



Creating Sustainable Product Service Systems

**The model of the
Eco-costs/ Value Ratio**

**dr. ir. Joost G. Vogtländer
Delft University of Technology,
2009**



The Issues:

1. What is a sustainable product?
2. Understanding the concept of the “value” of products and services
3. How can you calculate the “eco-burden” of a product
4. What is the meaning of eco-efficiency (E/E indicator)?
5. How can we generate eco-efficient value creation?
6. How do we apply PSS successfully?

“Bundling Products and Services” has a long history in business



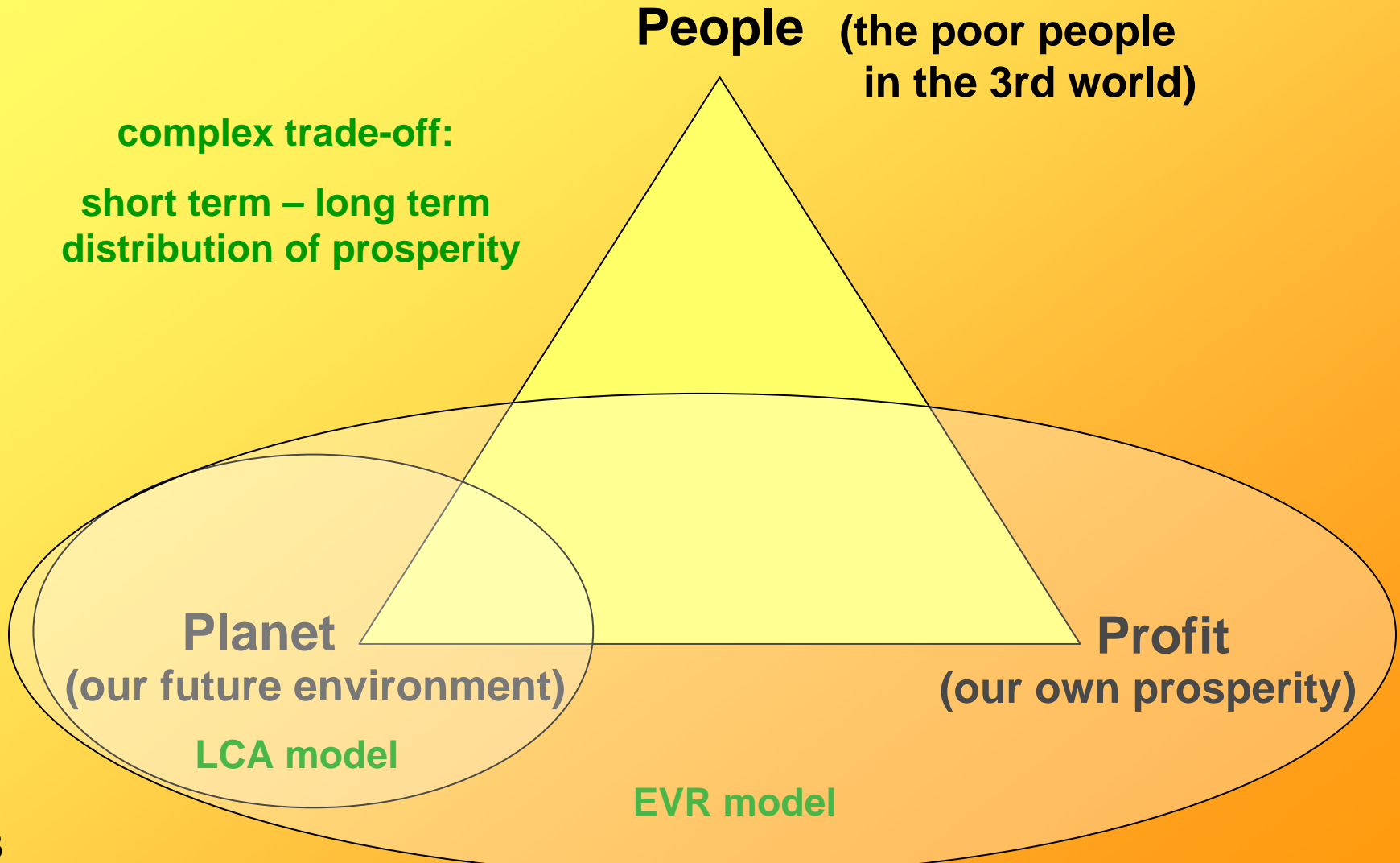
**In 1993-1997
environmentalists
'invented' PSS
as a hype**

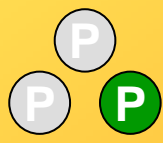
**In 2003-2006
environmentalists
played down the
importance of PSS**

**In 2009, however:
you can prove that
PSS works,
you will learn how**

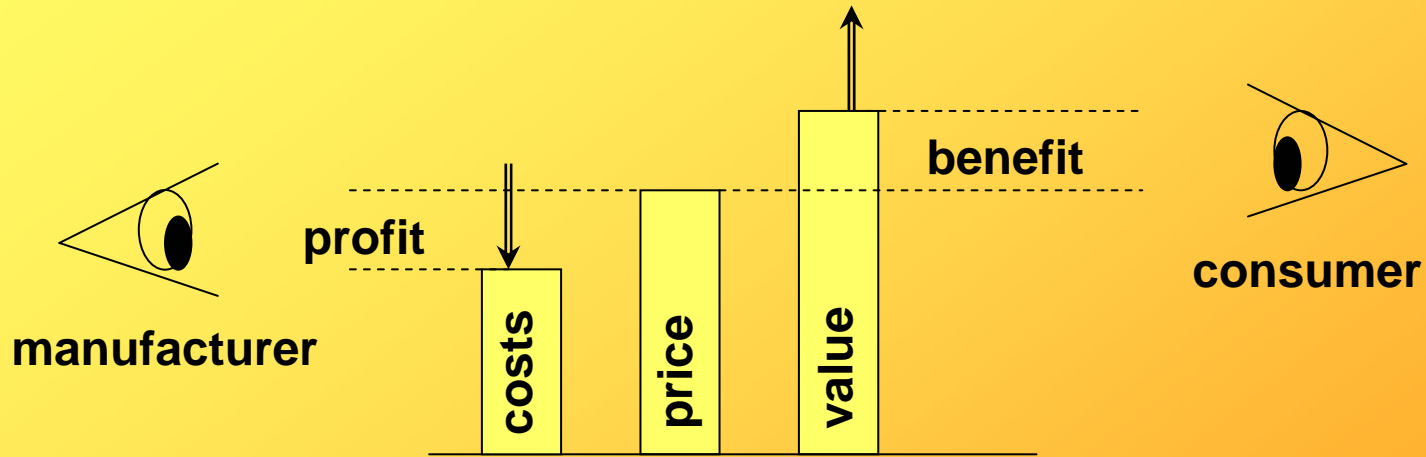


The road towards sustainability requires well balanced decisions on the 3 P's





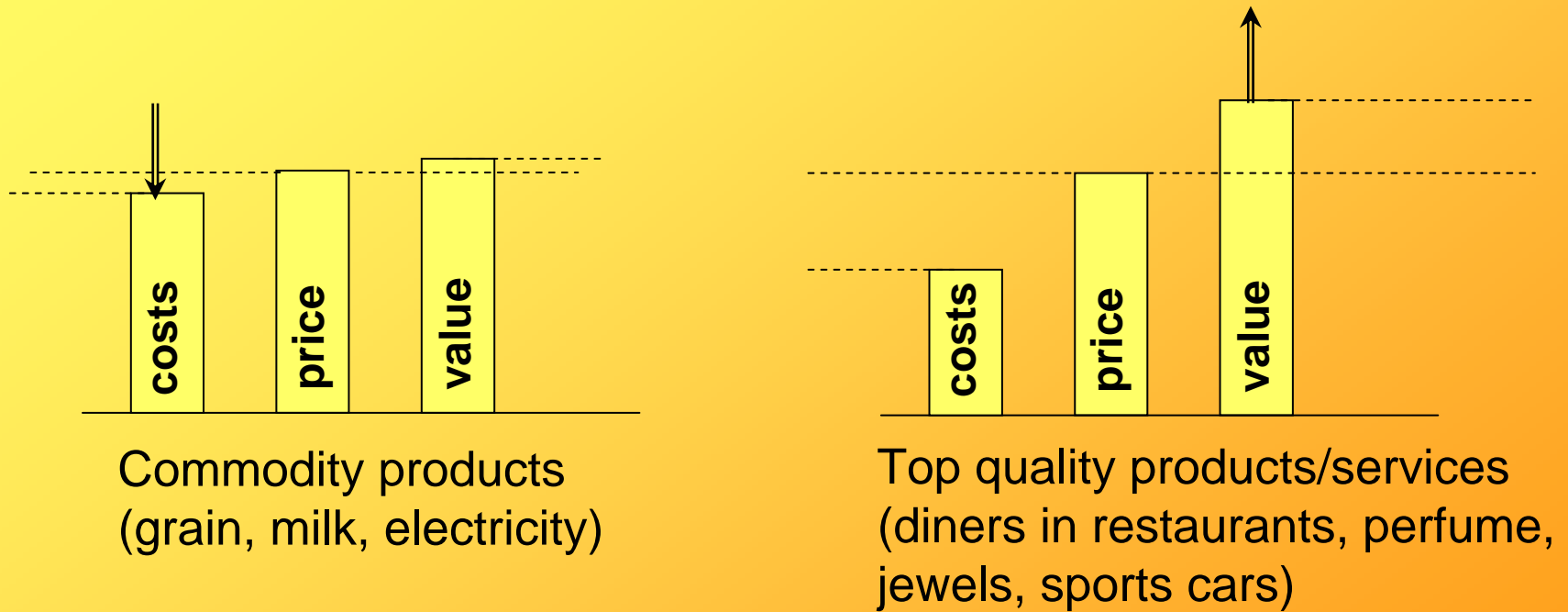
The model of the costs, the price and the value



