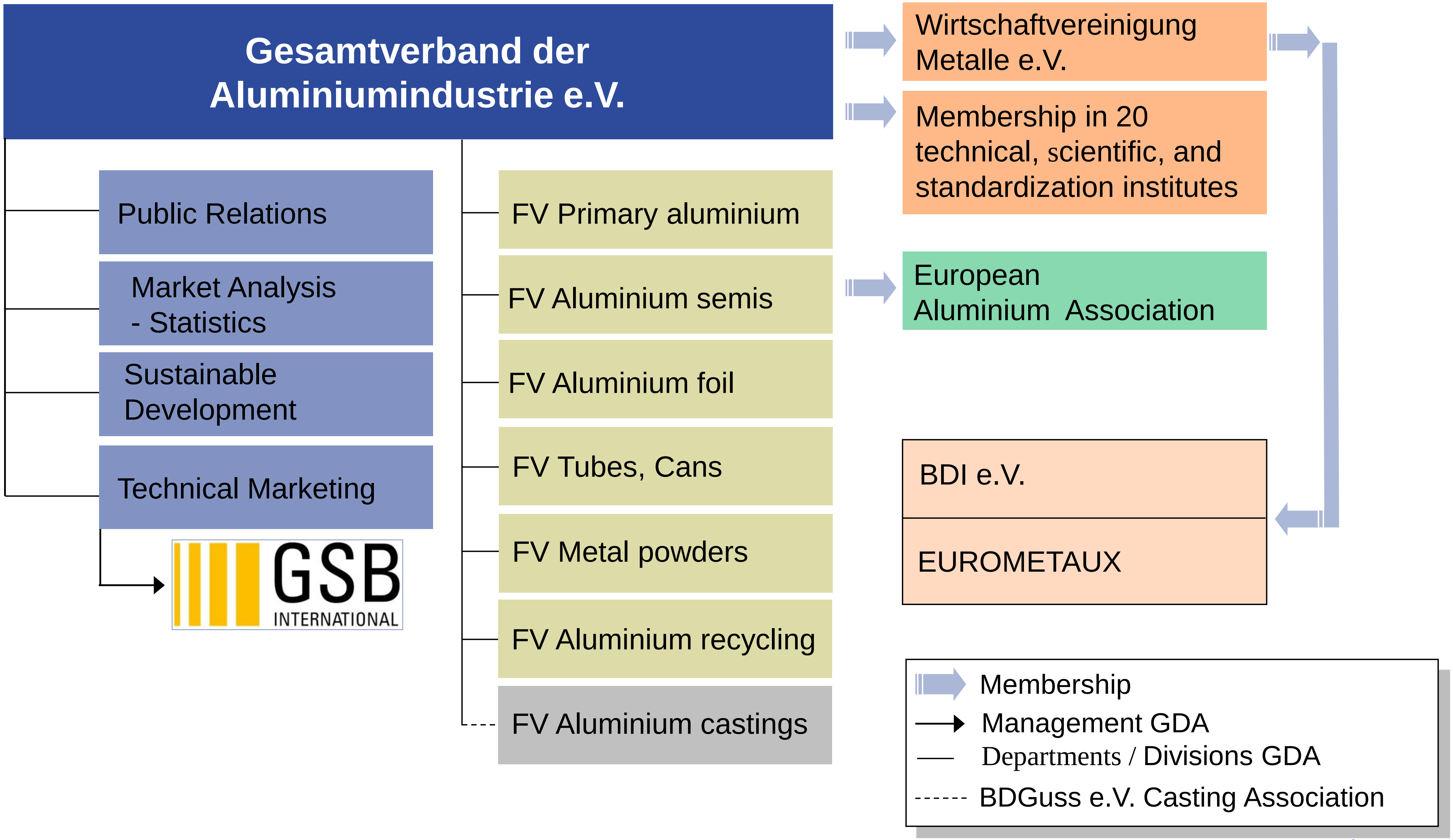
GESAMTVERBAND DER ALUMINIUMINDUSTRIE e.V.

„Environmental Benefits Through Lifecycle Assessment“

by Jörg H. Schäfer, Head of Recycling and Sustainability, GDA

March 19th 2015 at AMAP Colloquium, Aachen

Introduction of GDA - Organisation



Content

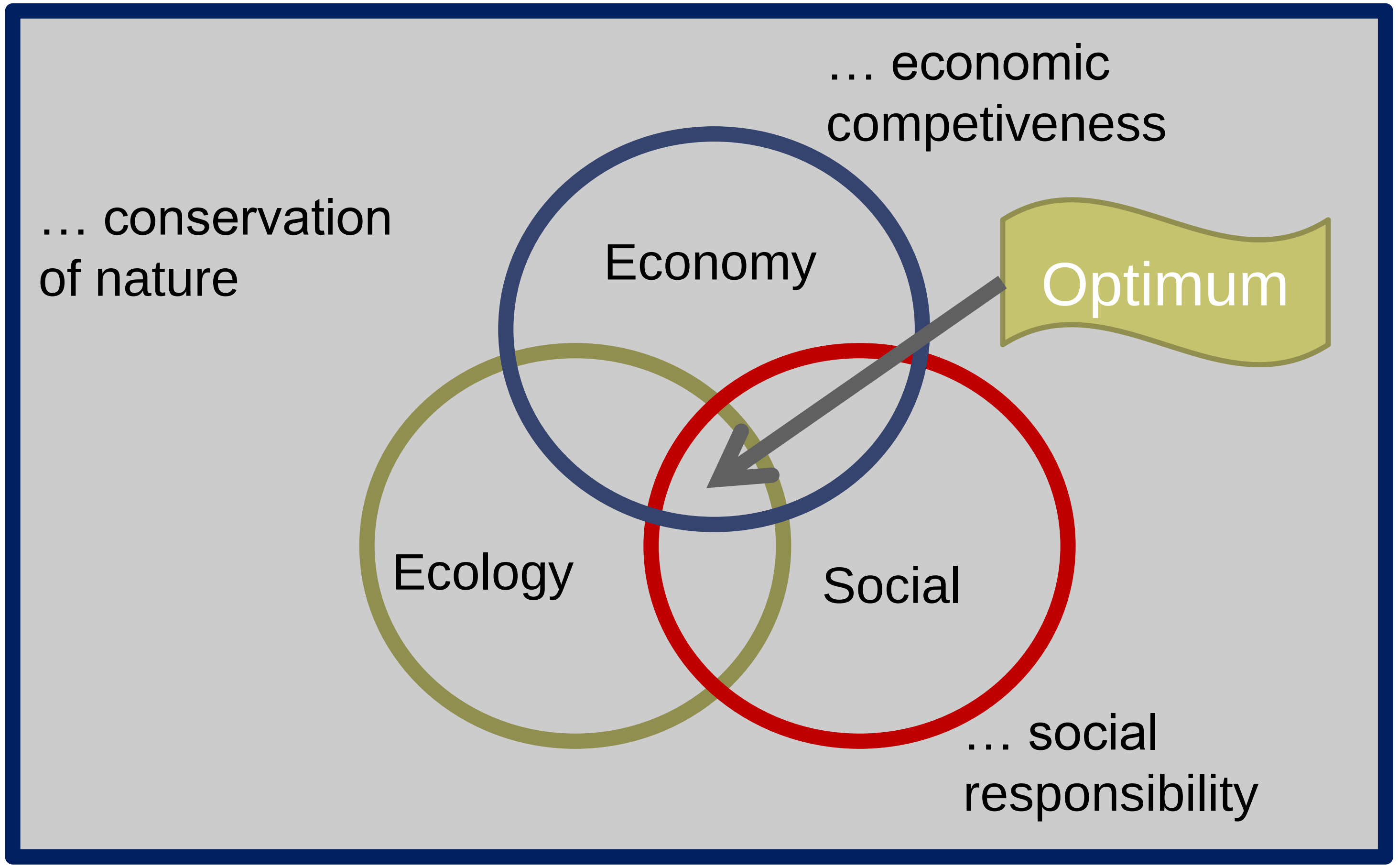
- Introduction
  - Sustainable Development
  - Life Cycle Assessment
  - Carbon Footprint
- LCAs for packaging applications
  - The role of recycling
  - Food Supply chain
- Environmental Product Declarations für Buildings & Constructions
- LCAs in automotive applications
- Conclusions

From technical considerations to a Sustainable Development
– Example aluminium

~ 1880	~ 1970	~ 1992
Engineering capacity at the forefront Environment and costs are subordinate	Oil crisis Aluminium turns into energy glutton and emissions producer	**Opportunity to position aluminium above sustainability**

This is the political context in society in which we find ourselves today. Environmental questions must not be neglected.

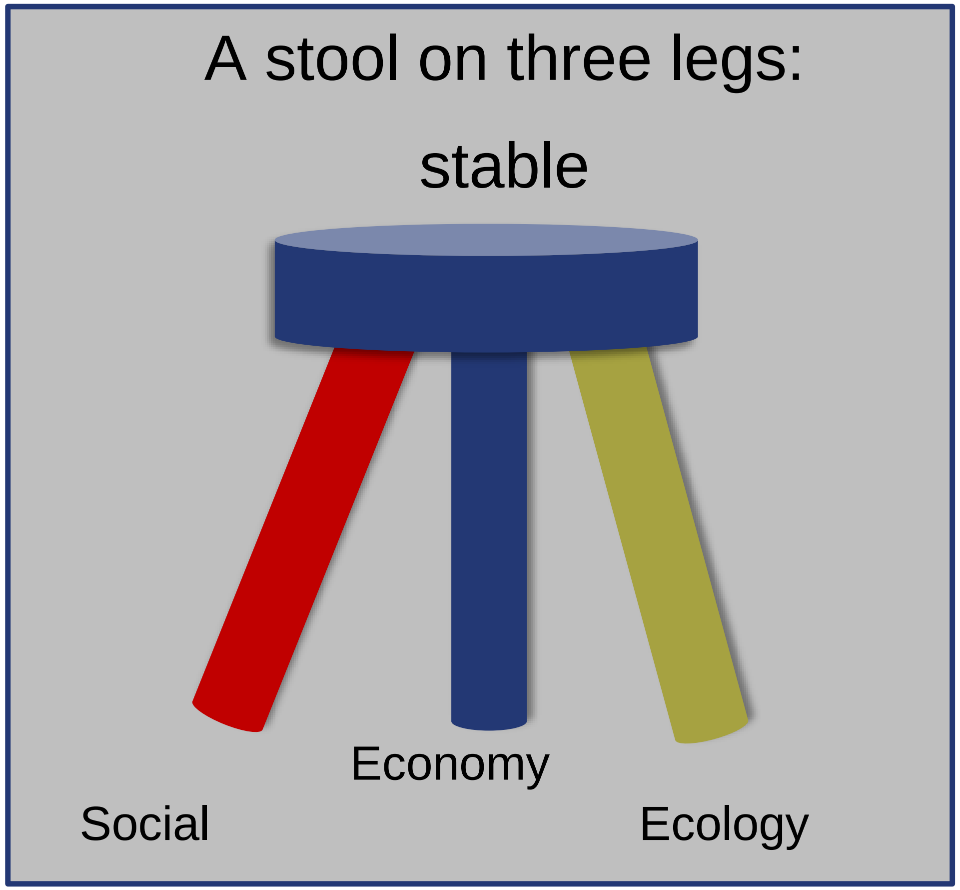
Sustainable development means…

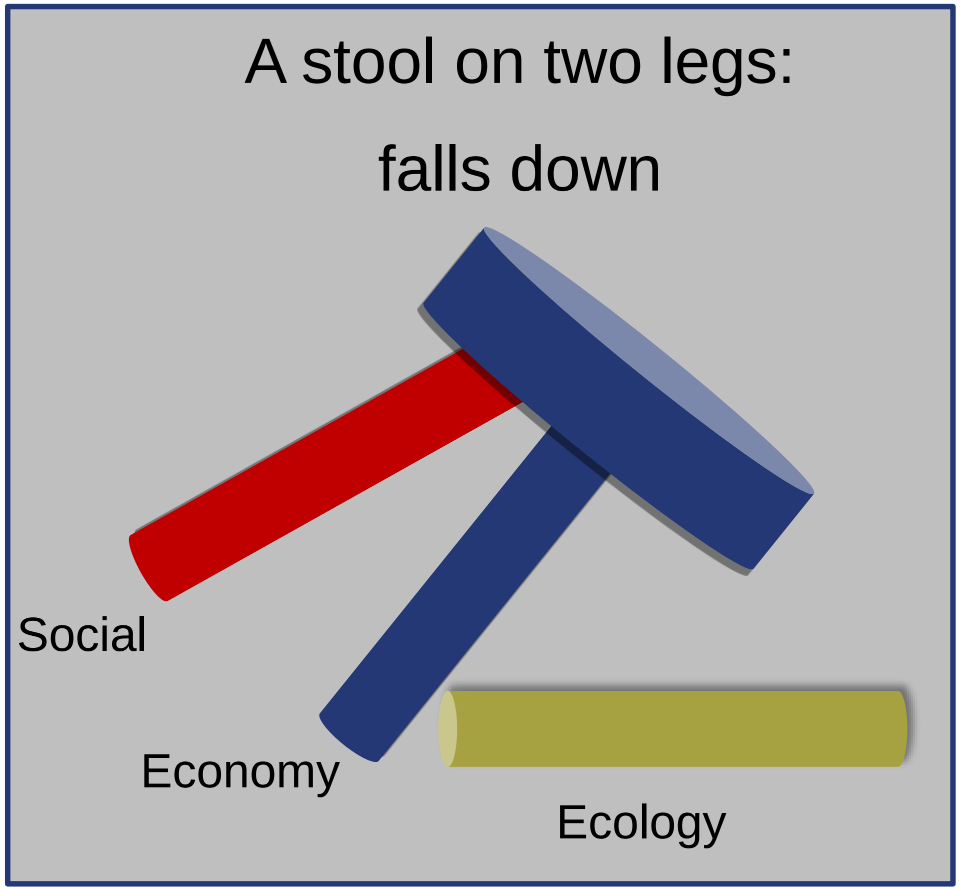


- The three components of sustainability are equally important
- It's NOT about maximizing only one of the components.
- The aim is to achieve an optimum situation.

