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ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

The use of life cycle assessment in the European Integrated Products Policy

« Study on external environmental effects related to life cycle of products and services »

BIO I.S. European commission – DG environment February 2003

2 December 2004

Life Cycle Approaches for Sustainable Consumption
Ecole Polytechnique Fédérale de Lausanne, Switzerland

Short introduction on Integrated Product Policy (IPP)

- **The principle**
  - « public policy which aims at or is suitable for continuous improvement in the environmental performance of products and services within a life cycle context »

    (IPP : Integrated Product Policy, Weimar 1999)
  - The 3 aims of the IPP :
    - To encourage consumer demand for more ecological products
    - To encourage industry to increase its supply of more ecological products
    - To use the pricing mechanism (different VAT rates, increased manufacturer liability,…)

Objectives of the study

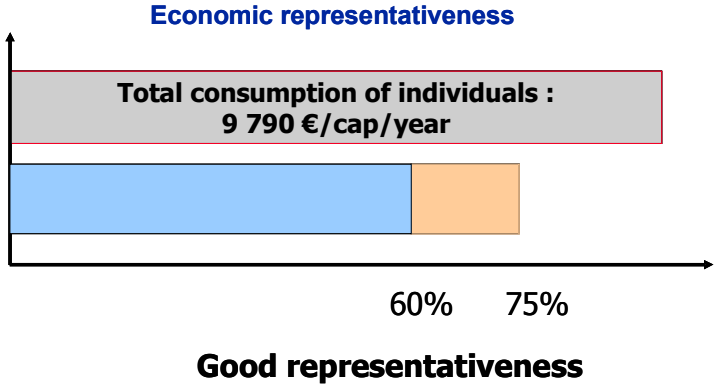
- **To give an overview of environmental impacts :**
  - Physical impacts ;
  - Monetary quantification.
- **Products and services which make European economy.**
- **Distribution of the impacts across the various stages of the life cycle.**
- **Prioritisation of targets of IPP**

Content of the study

- Phase 1 : LCA *(Life Cycle Assessment)*
  - Environmental impacts related to the life cycle
  - Products and services consumed in EU and candidate countries
- Phase 2 : monetary evaluation
  - Evaluate environmental impacts in monetary terms

Products and services categories

- **Specifications of the classification**
  - 30 categories of final products and services
  - Covering the entire economy



- **Electric and electronic products and equipment**
- **Construction work**
- **Building occupancy**
- **Packaging**
- **Textiles**
- **Transports**
- **Food and beverage**
- **Clothing and footwear**
- **Housing**
- **Health care and body care**
- **Transport**
- **Communication, recreation and culture**
- **Others**