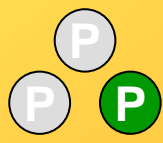
In a integral approach, businesses will continuously strive for improvement of the value/costs ratio

Note: value = product quality + service quality + image

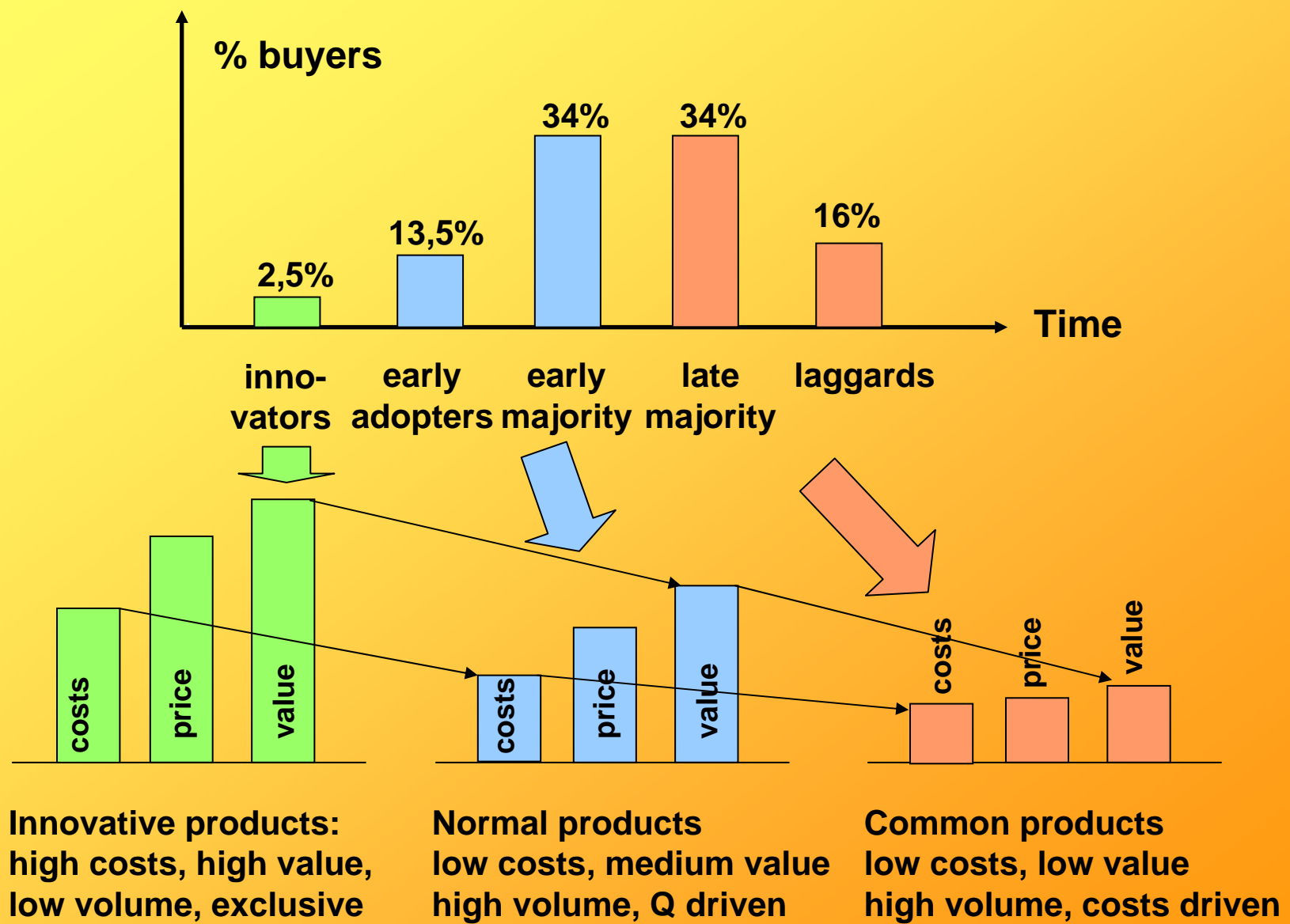
The difference of commodity products and top quality services is the margin



Commodity products are high volume, low margin
Top Quality products and services are low volume, high margin



The value and the costs get lower in time during the life of a product type



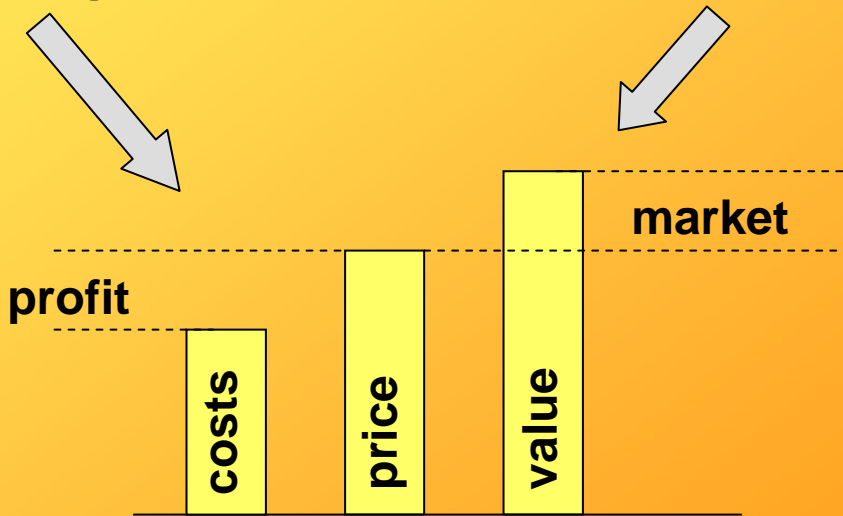


Case: the value bundle of the mobile phone market (a PSS)



**The mobile phone
(negative margin)**

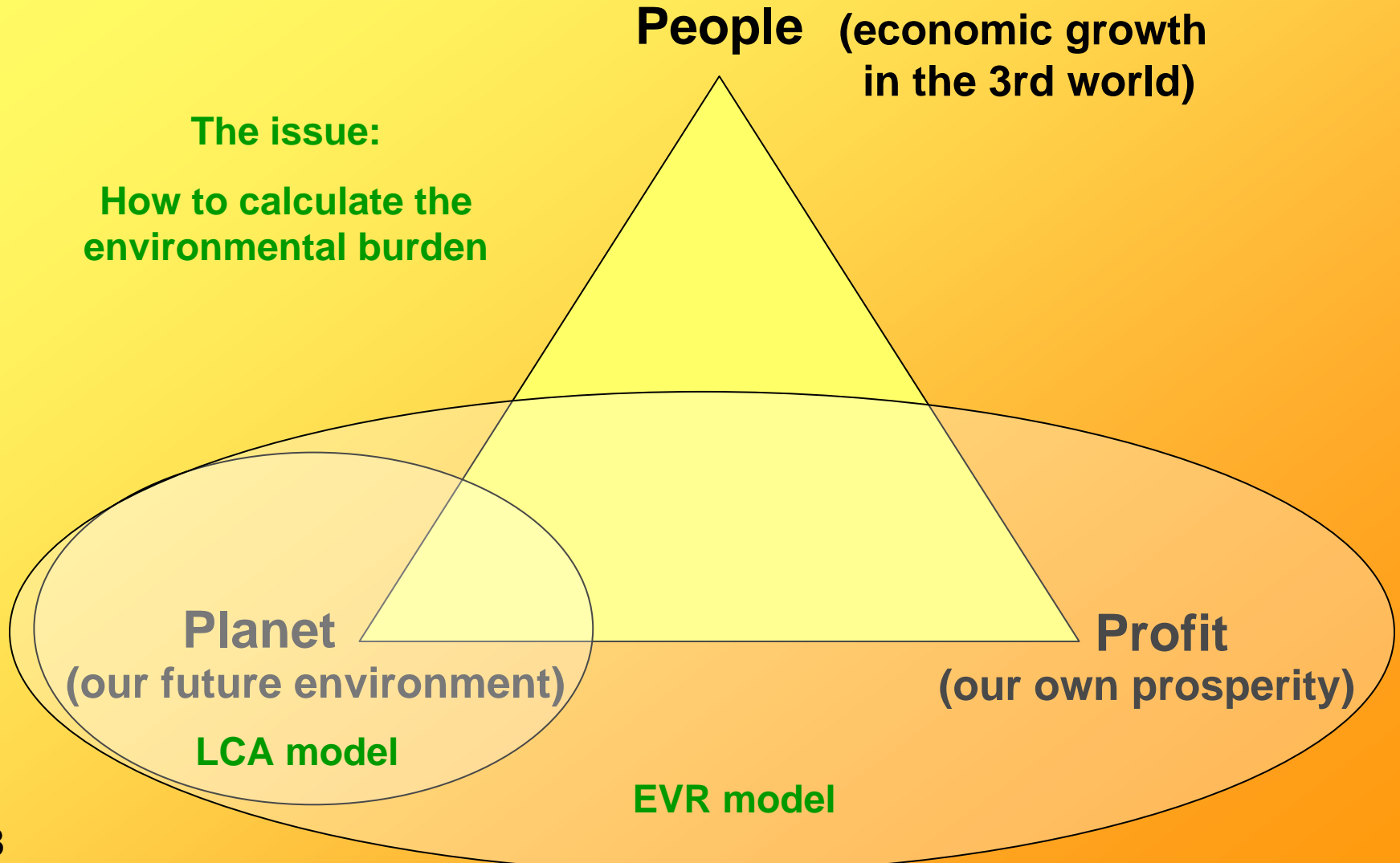
**The telecom services
(positive margin)**