Sustainable development as optimum of all three components

Illustration: sustainability as stool on three legs





Sustainable development which neglects one of the components doesn't work

Everyone’s talking about sustainability – what does it mean?

Federal Chancellor Dr. Angela Merkel

“Sustainability is based on a clear assumption: **In order to ensure that future generations have development opportunities, we need to think of economic competitiveness, social responsibility and the conservation of nature together.** What we do or don’t do today must not be allowed to take away from the opportunities of our children and grandchildren to live a life of prosperity in an intact environment. … ."

Ensuring development potential for future generations

Sustainable development in the German constitution

- In Germany the principle of sustainability was anchored in article 20a in the constitution in 1994 as state objective.

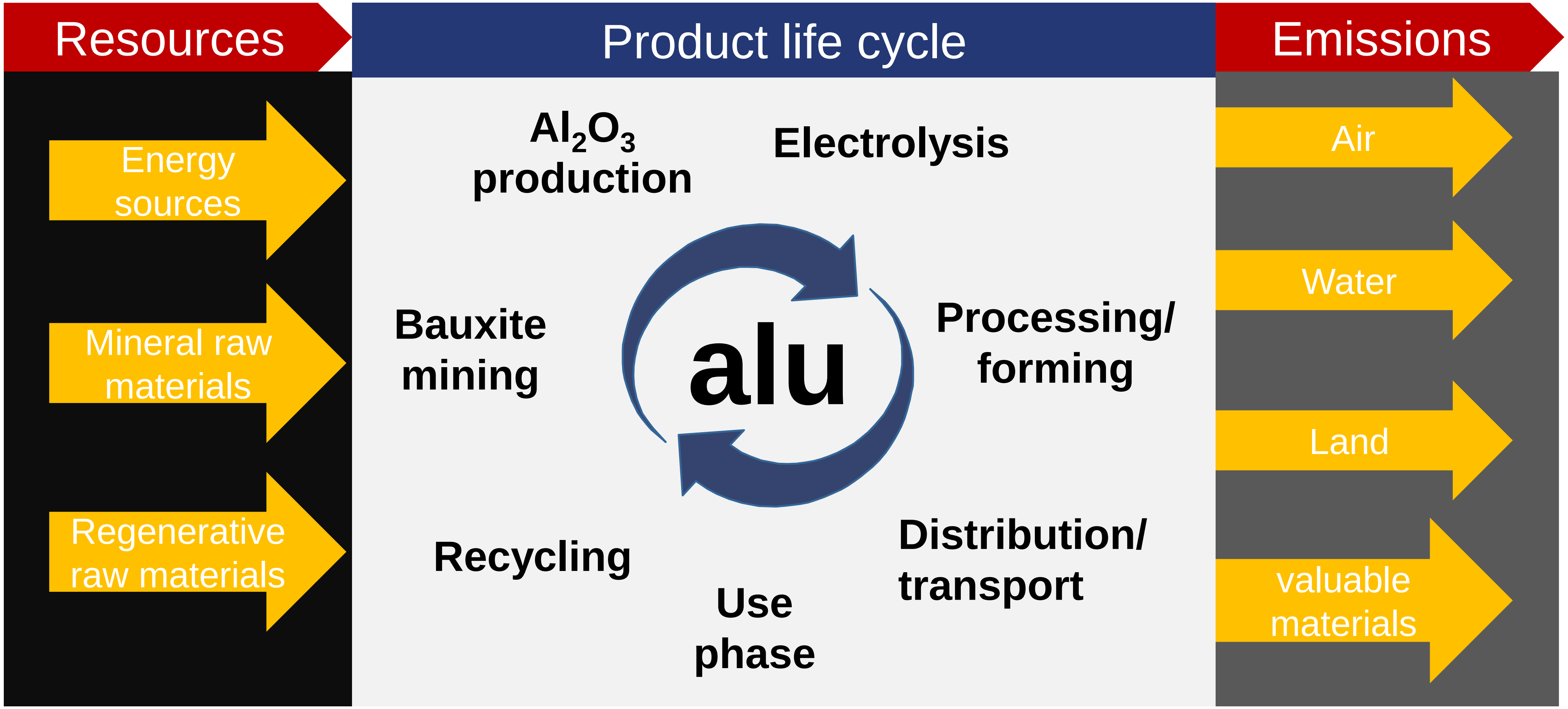
- Article 20a:

As responsibility for future generations the state **will conserve nature** … in the framework of the constitutional order by legislation and according to the law… .

➤ A social market economy is replaced by a sustainable market economy.

➤ SD implemented as an overarching societal objective

Beginning 90th: Standardization of Life Cycle Assessment



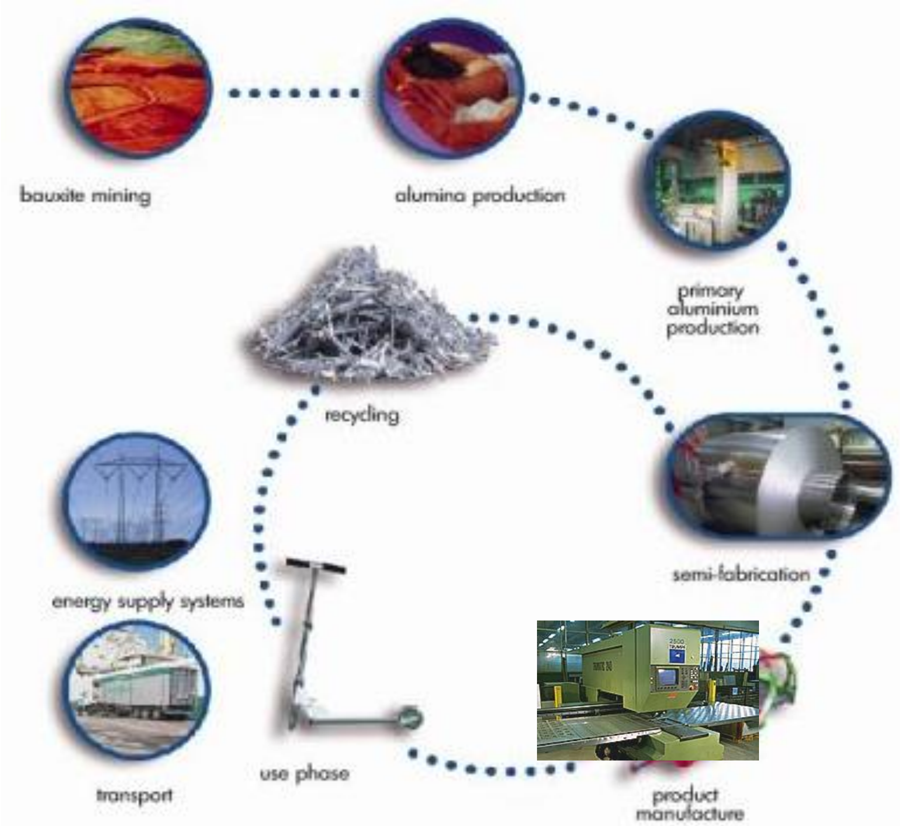
Today: LCA is the only tool to assess environmental performance of products

The Importance of LCAs for Al

Consideration of the entire life cycle:

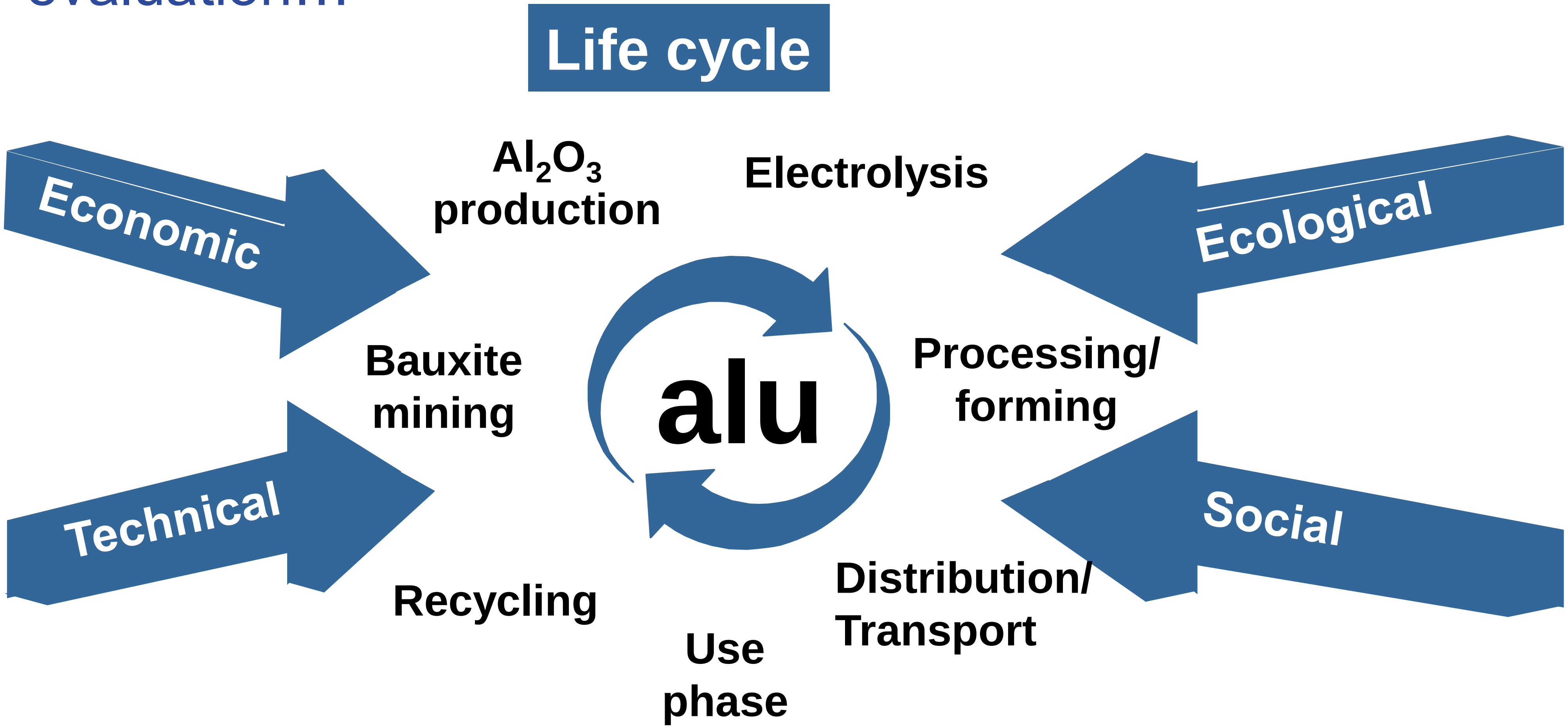
aluminium offers e.g.

- high energy demand for
  - electrolysis
- relative energy savings for
  - transport
  - recycling



Consideration of the entire life cycle is essential for aluminum to get a balanced picture.

Sustainability and life cycle assessment as basis for making an evaluation…

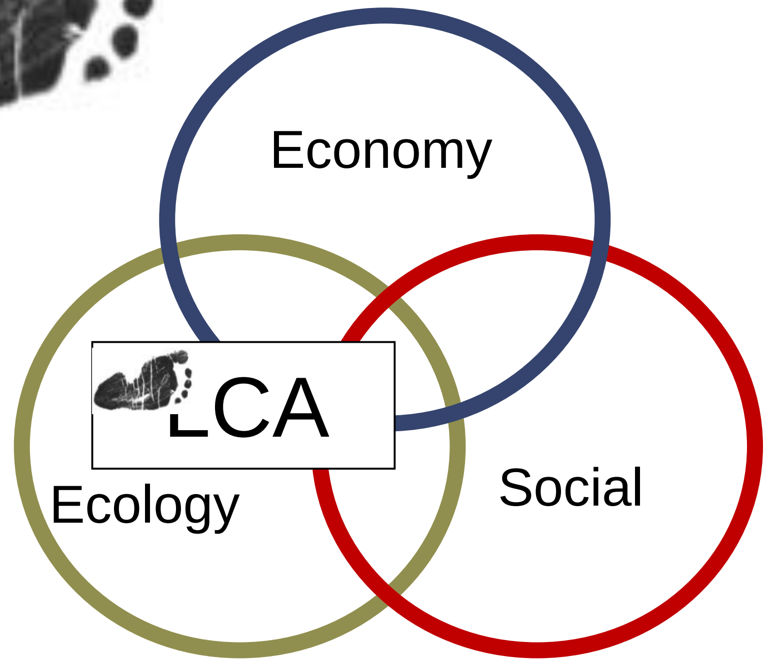


… of our industry and our products

Other approaches / Concepts: The Carbon Footprint

The Aluminium Industry

- is dedicated to a Sustainable Development.
- uses LCAs to optimize and evaluate the environmental performance of its products.



The Carbon Footprint is a single indicator in an LCA and does not refelct other environmental aspects than Climate Change

The Carbon Footprint is a single indicator and one part of an LCA. This has to be reflected in the sustainability debate and environmental discussions.