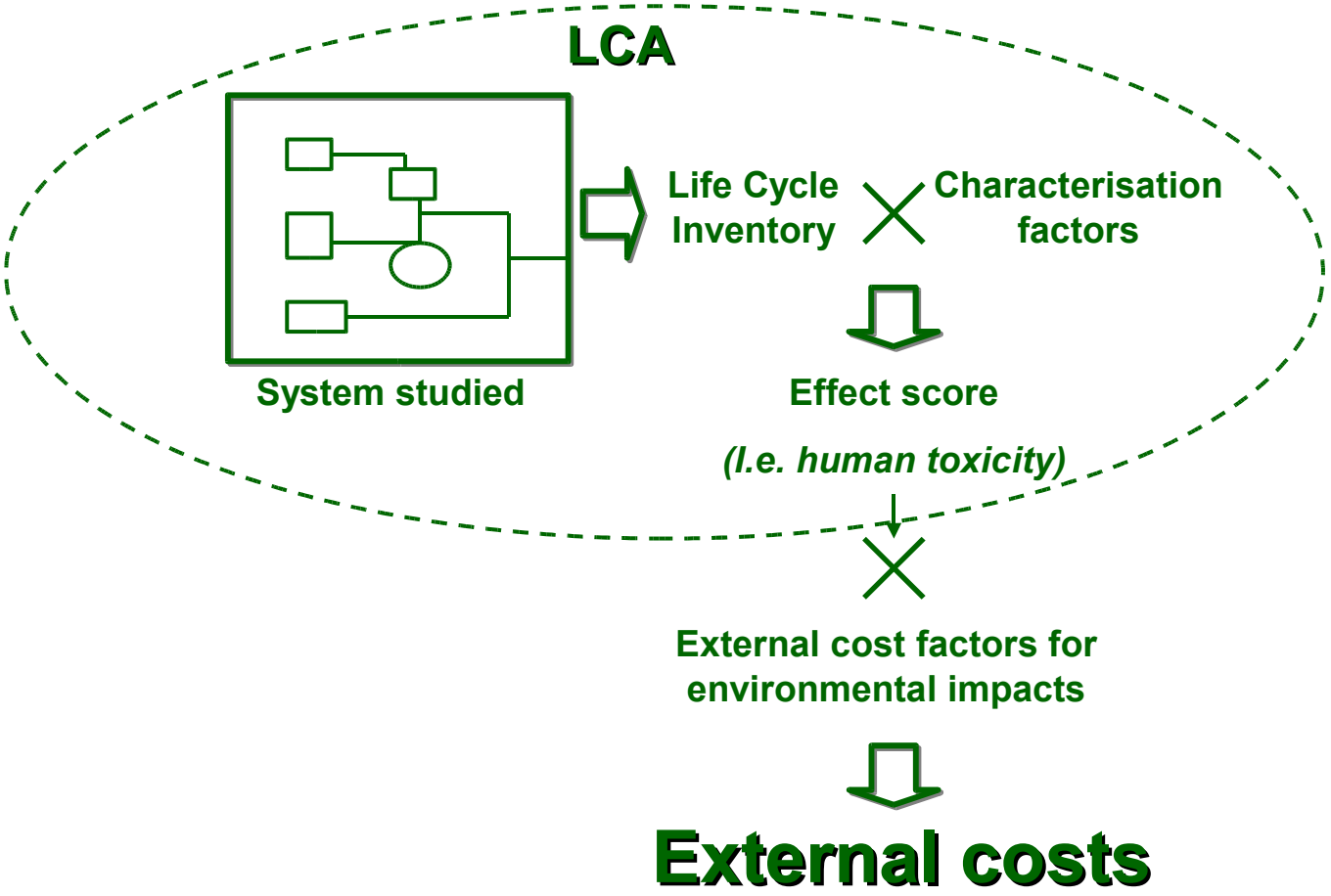
Methodology elaborated

- **Integration of the dimensions of the IPP**
  - Environmental impacts
    - Resources consumption, air emissions, water emissions emissions to soil
  - Life cycle approach
    - Production
    - Use
    - End of life
  - Entire European economy

- **3 steps :**
  1. Life Cycle Inventory (LCI)
  2. Environmental assessment
  3. Monetarisation

Monetarisation

- **Methods to Assess the LC External Costs from LCAs data**



Hypotheses

- **Functional unit**

  Quantity Q of products needed to fulfil the demand of European consumers per year