“Product Service System” (= bundling in 1 package)

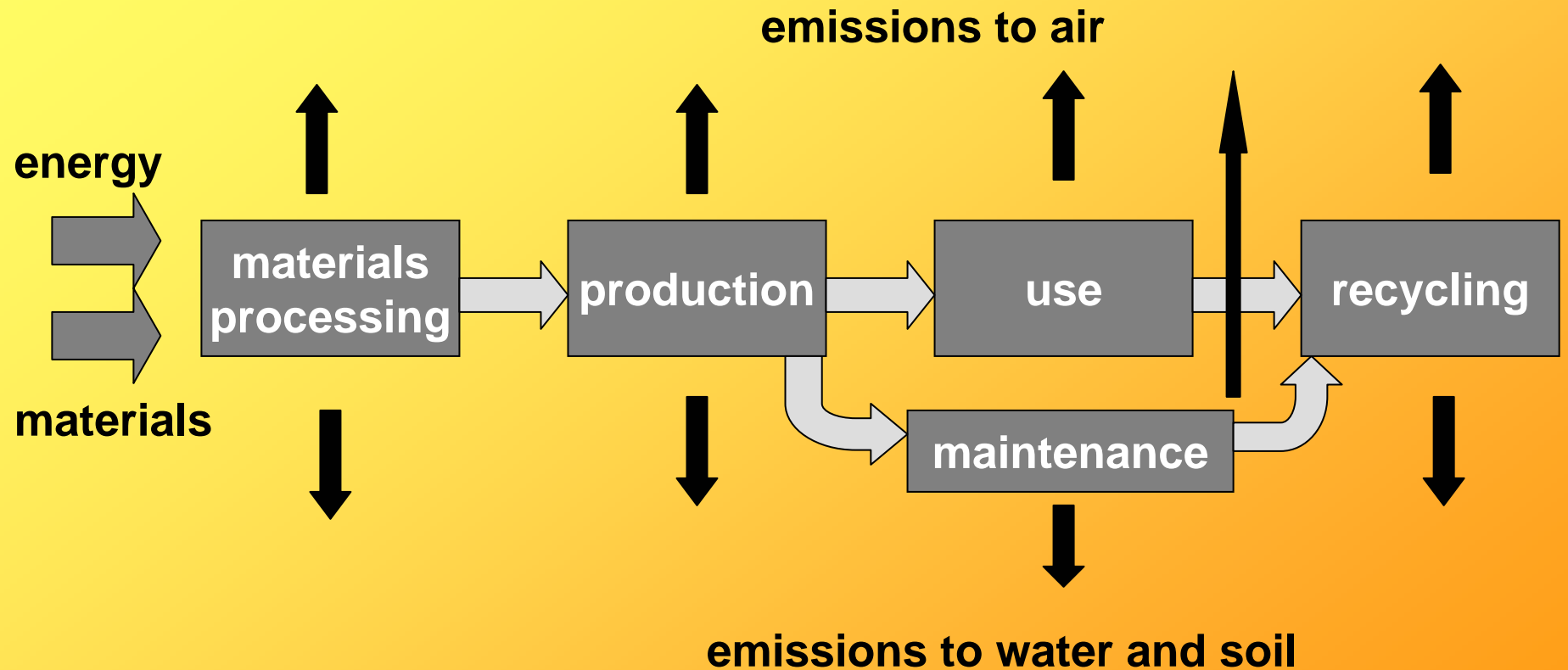


**We understand now the Profit & Prosperity P.
Next: the P of Planet.**





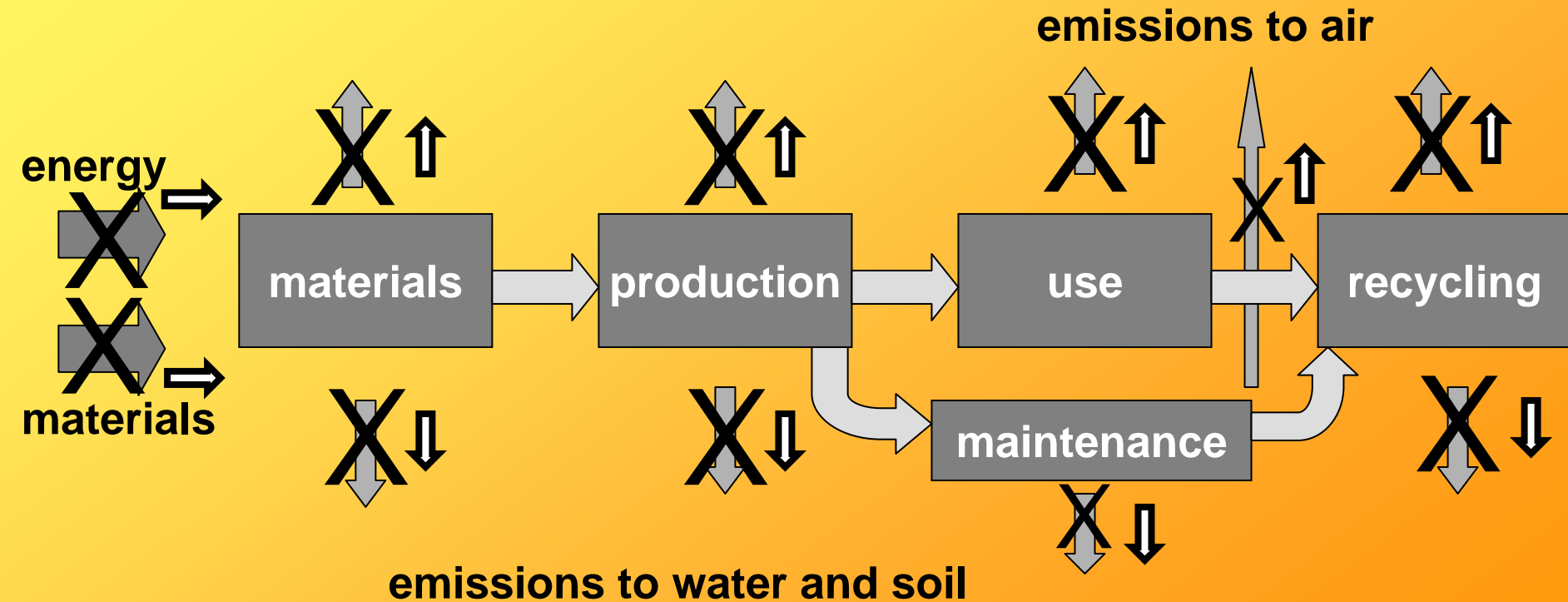
The environmental burden might be characterised by the 'external costs' of damage



..... the calculation is extremely complex and involves many assumptions and subjective weighting steps.....

.... however, I prefer to define eco-costs in terms of the 'marginal prevention costs'

“the eco-costs are the costs of prevention measures, which are required to reduce the current emissions, to a sustainable level”



Comparison of eco-costs and 'external damage costs': prevention results in less damage

Eco-costs of emissions (the marginal 'pollution prevention costs') 2007:

acidification:	7,55	€/kg SO _x equivalent
- eutrophication:	3,60	€/kg phosphate equivalent
- eco toxicity:	802	€/kg Zn equivalent
- carcinogenics:	14,5	€/kg PAH equivalent
summer smog:	3,54	€/kg VOC equivalent
fine dust:	14,5	€/kg fine dust PM10
- global warming:	0,135	€/kg CO ₂ equivalent

Marginal external damage costs related to health problems, from the Benefits Table database of the European Commission DG Environment:

	The Netherlands	EU-15 average	
acidification:	7,00 €/kg	5,20 €/kg	(SO _x equivalent)
fine dust:	18,0 €/kg	14,0 €/kg	(fine dust PM2.5)
summer smog:	2,40 €/kg	2,10 €/kg	(VOC equivalent)

Examples of eco-costs of emissions:

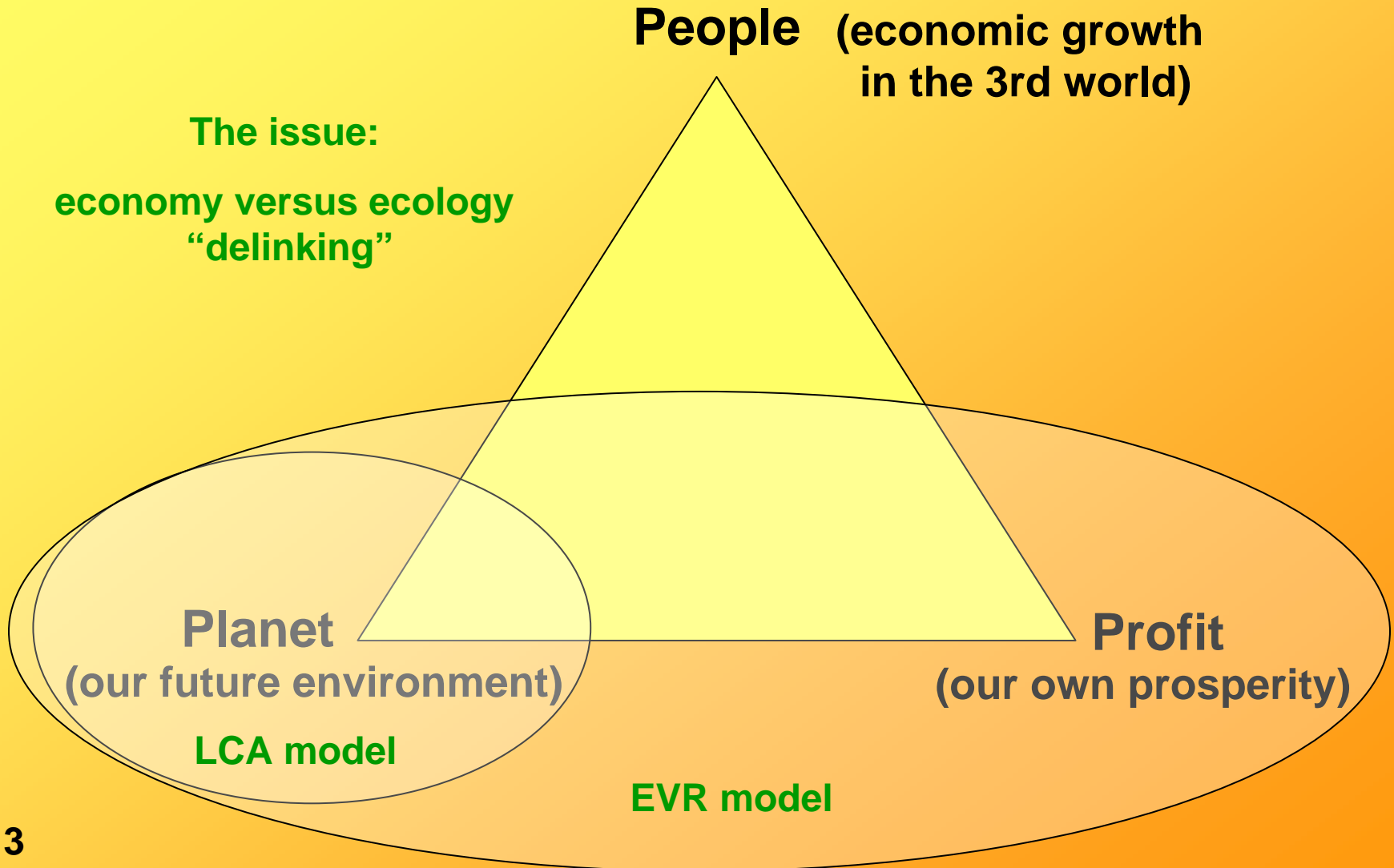
PVC:	€0,33 per kilogram	(price €0,60 per kilogram)
Aluminium:	€2,22 per kilogram	(price €2,20 per kilogram)
Recycled AL:	€0,27 per kilogram	(price €2,20 per kilogram)

Examples of eco-costs per Euro 'real money':

Transport by plane:	€ 1,00 thru €1,50 per Euro
Transport by truck:	€ 0,45 thru €0,70 per Euro
Warehouses:	€ 0,50 per Euro
Offices and houses:	€ 0,35 per Euro
Cars:	€ 0,30 per Euro (excl fuel!)
Diesel:	€ 1,00 per Euro
Labour:	€ 0,05 tot €0,15 per Euro



**We understand now the P of Profit & Prosperity and how to calculate the eco-costs (the P of Planet).
Next: the delinking of economy and environment.**



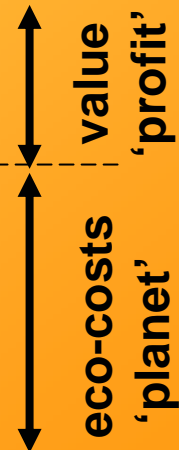
The tripple P model is not about “or” but about “and”

“What we need now is a new era of economic growth – growth that is forceful and at the same time socially and environmentally sustainable.”

(Brundtland, 1987)

“The delivery of competitively priced goods and services that satisfy human needs and bring ‘quality of life’, while progressively reducing ecological impacts and resource intensity, throughout the lifecycle, to a level at least in line with the earth’s estimated carrying capacity”

(WBCSD, 1995)



value
‘profit’

eco-costs
‘planet’

The basic idea of the EVR model: Combining the value chain of Porter and the LCA chain

Value : value + Δ value + Δ value + Δ value + Δ value + Δ value + Δ value = Total value

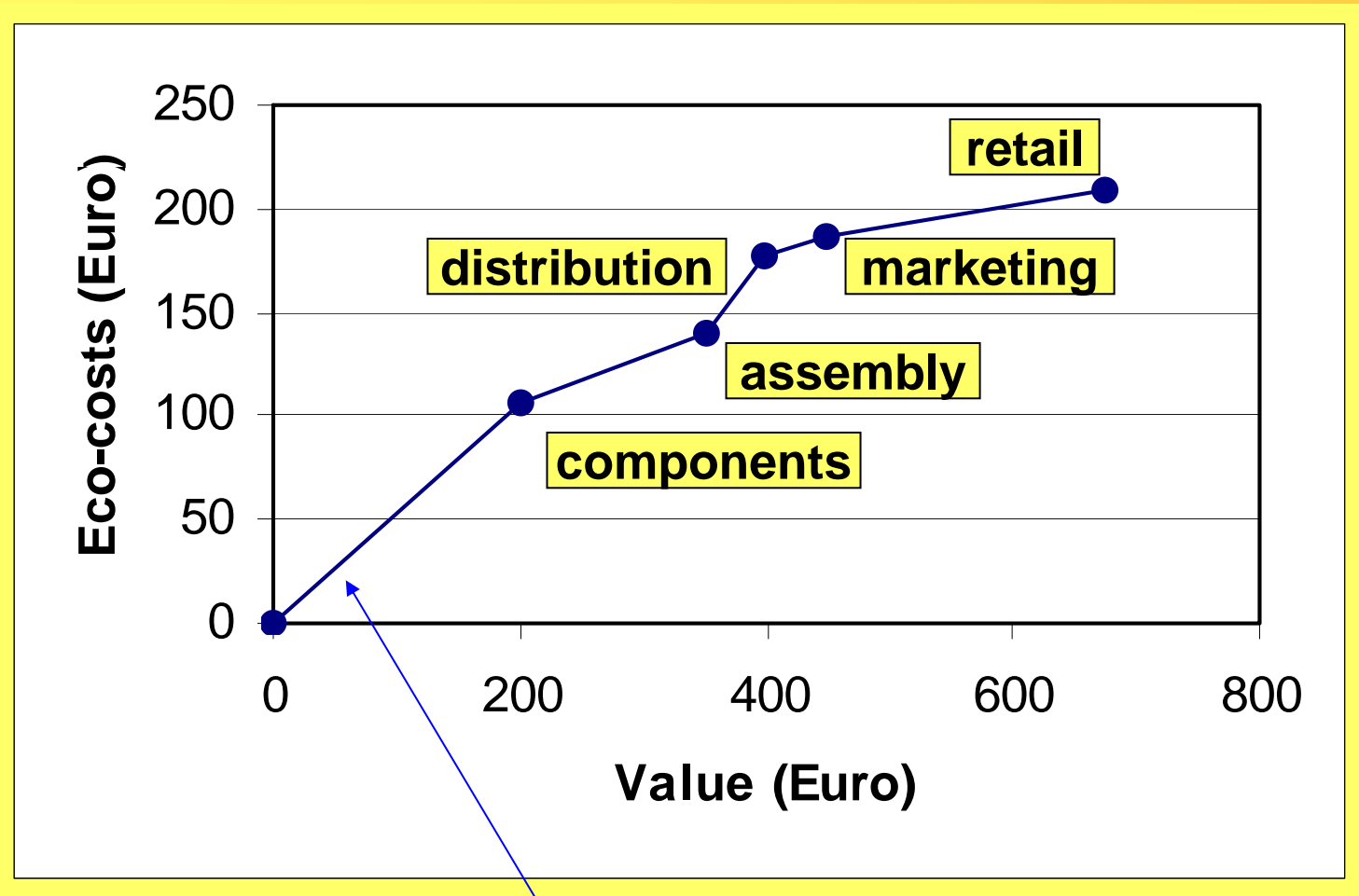


Costs : costs + Δ costs + Δ costs + Δ costs + Δ costs + Δ costs = Total costs

Eco- Δ eco- + Δ eco- + Δ eco- + Δ eco- + Δ eco- + Δ eco- = Total eco-
costs costs costs costs costs costs costs costs