Environmental indicators in an LCA

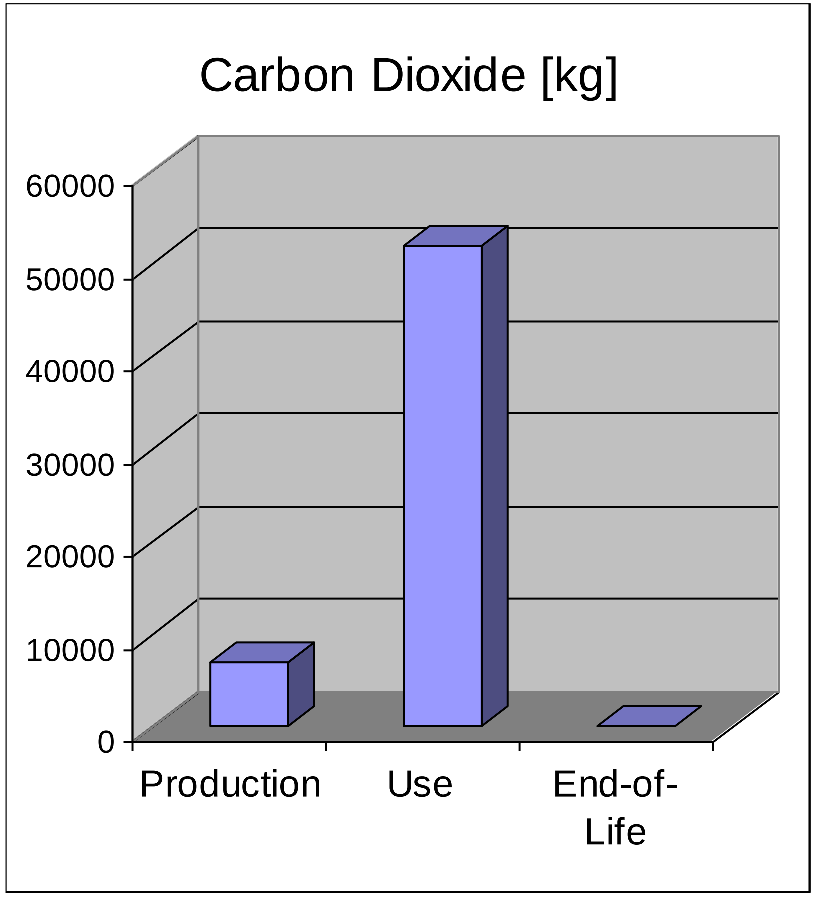
- **Greenhouse effect**
- Eutrophication
- Acidification
- Summer smog
- Ozone depletion
- Fossil resources
- Cumulative energy use (renewable/non-renewable)
- …

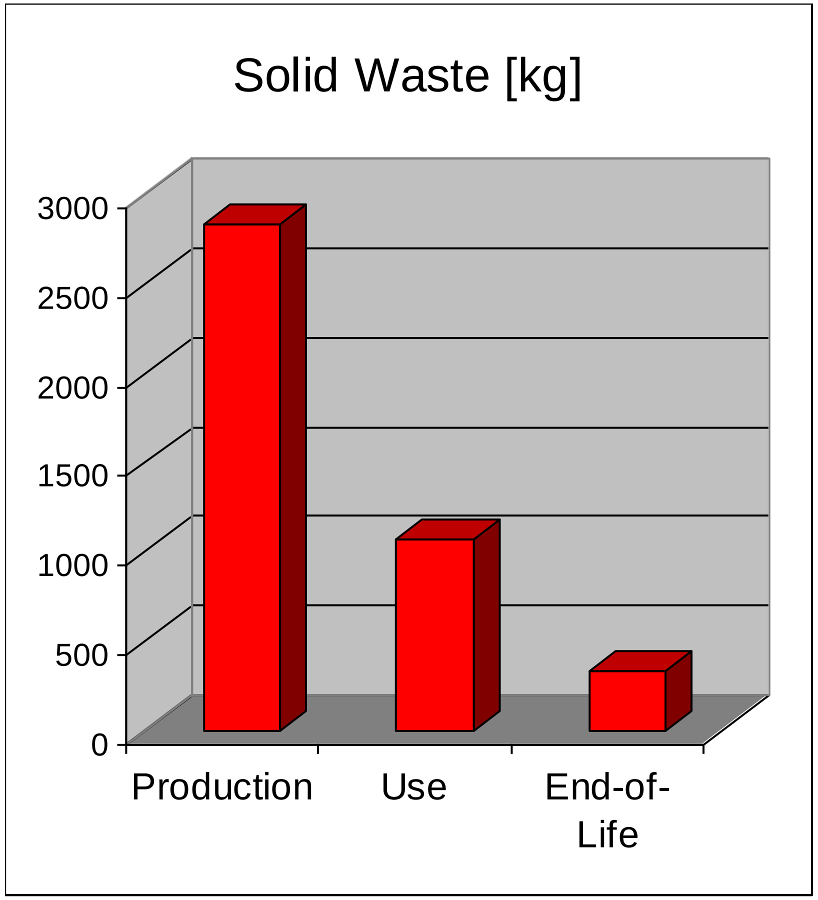
…

If only the Carbon Footprint is investigated no fields of tension are visible or if information is lacking

What happens if other indicators are considered ?

Example of a car

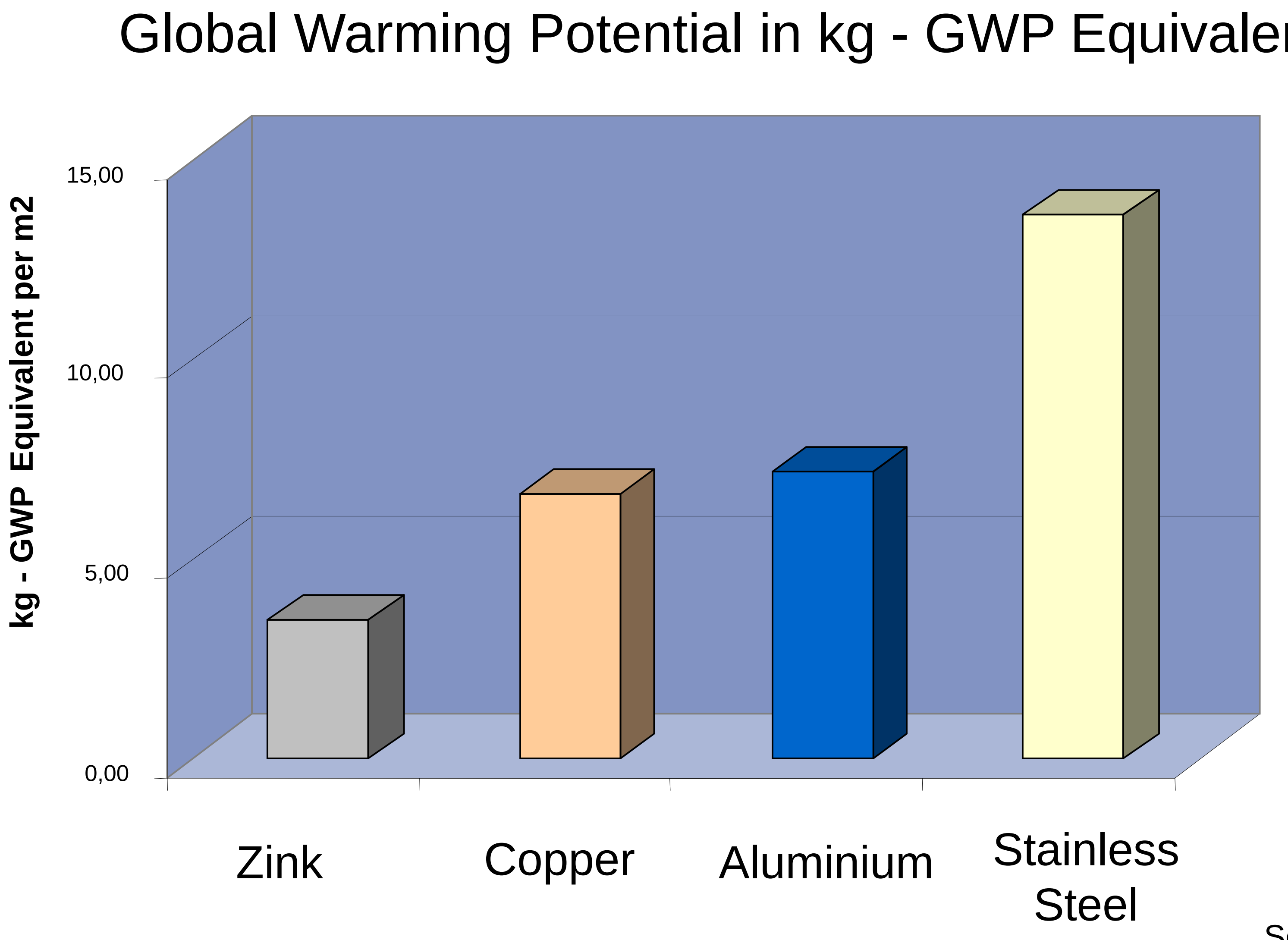




Significance of the use phase differs tremendously!
The CF alone can not highlight the tensions.

Dr. Gerald Rebitzer, Alcan, Data from [USCAR AMP Project 1998] (generic US family sedan)

What about the building sector – LCA of roofing materials



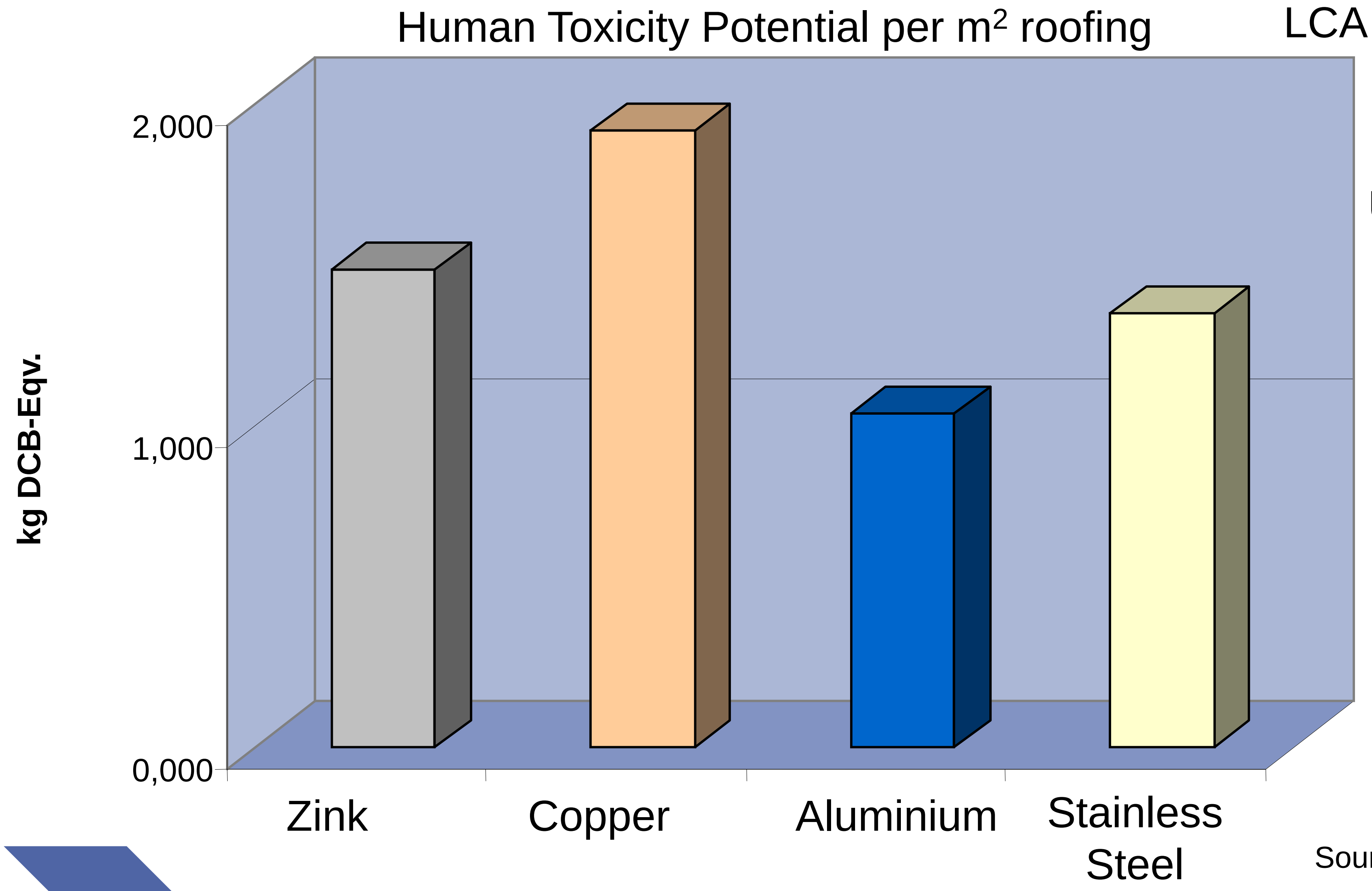
95%
Recycling Rate!

Use phase
not included!

Source: Fraunhofer Institute, ISI

Other Indicators than Global Warming Potential

LCA of roofing materials



Methodology under discussion

Source: Fraunhofer Institute, ISI

What is more important „health“ or „Climate“ ?

LCA in the packaging area – beverage cans

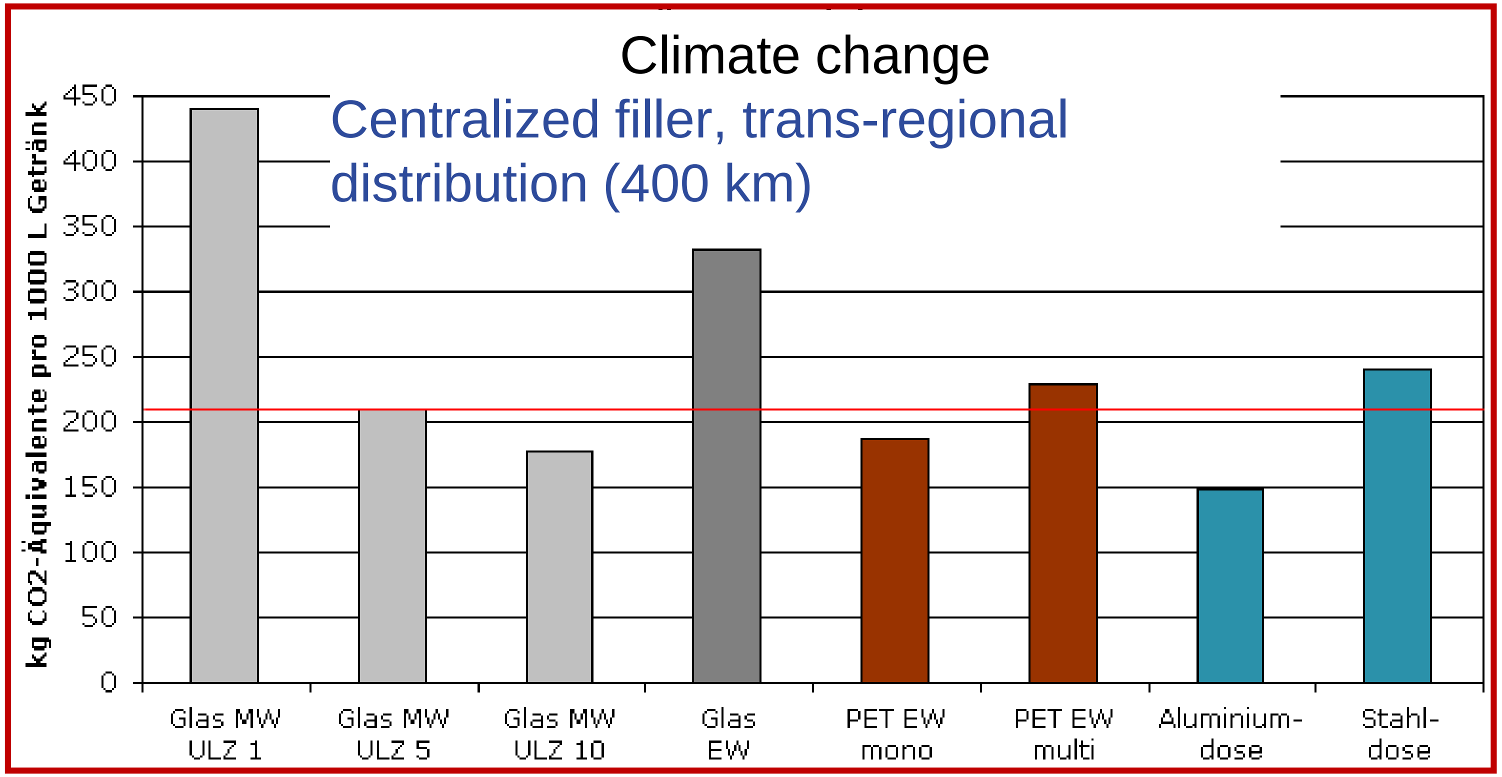
LCA for beverage containers – UBA III

UBA I 1995
Al beverage can
negative

UBA II 2001
Al beverage can
negative/neutral

UBA III 2012-15
Al beverage can
??

Umwelt Bundes Amt
Für Mensch und Umwelt

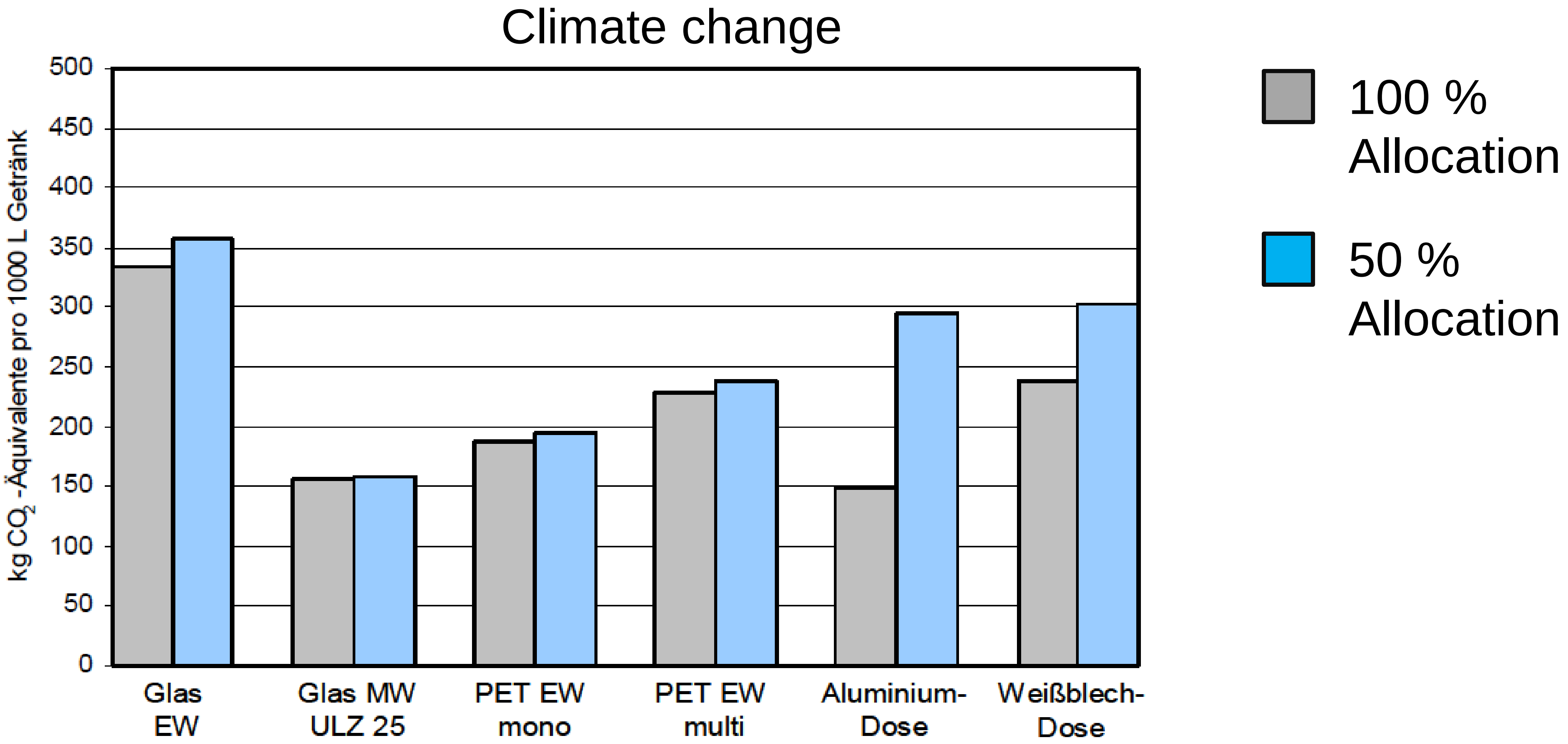


Key parameters are

- distribution distance
- **recycling approach**
- **tripage rate**

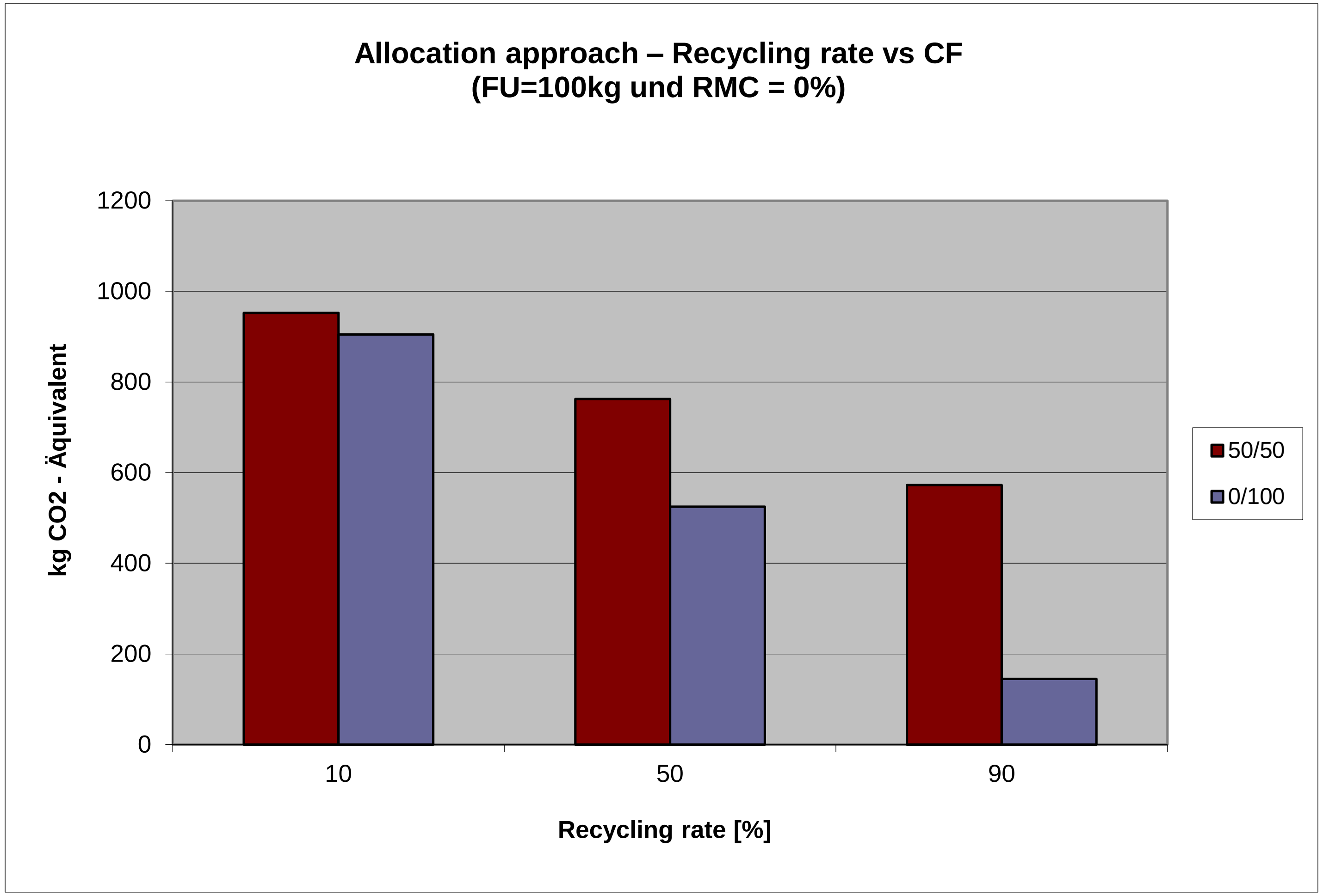
Conclusions are the base for the deposit system in Germany

The recycling approach of UBA



So far, UBA preferred the 50/50% allocation approach

The effects of the choice of the recycling approach



50%/50%:
Gives credits for the use of recycled metal and end-of-life recycling equally shared

0%/100%:
Gives credits exclusively for end-of-life recycling

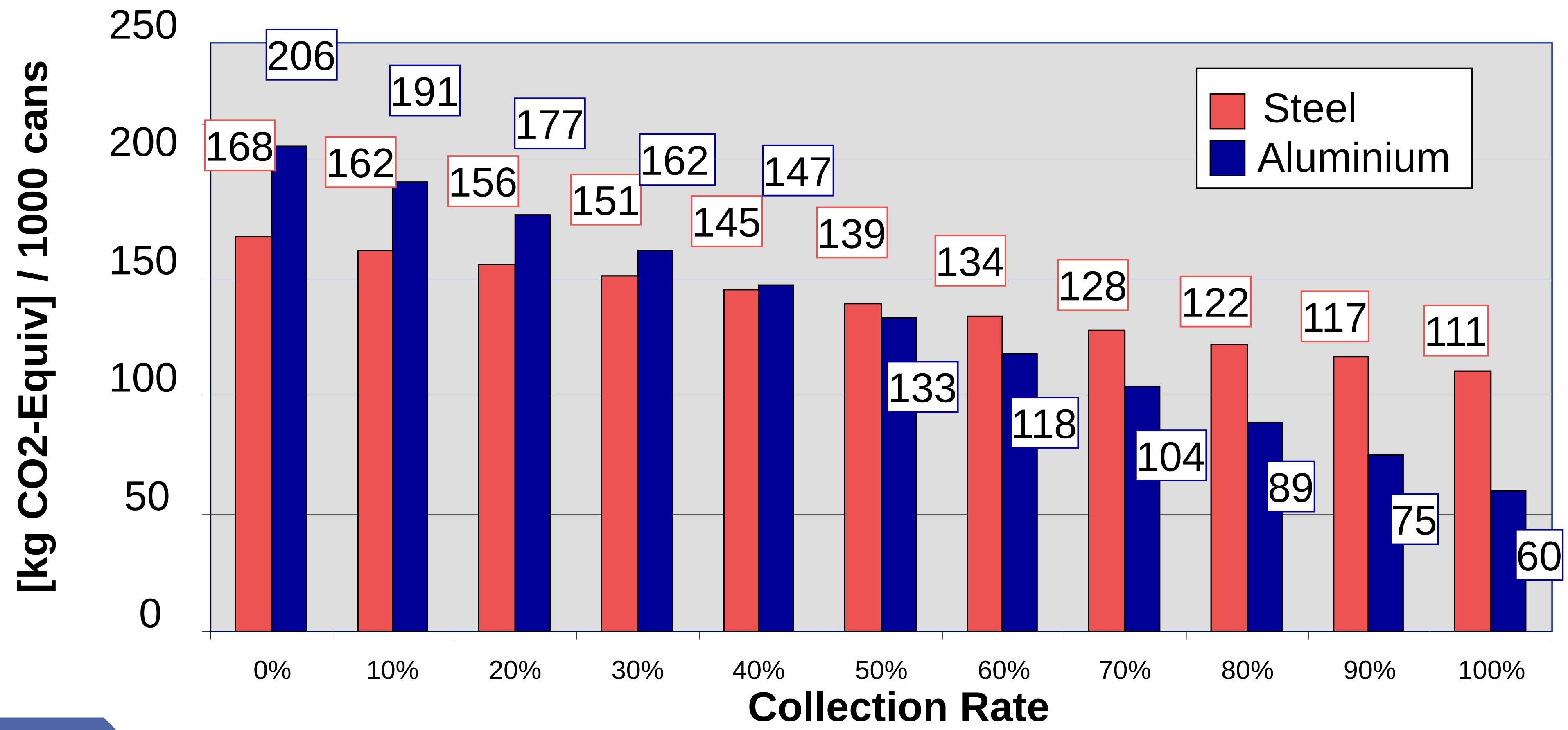
Considerable difference

Why is 100% allocation for aluminium plausible

- The 0/100 approach creates a far greater incentive to recycle aluminum scrap.
- Recycled aluminum is always the maximum replacement for primary aluminum, which is reflected in the 0/100 method.
- A product that absorbs large amounts of recycling aluminum, but does not itself emit any aluminum recycling, contributes to a situation, whereby aluminum is no longer available to future generations.
- Due to the circumstances of the aluminum markets, increasing the recycling metal content (RMC) in a product would only shift the unavoidable use of primary aluminum to other products. The ecological consequences on the system of the total aluminum market (aluminum pool) would not change overall.
- Due to the fact that aluminum demand is continuing to grow and metal products frequently have a very long service life, the scrap supply is limited for the production of new products.