Note: the Δ eco-costs are relatively high at the front end of the chain, the Δ value is relatively low at the front end, which is causing a double problem in the developing countries

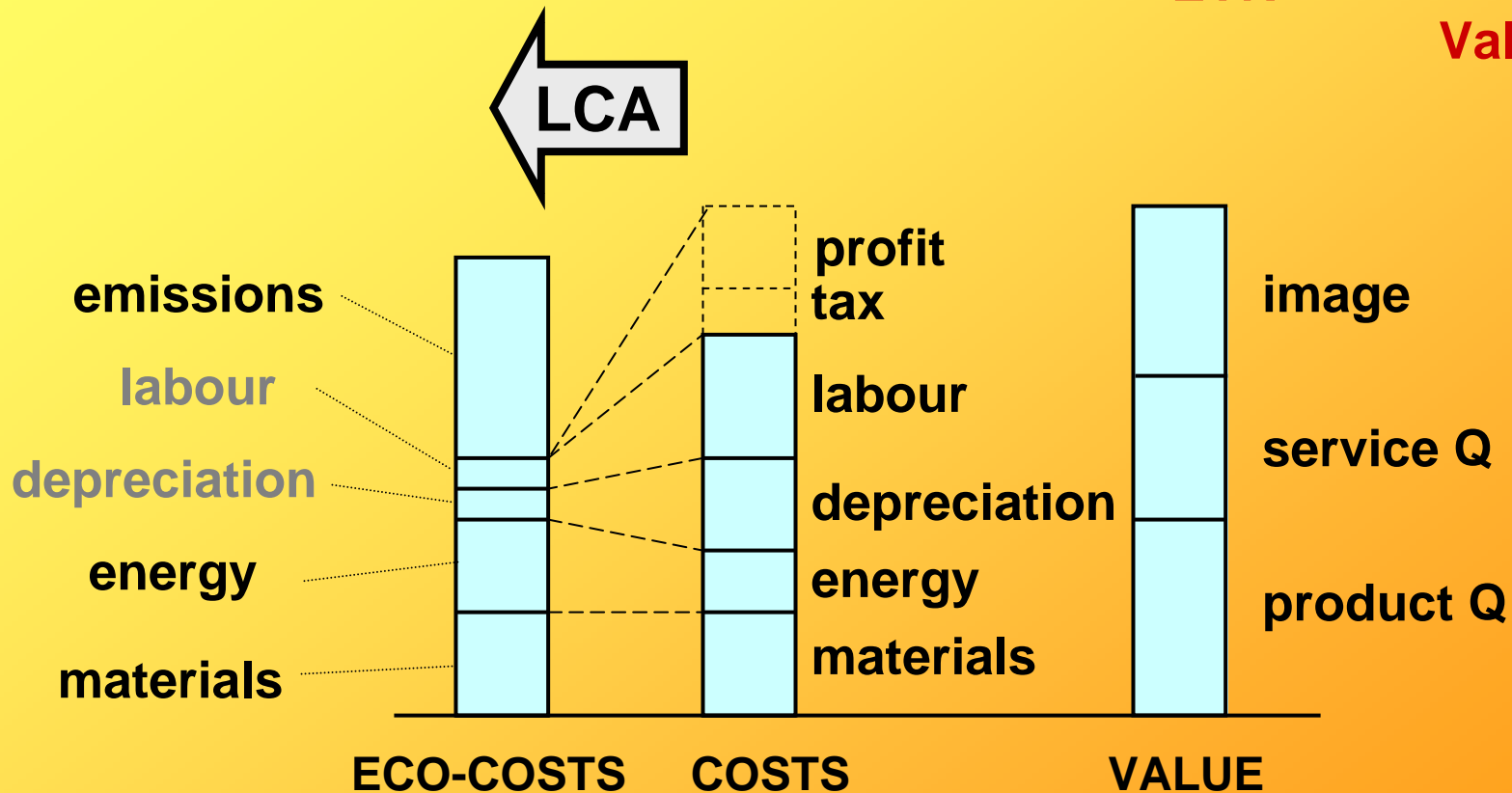
Case: The EVR in a production chain. A TV from components to the retail shop, produced inside the EU



Note that the slope of the line is the EVR

The eco-costs, the costs and the value of a product and/or service

$$EVR = \frac{\text{Eco-costs}}{\text{Value}}$$



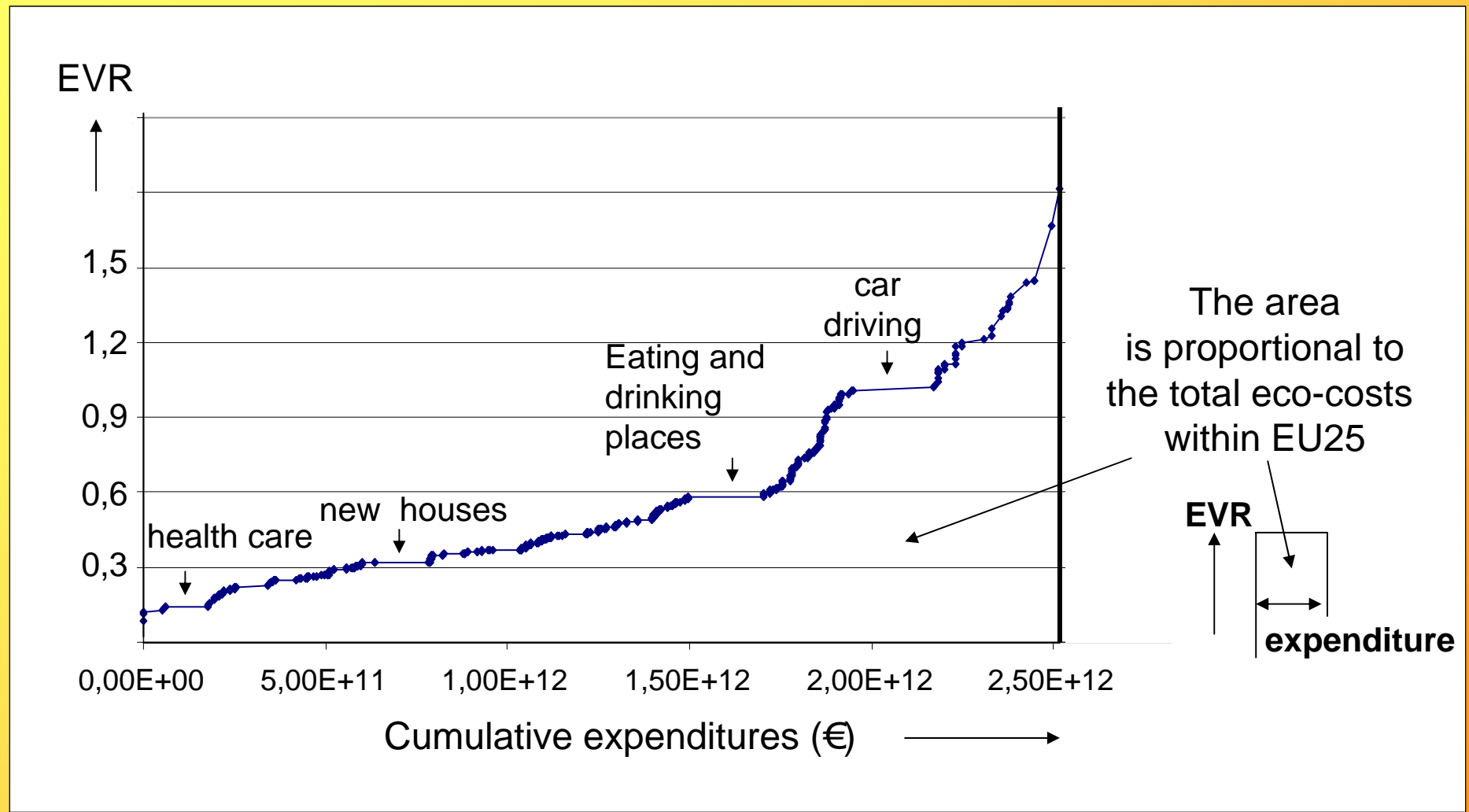
Note: Value is the market value (the fair price)

The consumers side: Preference of expenditures of households in the Netherlands (1995)