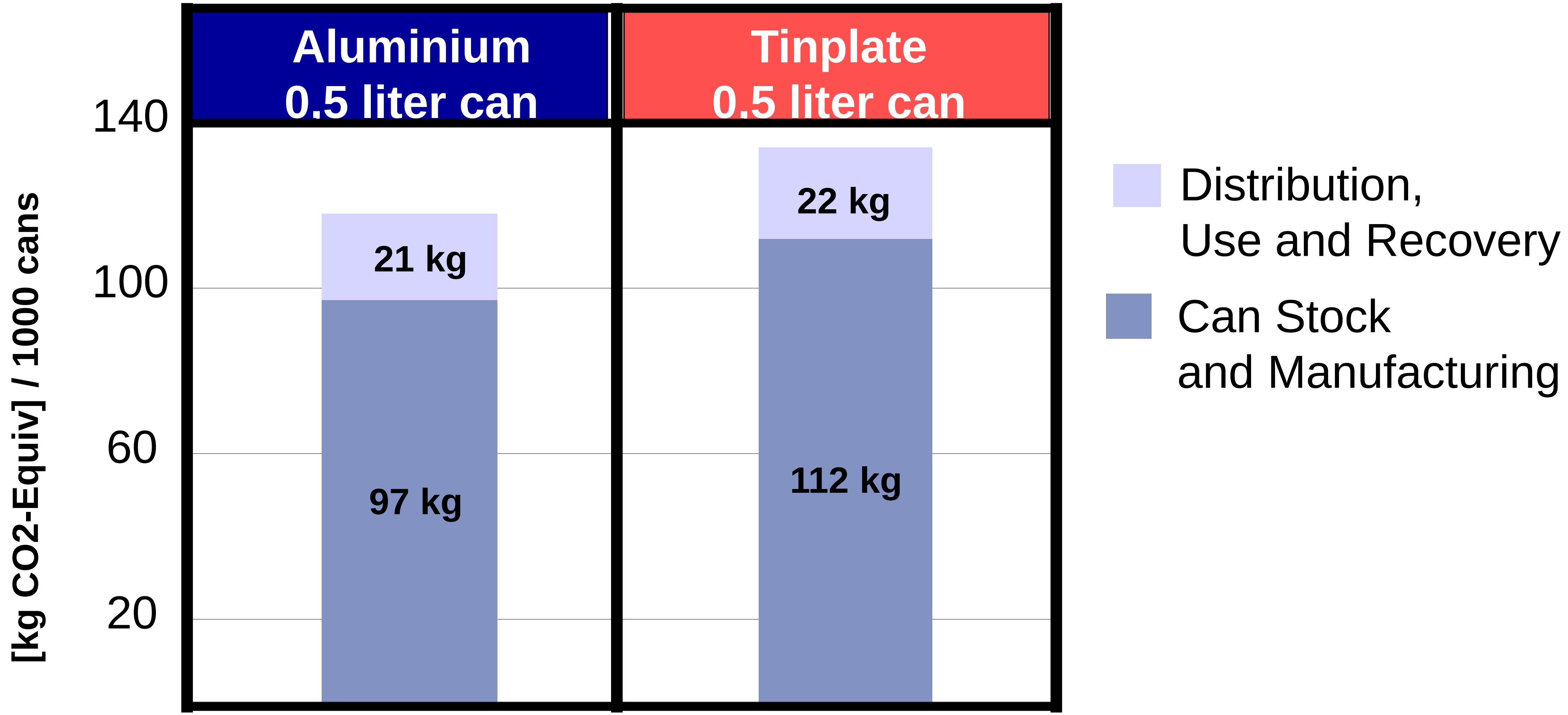
Strong arguments in favour of end-of-life recycling

Global Warming Potential 0,5 l beverage can



Higher collection rate means better performance for Al beverage can

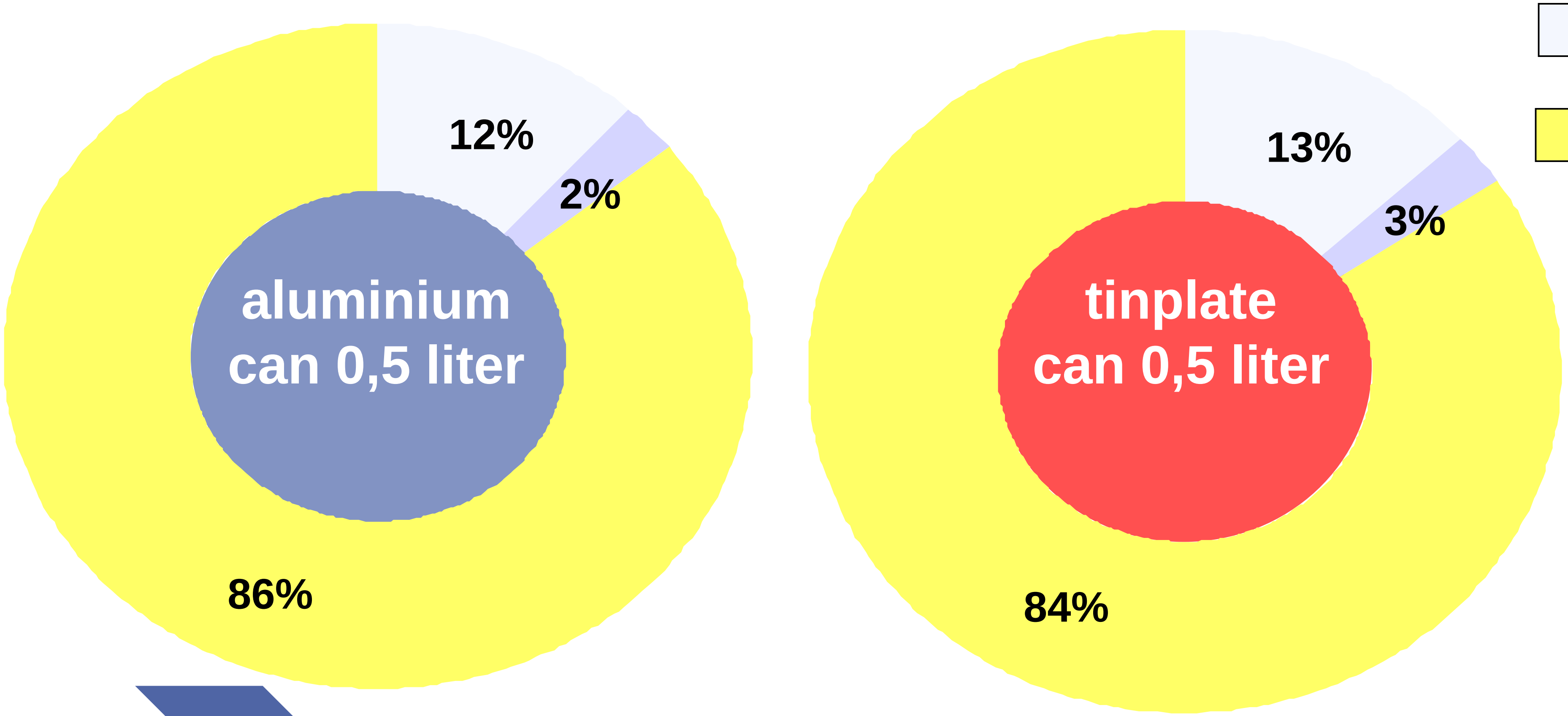
Carbon Footprint – break down for a 0,5 liter can: 60% recycling rate



Carbon Footprint of 500 liter beer supply ready for consumption in 0,5 liter cans*

841 kg CO_2-Equiv.

857 kg CO_2-Equiv.



Distribution, Use and Recovery

Can Stock and Manufacturing

beer

*60% recycling rate

Beer more climate intensive than packaging

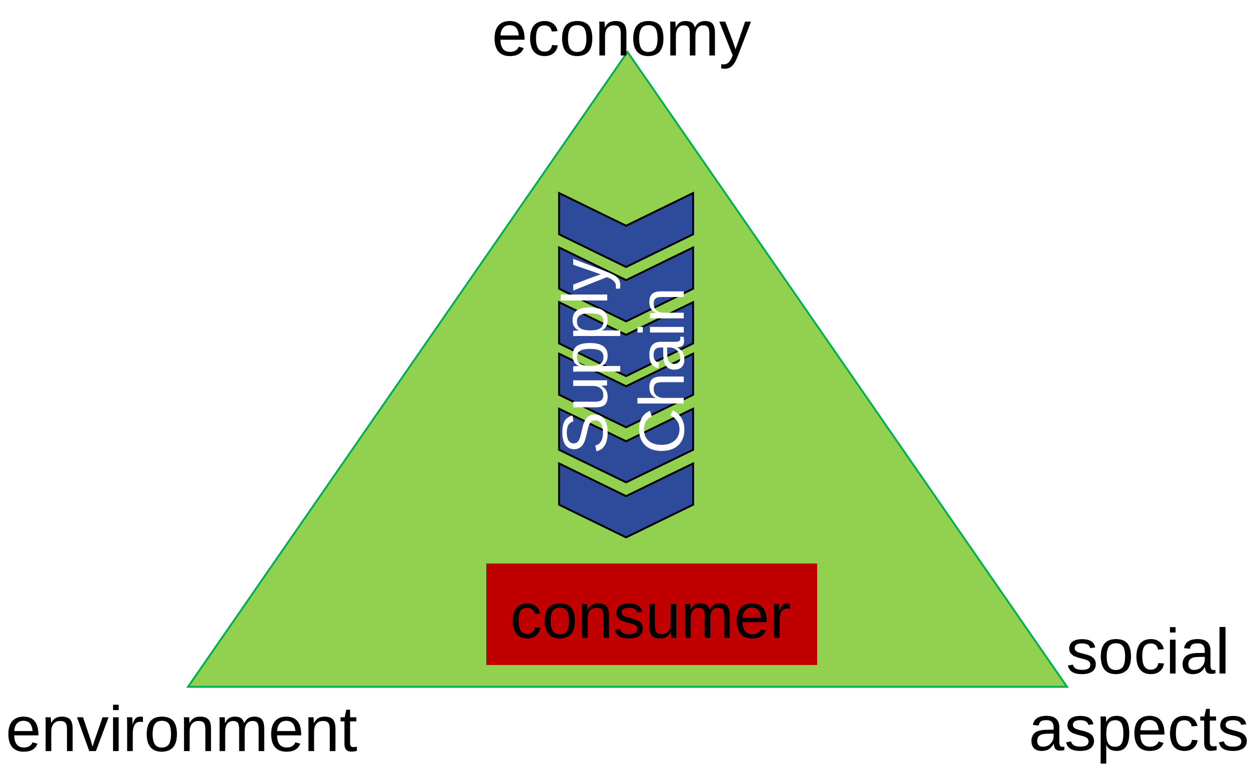
How to consider sustainability of packaging ?

Consideration of

life cycle of packaging

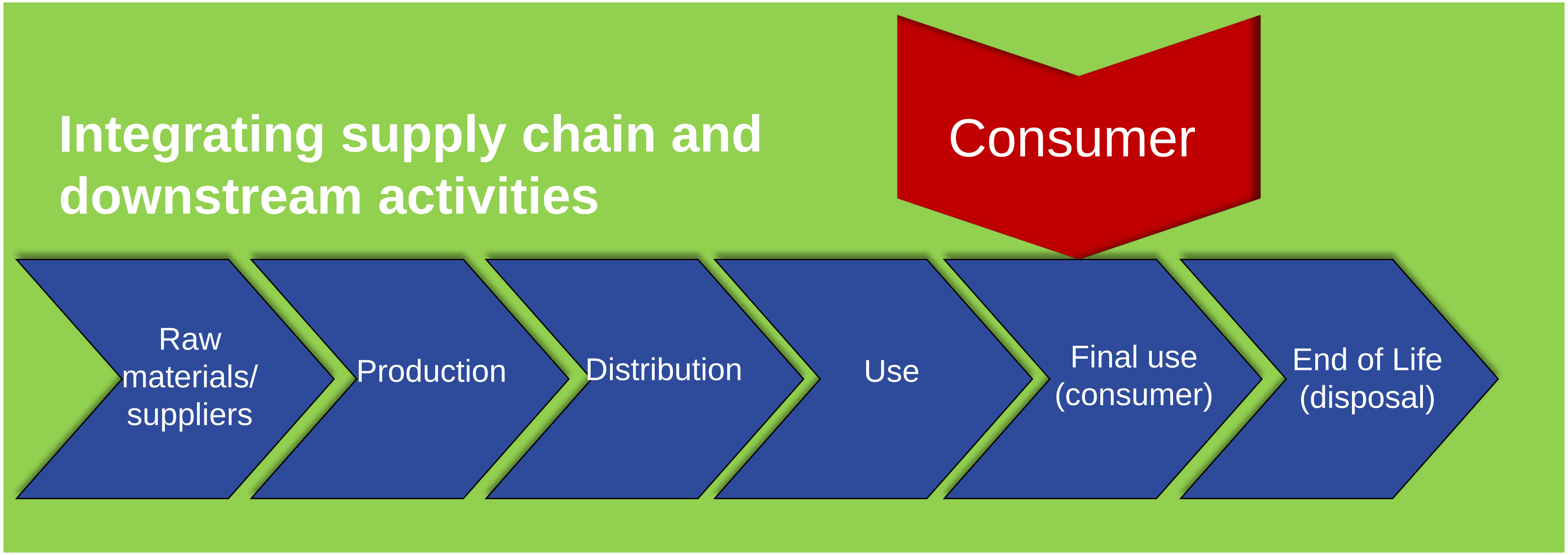
life cycle of food supply

role of the consumer



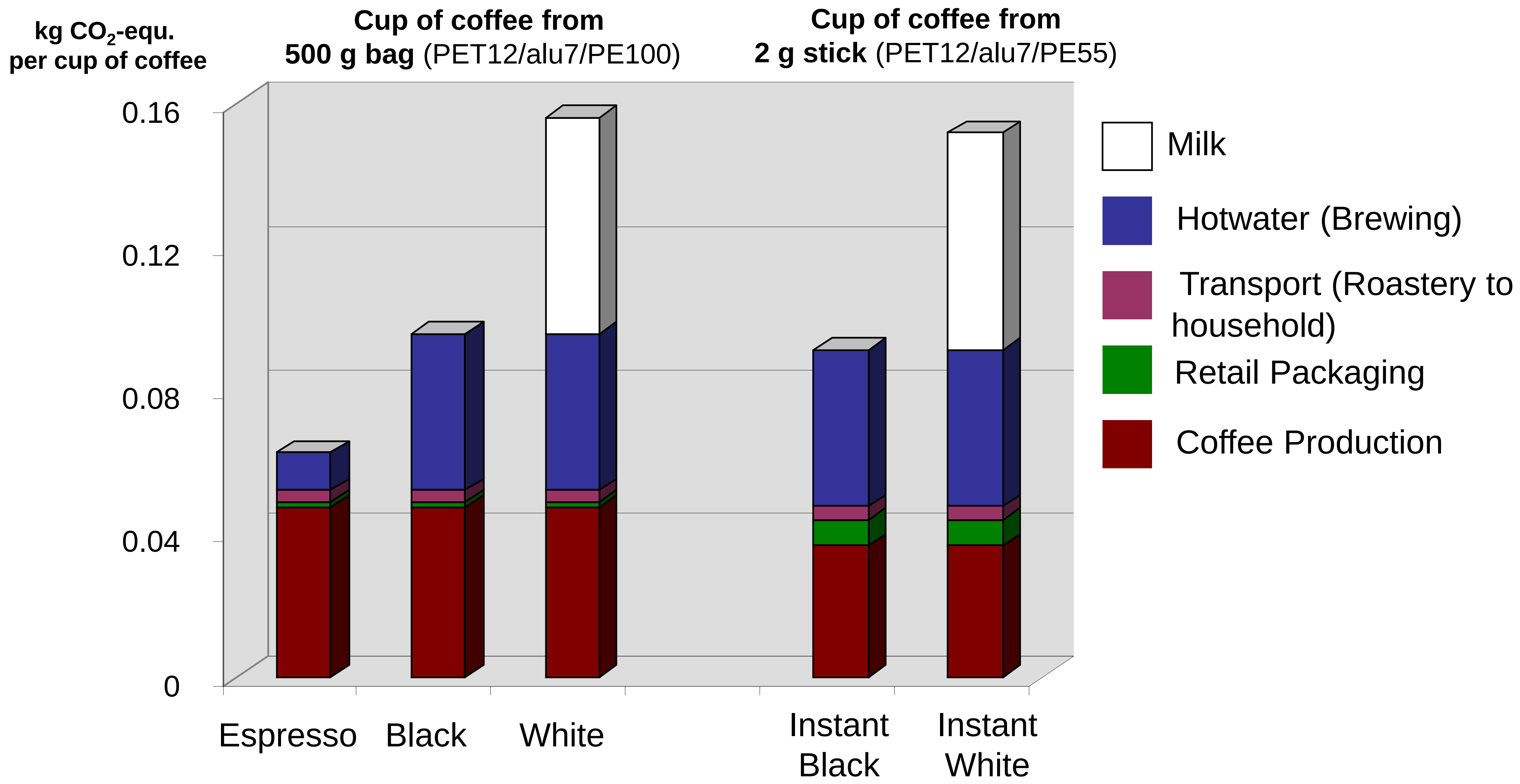
Evaluation of sustainability performance needs more than just looking into packaging

Supply chain of packaging



Extension to complete system

Example Coffee: GHG-Emissions



ESU-services, 2008

Conclusions – Coffee

- CO_2 contribution of the packaging in the food supply system is relatively low
- Production of coffee (due to high processing) has a relatively high share

A small investment in packaging saves already a large amount of resources used in the supply chain before consumption

Conclusions – Coffee (2)

- Portion packed (stick pack) has a relatively higher share compared to family packs.
- However, they may contribute to the prevention of wastage and spoilage, thus even saving “overall” resources.

„Best“ packaging depends on the specific consumption pattern and application

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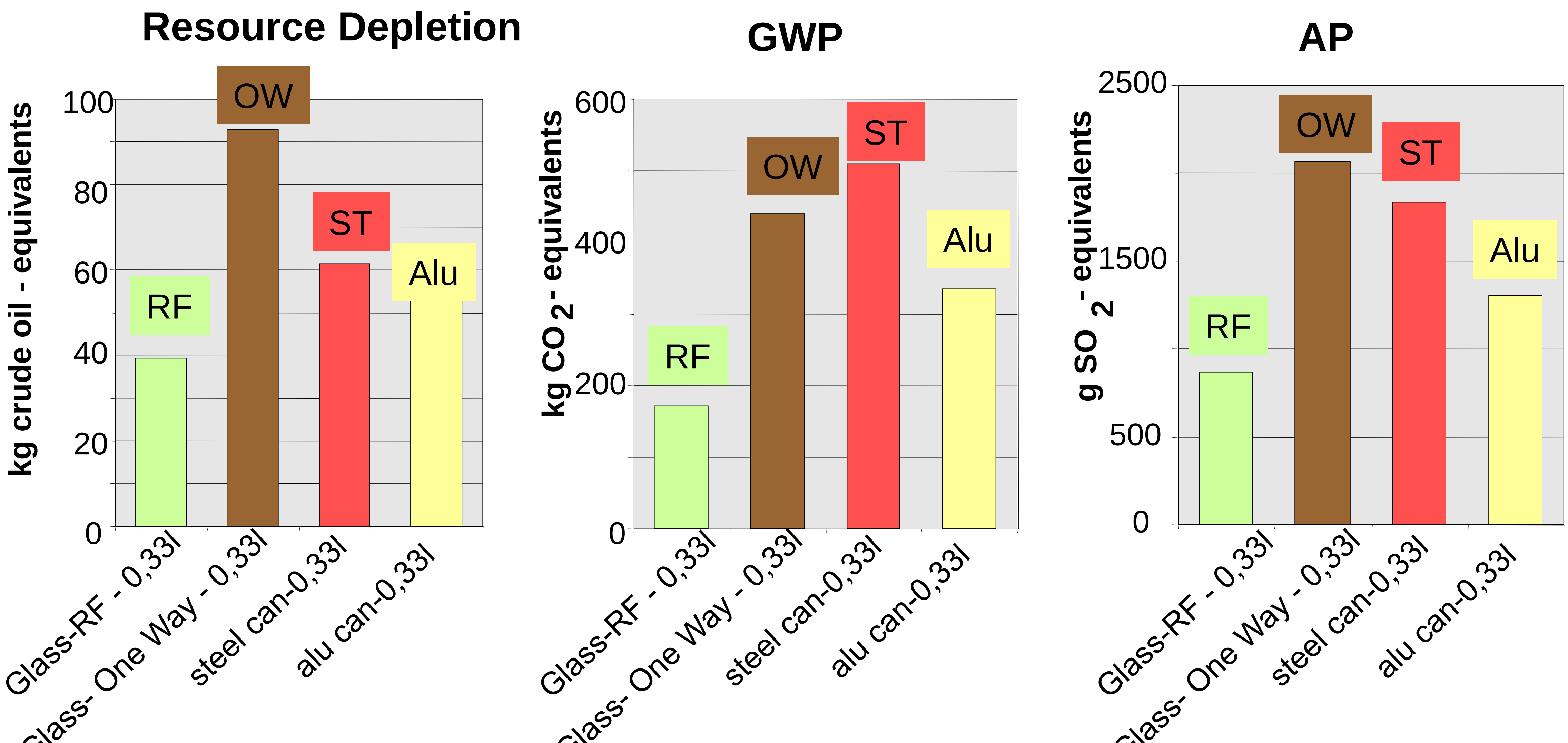
WHAT IS ENVIRONMENTALLY SPEAKING BETTER: REFILLABLE GLAS OR ALUMINIUM BEVERAGE CAN ?

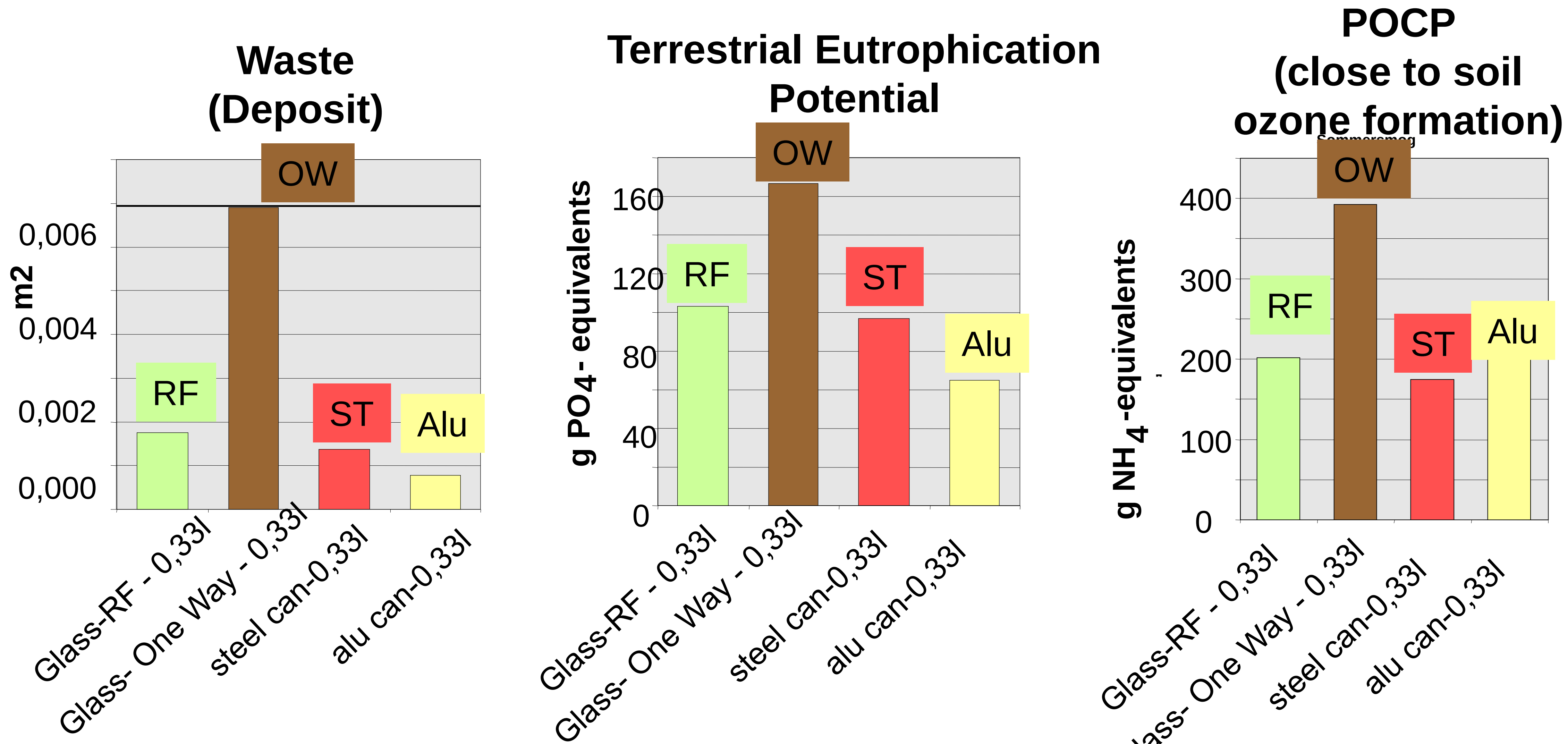
HAVE A GUESS !