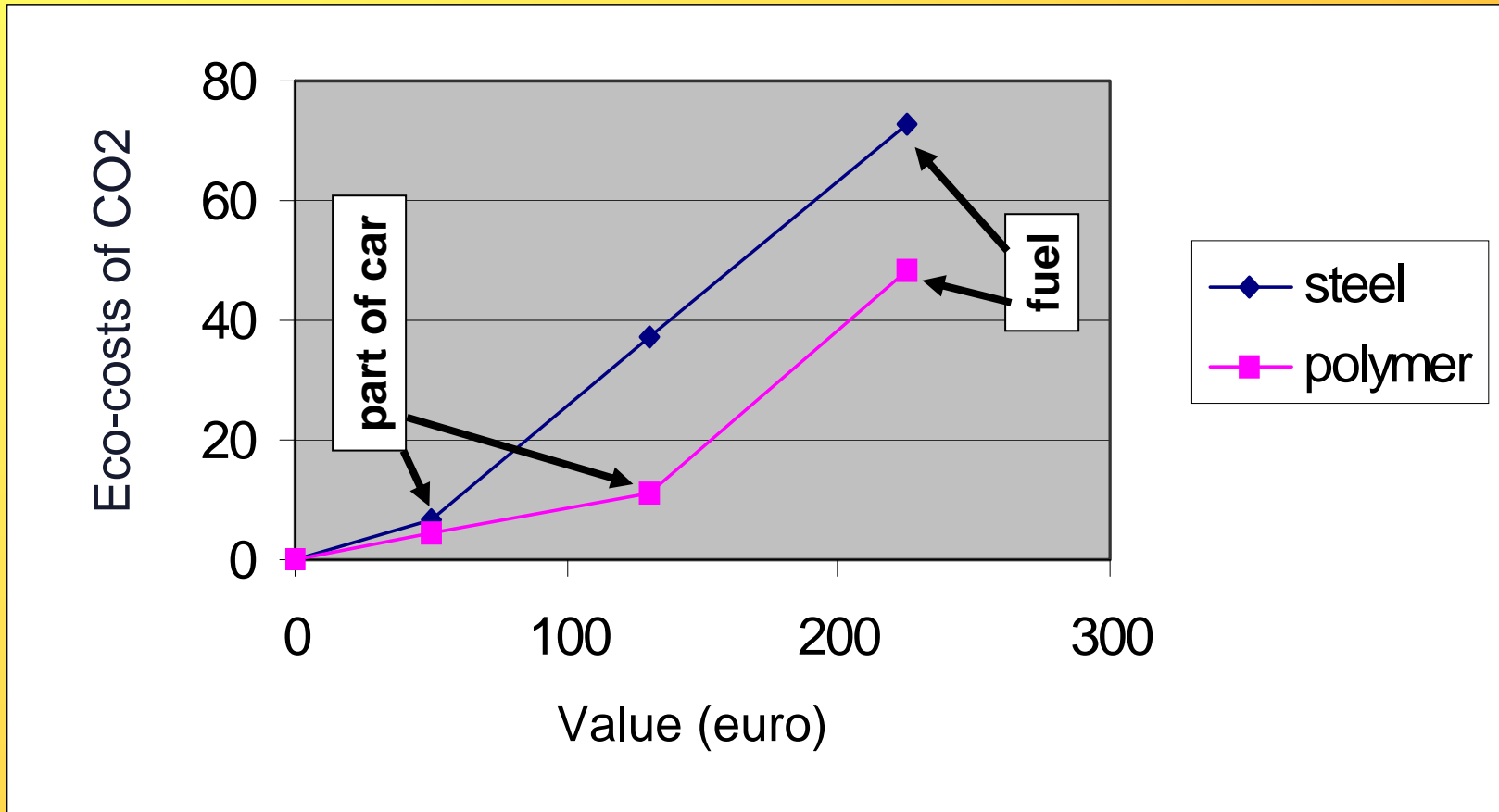
EVR: transport & holidays = 0.70 – 1.50 ; housing 0,3 ; clothing & health 0,2

EVR and the total expenditures of all consumers in the EU25



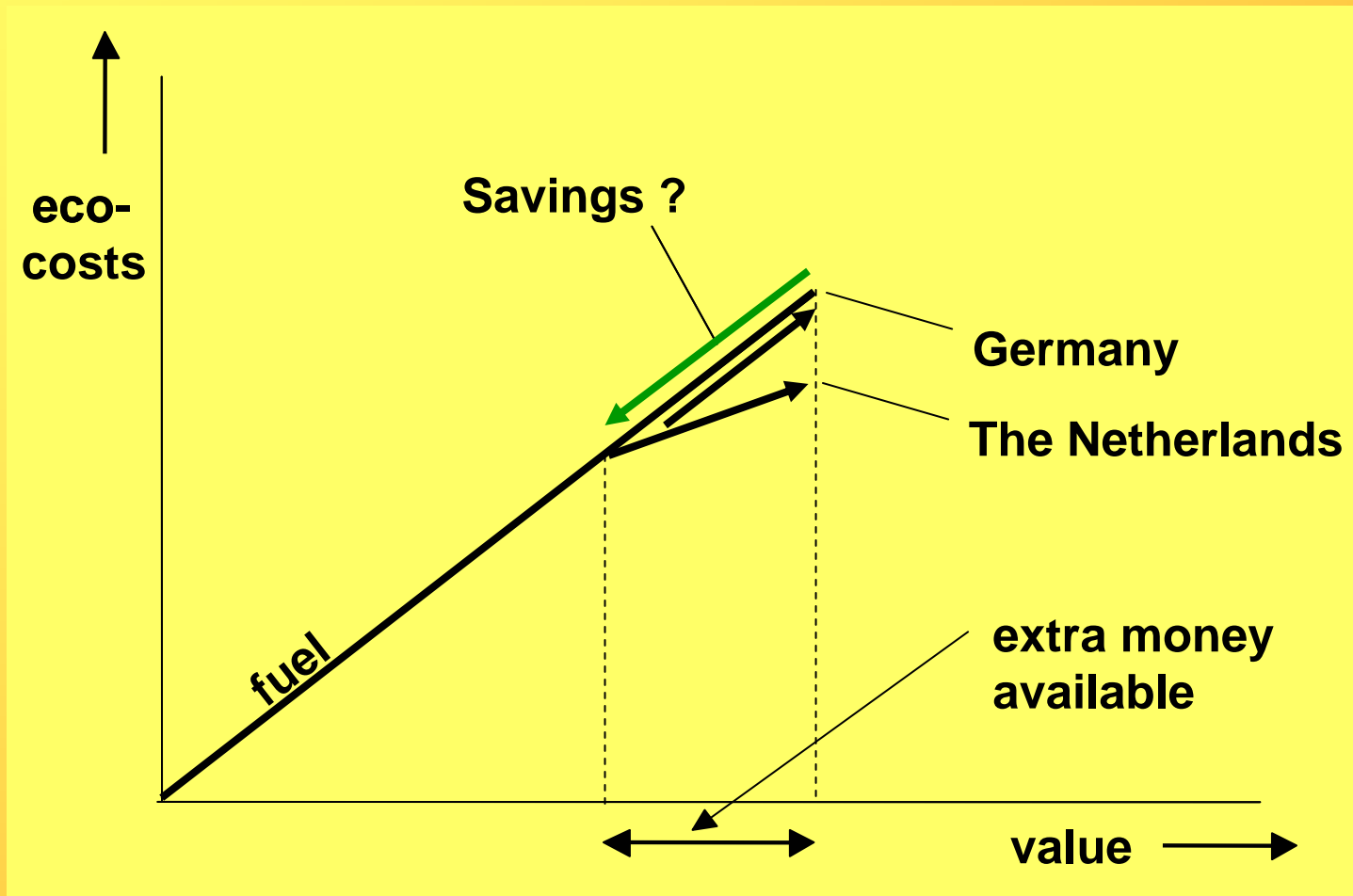
Two strategies: - ask (force) industry to reduce the eco-costs
- reduce consumer spending at the high end of the curve

Case: Reduction of the weight of a car, by a redesign of a part of the coach-work (cumulative effect over the total life cycle)