GERMAN EPA*: LCA of drinks packaging II, 1 – results (0,33l systems, CO_2 containing drinks)



*Umweltbundesamt, study of 2000

GERMAN EPA*: LCA of drinks packaging II, 1 – results (0,33l systems, CO2 containing drinks)

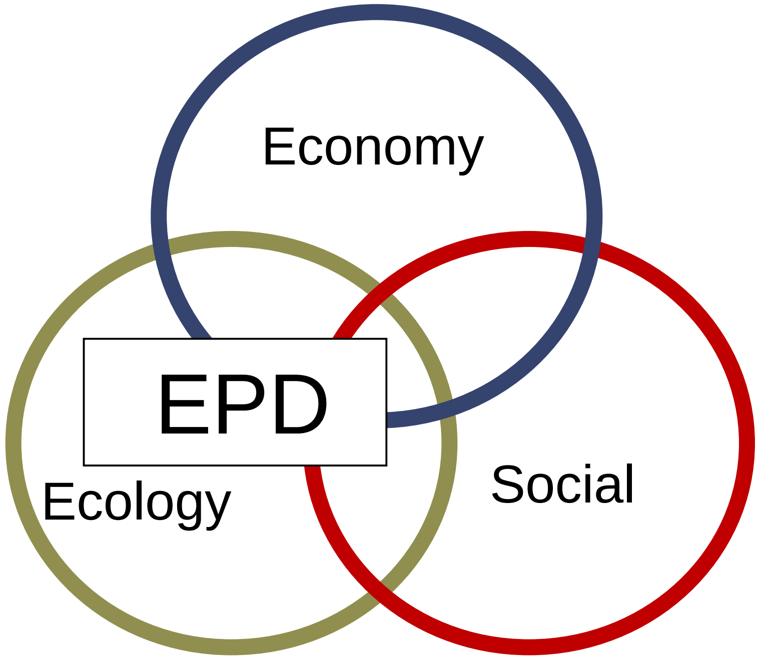


*Uweltbundesamt, study of 2000

WHAT IS ENVIRONMENTALLY SPEAKING BETTER: REFILLABLE GLAS OR ALUMINIUM BEVERAGE CAN ?

DIFFICULT TO JUDGE !

The role of EPDs (Environmental Product Declarations)



EPD are a information system to supply harmonized environmental information

The GDA EPD Programme for Building & Construction

ENVIRONMENTAL PRODUCT DECLARATION
in accordance with ISO 14025 and EN 15804

Declaration holder	Gesamtverband der Aluminiumindustrie e.V. (German Aluminium Association GDA)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GDA-20130258-IBG1-EN
ECO EPD Ref. No.	ECO-00000018
Issue date	18.11.2013
Valid until	17.11.2018

Blank aluminium sheet
GDA – Gesamtverband der Aluminiumindustrie e.V. (German Aluminium Association)

www.bau-umwelt.com / https://epd-online.com

ENVIRONMENTAL PRODUCT DECLARATION
in accordance with ISO 14025 and EN 15804

Declaration holder	Gesamtverband der Aluminiumindustrie e.V. (German Aluminium Association GDA)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GDA-20130259-IBG1-EN
ECO EPD Ref. No.	ECO-00000019
Issue date	18.11.2013
Valid until	17.11.2018

Coil-coated aluminium sheet
GDA – Gesamtverband der Aluminiumindustrie e.V. (German Aluminium Association)

www.bau-umwelt.com / https://epd-online.com

ENVIRONMENTAL PRODUCT DECLARATION
in accordance with ISO 14025 and EN 15804

Declaration holder	Gesamtverband der Aluminiumindustrie e.V. (German Aluminium Association GDA)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GDA-20130260-IBG1-EN
ECO EPD Ref. No.	ECO- 00000020
Issue date	18.11.2013
Valid until	17.11.2018

Cold-formed aluminium sheet for exterior applications
GDA – Gesamtverband der Aluminiumindustrie e.V. (German Aluminium Association)

www.bau-umwelt.com / https://epd-online.com

ENVIRONMENTAL PRODUCT DECLARATION
in accordance with ISO 14025 and EN 15804

Declaration holder	Gesamtverband der Aluminiumindustrie e.V. (German Aluminium Association GDA)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GDA-20130261-IBG1-EN
ECO EPD Ref. No.	ECO-00000021
Issue date	18.11.2013
Valid until:	17.11.2018

Aluminium composite panels
GDA – Gesamtverband der Aluminiumindustrie e.V. (German Aluminium Association)

www.bau-umwelt.com / https://epd-online.com

4 EPDs on building products

Content of an EPD

5. LCA: Results

SYSTEM BOUNDARIES (X = INCLUDED IN THE LCA; MND = MODULE NOT DECLARED)

Product stage			Construction process stage		Use stage							End-of-life stage				Benefits and loads beyond the system boundary
Raw material supply	Transport	Production	Transport	Assembly	Use / Application	Maintenance	Repairs	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction	Transport	Waste treatment	Landfilling	Re-use, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X

LCA RESULTS – ENVIRONMENTAL IMPACT: 1m²

Parameter	Unit	A1 - A3	D
Global Warming Potential	[kg CO_2 equiv.]	3.7E+1	-2.4E+1
Ozone Depletion Potential	[kg CFC11 equiv.]	8.1E-7	-7.4E-7
Acidification Potential	[kg SO_2 equiv.]	1.7E-1	-1.4E-1
Eutrification Potential	[kg $(PO_4)^3$ equiv.]	1.0E-2	-7.1E-3
Photochemical Ozone Creation Potential	[kg ethene equiv.]	1.2E-2	-7.9E-3
Abiotic Depletion Potential non-Fossil Resources	[kg Sb equiv.]	2.1E-5	-1.3E-5
Abiotic Depletion Potential Fossil Fuels	[MJ]	5.5E+2	-2.6E+2

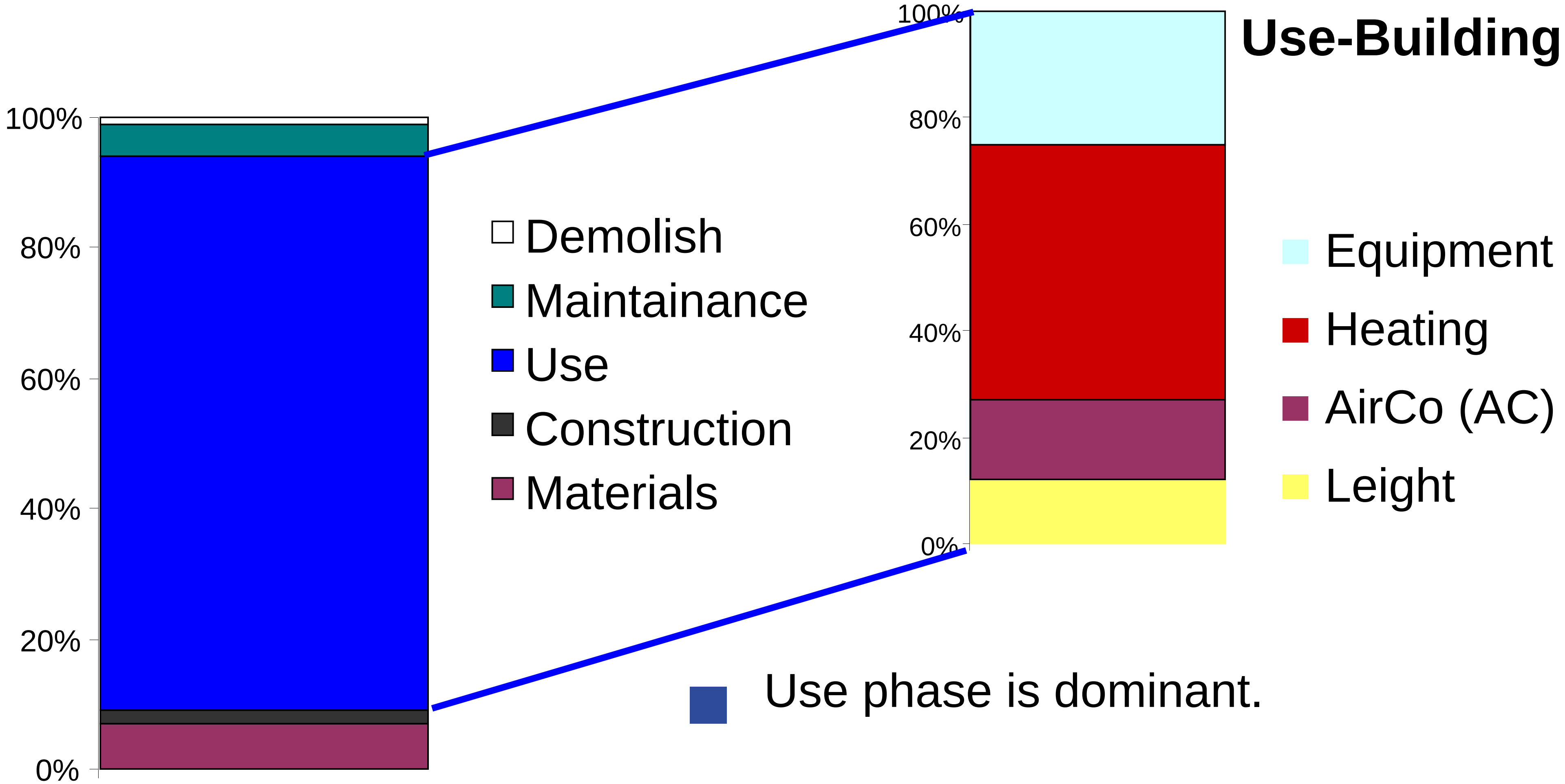
LCA RESULTS – USE OF RESOURCES: 1m²

Parameter	Unit	A1 - A3	D
Renewable primary energy as energy carrier	[MJ]	1.4E+2	-1.3E+2
Renewable primary energy as material utilisation	[MJ]	0.0E+0	0.0E+0
Total use of renewable primary energy sources	[MJ]	1.4E+2	-1.3E+2
Non-renewable primary energy as energy carrier	[MJ]	6.0E+2	-3.0E+2
Non-renewable primary energy as material utilisation	[MJ]	2.0E+1	0.0E+0
Total use of non-renewable primary energy sources	[MJ]	6.2E+2	-3.0E+2
Use of secondary materials	[kg]	0.0E+0	-
Renewable secondary fuels	[MJ]	1.8E-2	-1.6E-2
Non-renewable secondary fuels	[MJ]	1.7E-1	-1.4E-1
Net use of fresh water	[m³]	4.0E-1	-3.7E-1

LCA RESULTS – OUTPUT FLOWS AND WASTE CATEGORIES: 1m²

Ressource efficiency in buildings

Energy demand „System Administration Building“ (50 years, 4400m^2)



- Use phase is dominant.
- Use phase offers potentials for improvement

Environmental performance of cars

Gewicht trotz Aluminiumkarosserie und Al-Motor ca. 2,5 t

Quelle: Auto-Legenden

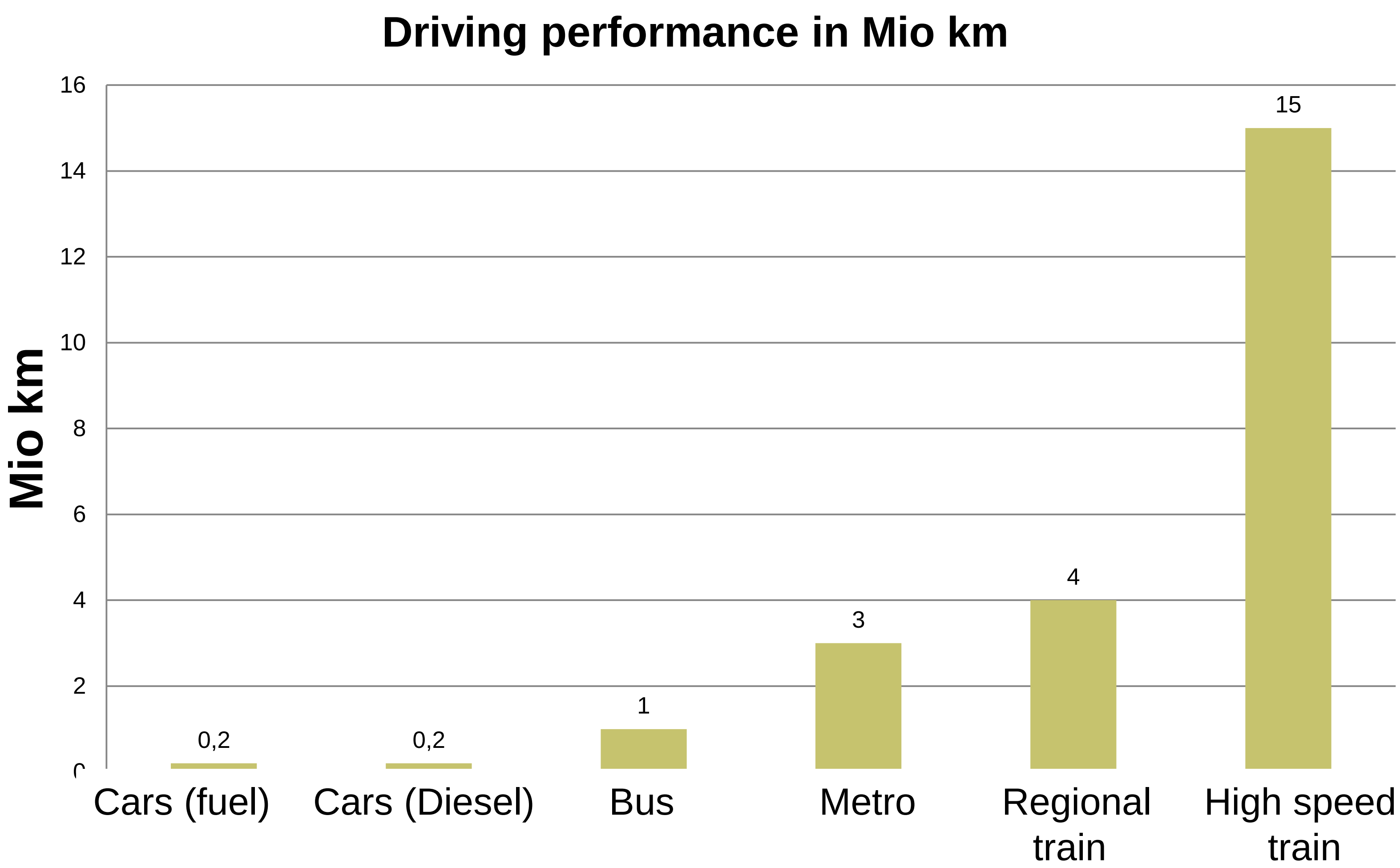
Farman A6B Super Sport, 1919

Background

- 19% auf greenhouse gas emissions are dedicated to transport.
- It seems to be evident that transport activities even increase (China, India and Middle East).
- Reduction of fuel demand of cars gains importance.
- Weight reduction of cars is part of the solution.

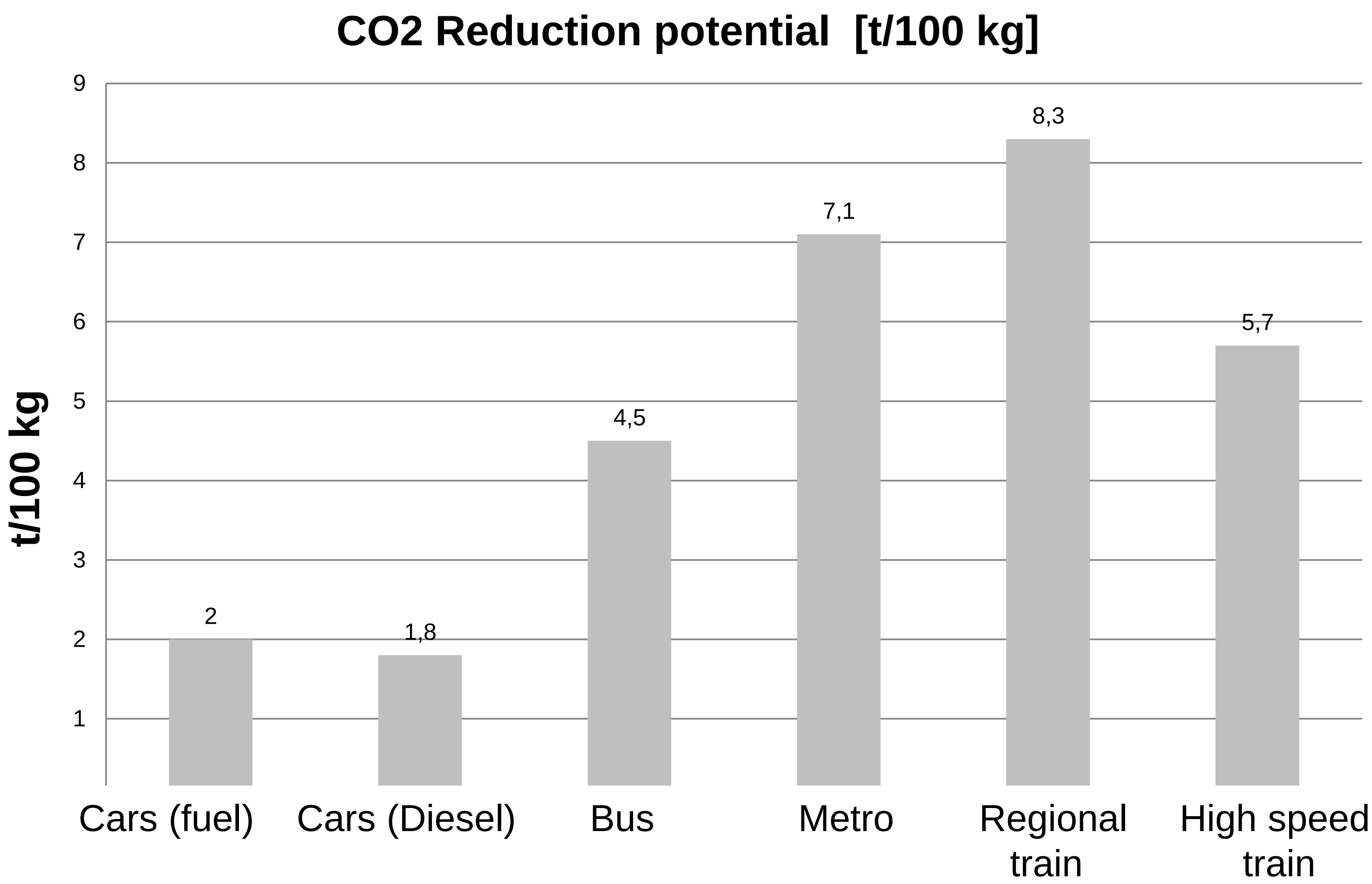
Aluminium as part of the solution

Driving performance of transport



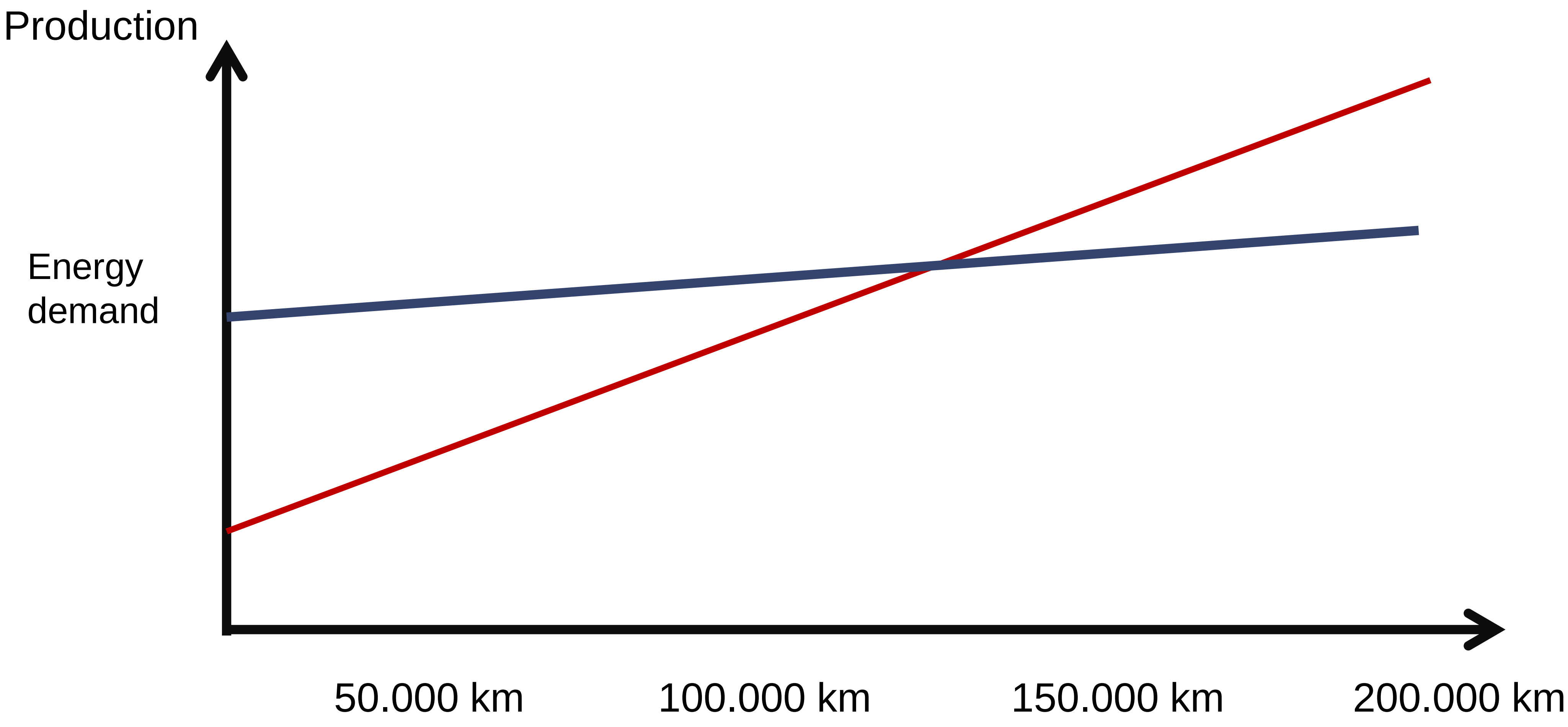
Source: ifeu

CO2-Reduction potetial related to 100 kg weight reduction



Quelle: ifeu

Use phase transport



Products in cars: bumper

Car:	
Weight:	1.100 – 1.200 kg
Consumption:	6 L/ 100 km
Performance:	200.000 km
Weight Aluminium:	3,2 kg
Weight HS Steel:	5,8 kg
Weight reduction:	45%
Fuel reduction:	0,36 L / (100 km 100 kg)

48 kg CO2 reduction in comparison with steel

Production of Al part: 36 kg CO2

Products in cars: front hood

- Car:
  - Weight: 2.000 – 2.100 kg
  - Consumption: 11 L/ 100 km
  - Performance: 200.000 km
- Weight Aluminium: 10,1 kg
- Weight HS Steel: 17,5 kg
- Weight reduction: 43%
- Fuel reduction: ~ 0,30 L / (100 km 100 kg)

130 kg CO_2 reduction in comparison with steel

Production of Al part: 120 kg CO_2

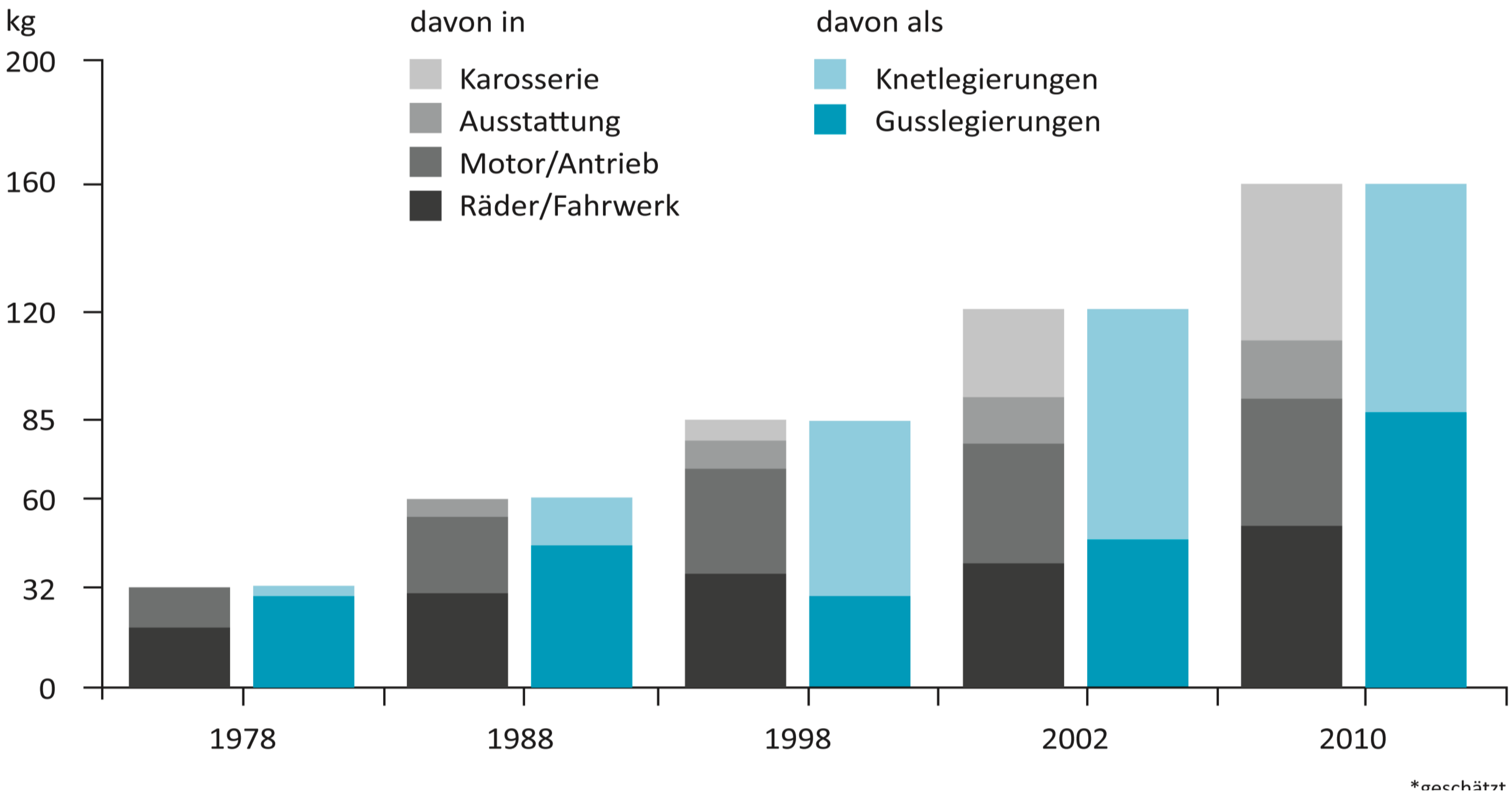
Products in cars: Body-in-White

- Car:
  - Weight: 1.700 kg
  - Consumption: 10,2 L/ 100 km
  - Performance: 200.000 km
- Weight Aluminium: 295 kg
- Weight HS Steel: 475 kg
- Weight reduction: 45%
- Fuel reduction: ~ 0,30 L / (100 km 100 kg)

→ 4.300 kg CO_2 reduction in comparison with steel

Production of Al part: 3.830 kg CO_2

Aluminium in cars (Western Europe)*



*estimated

Conclusions

- Sustainable Development is an overarching societal objective.
- Environment is only one dimension besides the economical and societal aspects in SD.
- LCA is a useful tool which is internationally accepted. Nevertheless, it covers only parts of the environmental dimension of SD.
- The Carbon Footprint is a single indicator and does not reflect the environment but climate change.
- Questions such as to what environmental costs the Carbon Dioxide is reduced cannot be answered.

Conclusions

- Recycling is decicive for aluminium applications in order to achieve a good environmental performance.
- LCA do include recycling.
- As higher the recycling rate as better is the environmental performance of aluminium products.
- Besides the CF it is necessary to reflect other environmental indicators.
- In transport applications aluminium can score better due to its light weight.

Conclusions

- EPDs deliver environmental information. They are not tailored for evaluations.
- An environmental assessment should be done on base of a real building.
- A better understanding can be achieved if the food supply system is investigated.

➔ The use of LCAs should be encouraged