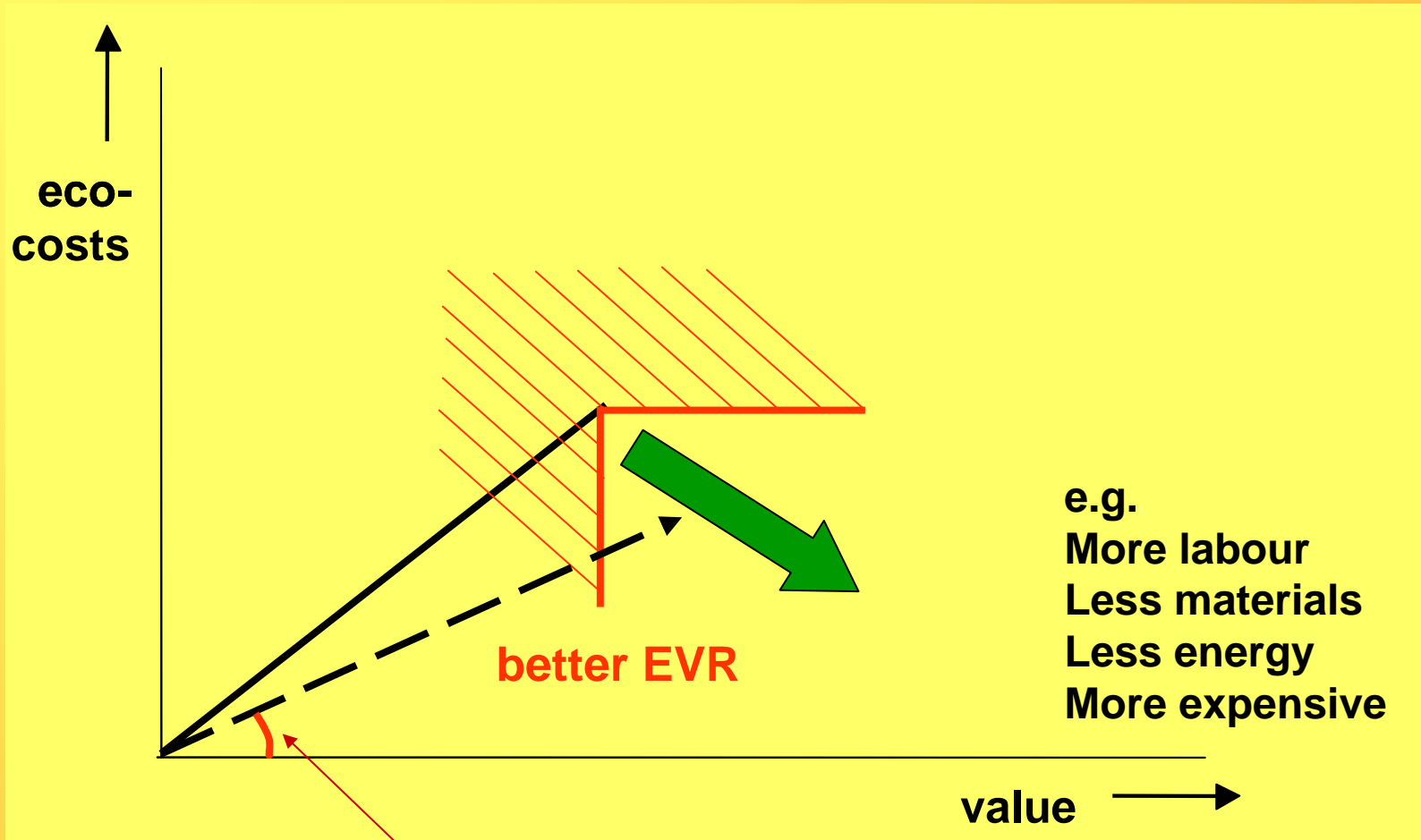


Data from Dr. Konrad Saur, PE Product Engineering GmbH

Case: 'Savings' of fuel by a better aerodynamic design? The 'rebound effect'



The required direction of 'delinking':
less eco-costs, but also more value
(='eco-efficient value creation')



e.g.
More labour
Less materials
Less energy
More expensive

Note: angle = $1/EVR$

Case: Better EVR of Hybrid Cars.

The Lexus features Eco-efficient Value Creation:

- better acceleration + less noise = more market value
- lower eco-costs (by better fuel efficiency)



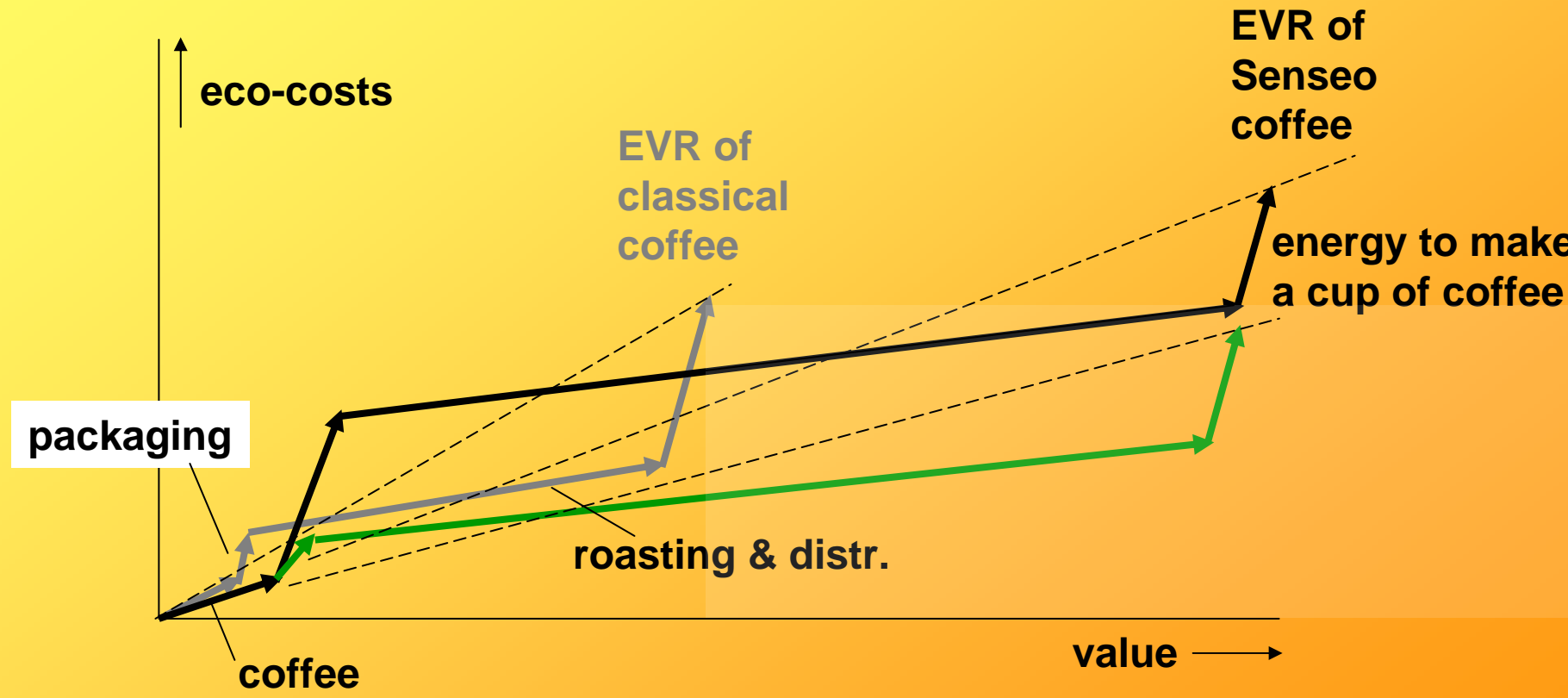
Case: Senseo of Sara Lee / DE (a PSS ?)

Eco-efficient Value Creation

- more convenience
= more market value
- lower eco-costs
(less boiling water)

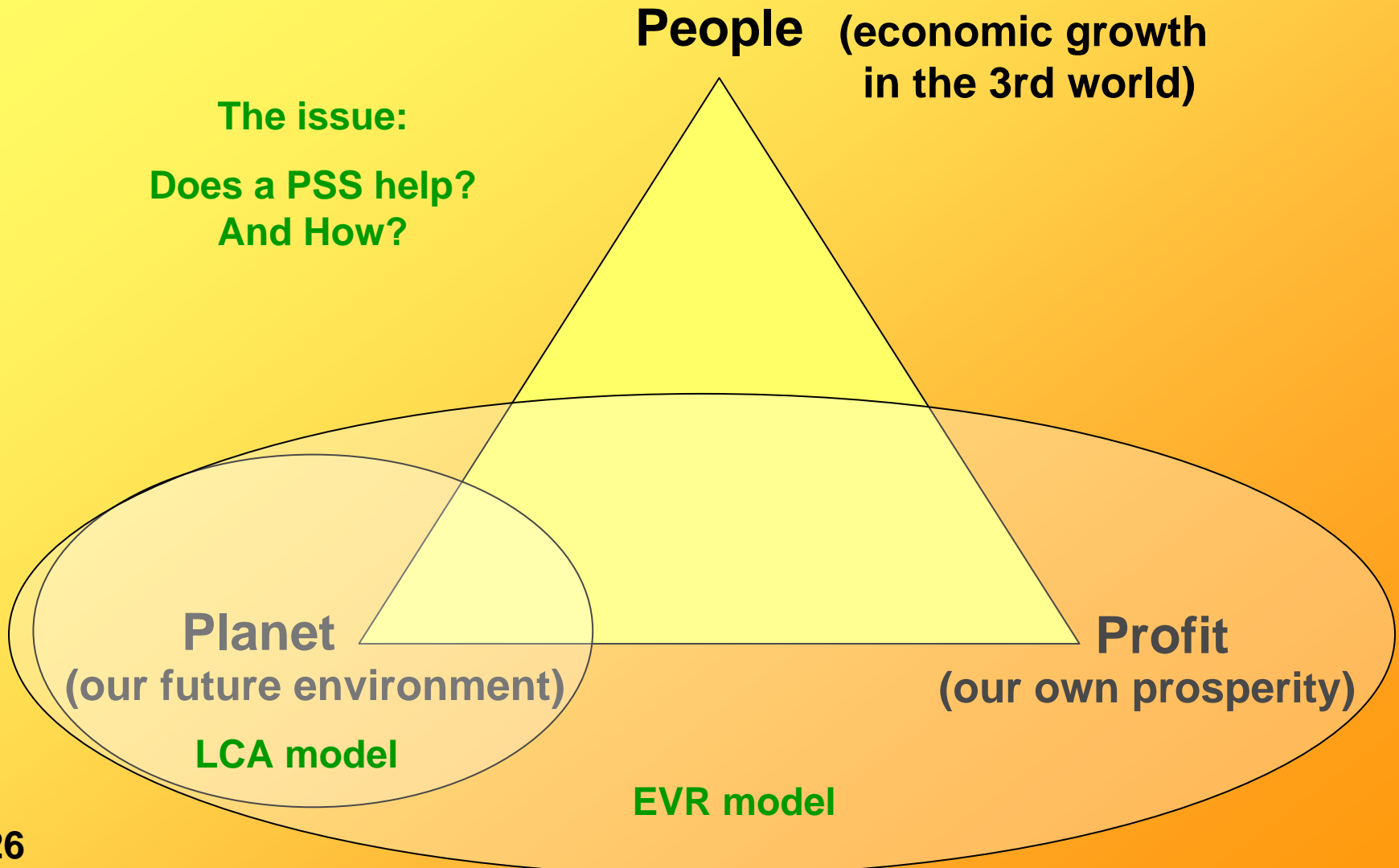


Case: Senseo of Sara Lee / DE (more value at a lower EVR)



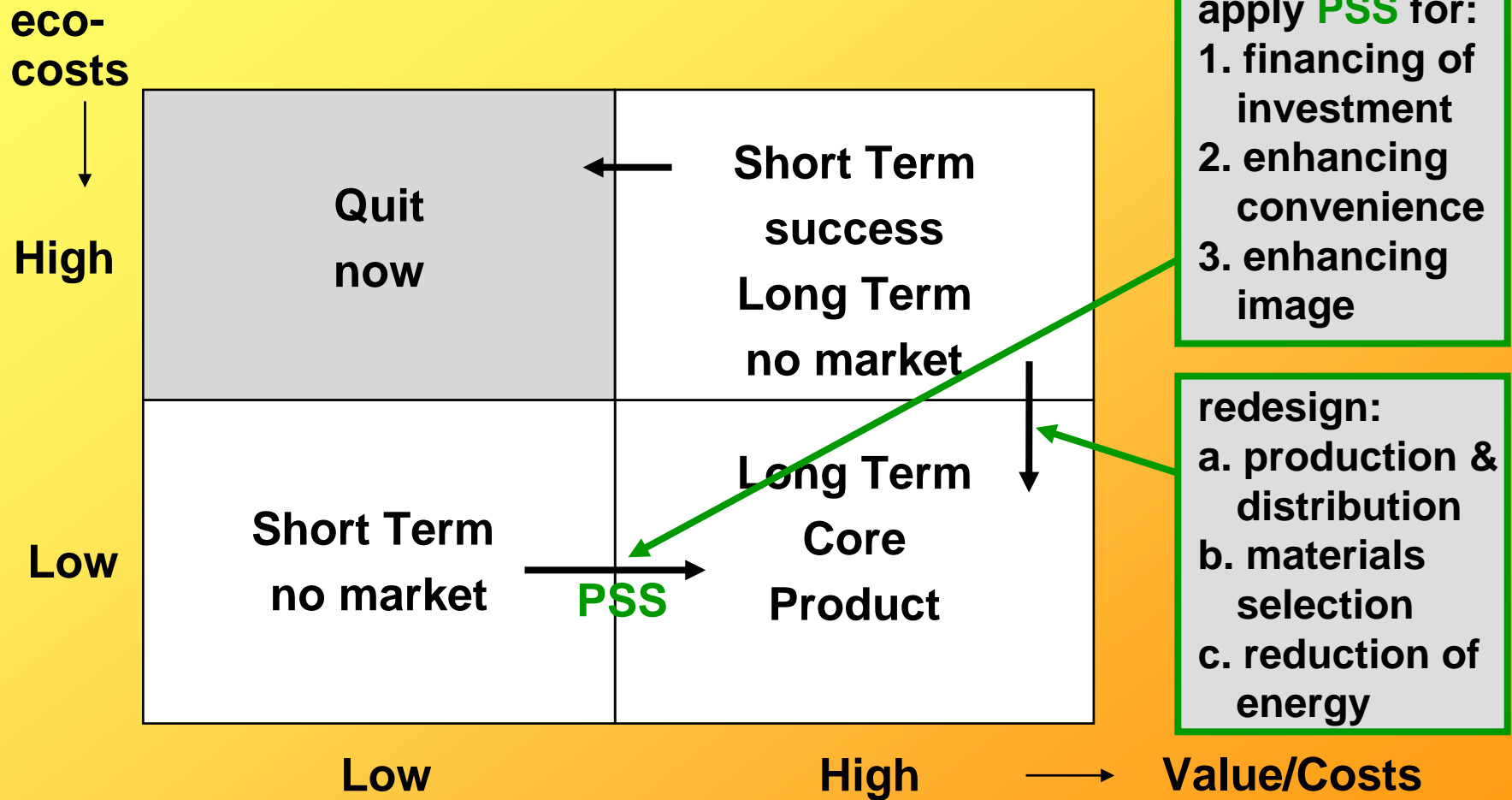
Last step: further reduction of the eco-costs of the packaging of Senseo

The 3 P's and the EVR model: Strategic consequences for developing a PSS



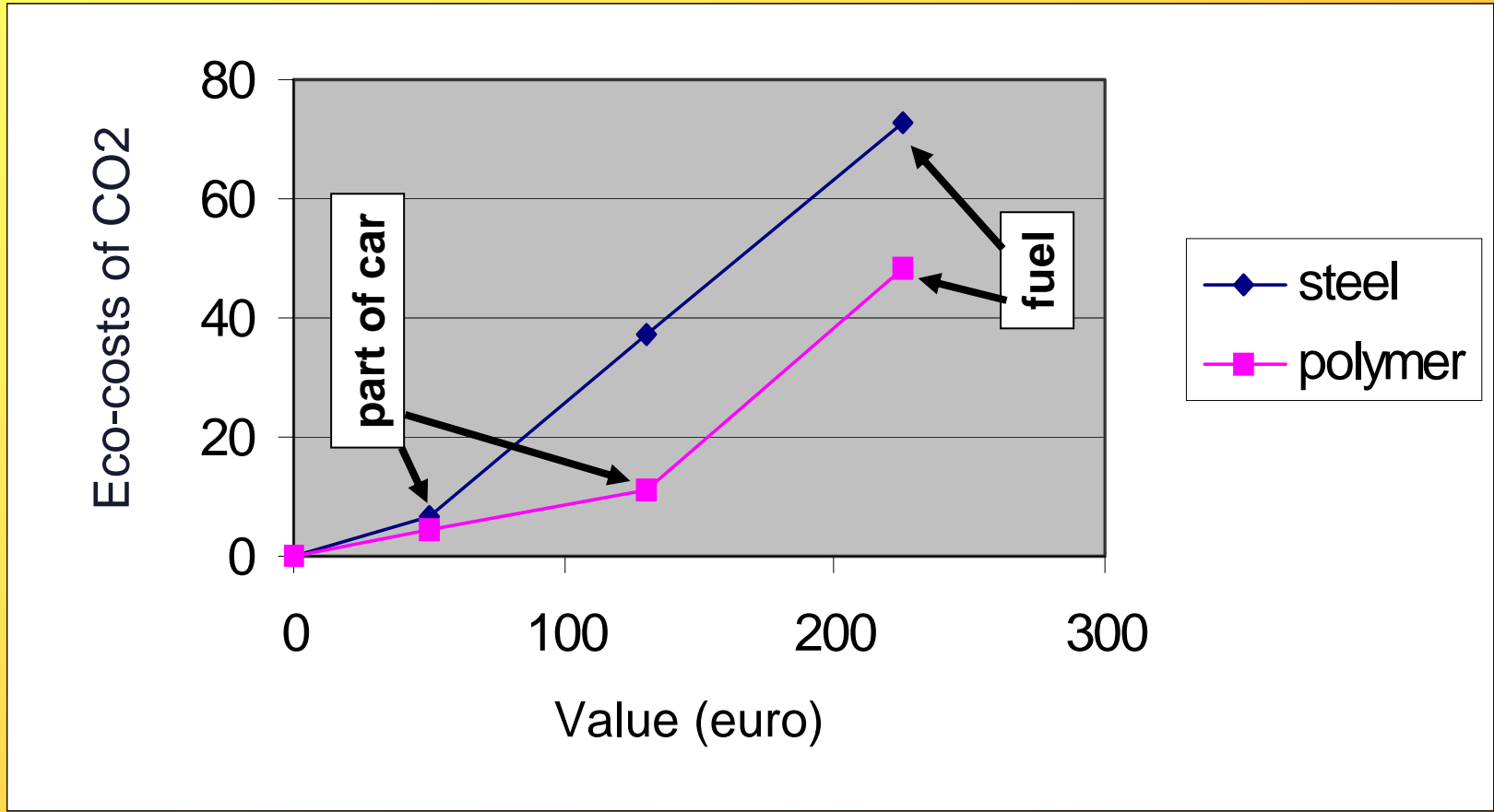


Product portfolio matrix for product strategy of companies



1. Example PSS: required financing of the investment

Case: Reduction of the weight of a car, by a redesign of a part of the coach-work



Note that polymer more than doubles the price of the car

2. Examples PSS: more convenience

Case: Senseo
of Sara Lee / DE



Result: more value

Case: train + bike system



+



=



Result: more value

3. Examples PSS: more image

**Case Chauffeur + Car:
'posh'**



Result: more value

**Case Sustainable Dance Club:
'cool'**



Result: more value

Concluding:

Don't blame the customer

for not buying 'green'

but

create 'eco-efficient value'

(= minimum Ecocosts/Value Ratio)

by means of a PSS