  – Time period : 1999

  – Geographic reference : European Union

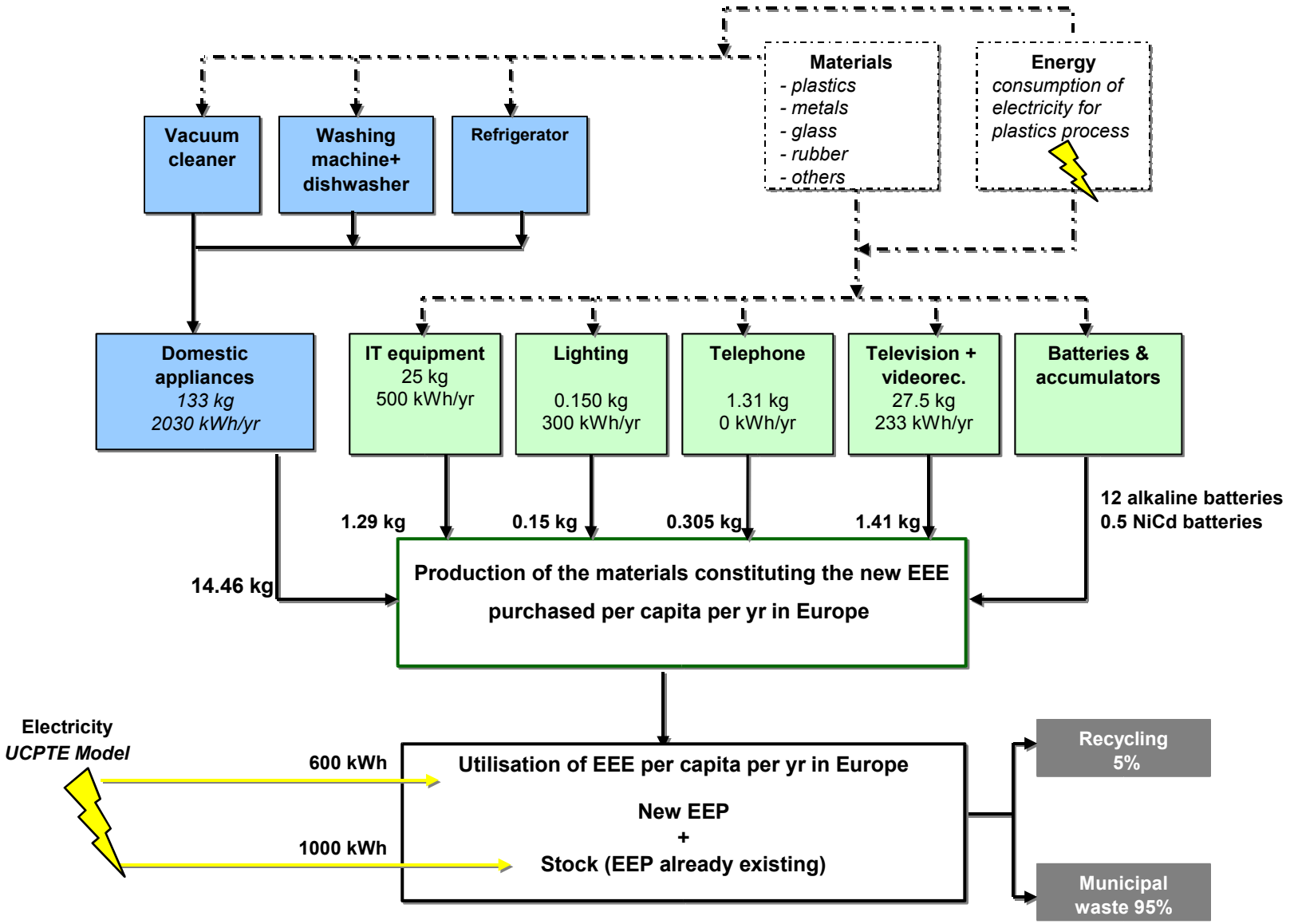
  – Scope reference : consumption

- **System boundaries**

  – LCA results are presented at the level of categories

  – LCA system referring to a given category is composed of various product sub-systems.

Example : Electric & Electronic Equipments



Environmental impacts considered

Environmental Impacts

- **Linked to resources consumption**
  - Depletion of non renewable resources
- **Linked to air emissions**
  - Greenhouse effect (direct, 100 yrs)
  - Stratospheric Ozone Depletion
  - Air acidification
  - Photochemical oxidation
- **Linked to water effluents**
  - Eutrophication
- **Linked to human health**
  - Human Toxicity
  - Years of Life Lost
- **Linked to ecotoxicological risk**
  - Aquatic Ecotoxicity
  - Sediment Ecotoxicity
  - Terrestrial Ecotoxicity

Other Environmental Indicators

- Primary energy
- Fossil energy
- Consumption of raw materials
- Dusts
- Dioxins
- Metals into air
- Metals into water
- Metals into soil
- Municipal and industrial waste
- Hazardous waste
- Inert waste

Modelling of an average citizen consumption per year

Drinkable water

59m³

Textiles

14 kg

Shoes

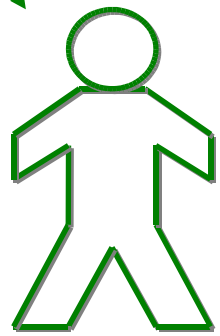
4 pairs

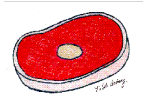
Soap & toiletries

5 kg

Vegetable food

491 kg



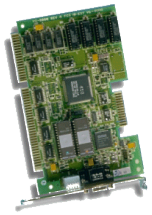


Non vegetable food

97 kg

Packaging

155 kg



Electric & electronic equipments

18 kg

Newsprint

26 kg

Public transports

2 678 pkm

Municipal Solid Waste

575 kg

Building & civil work

2 630 kg

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Results obtained

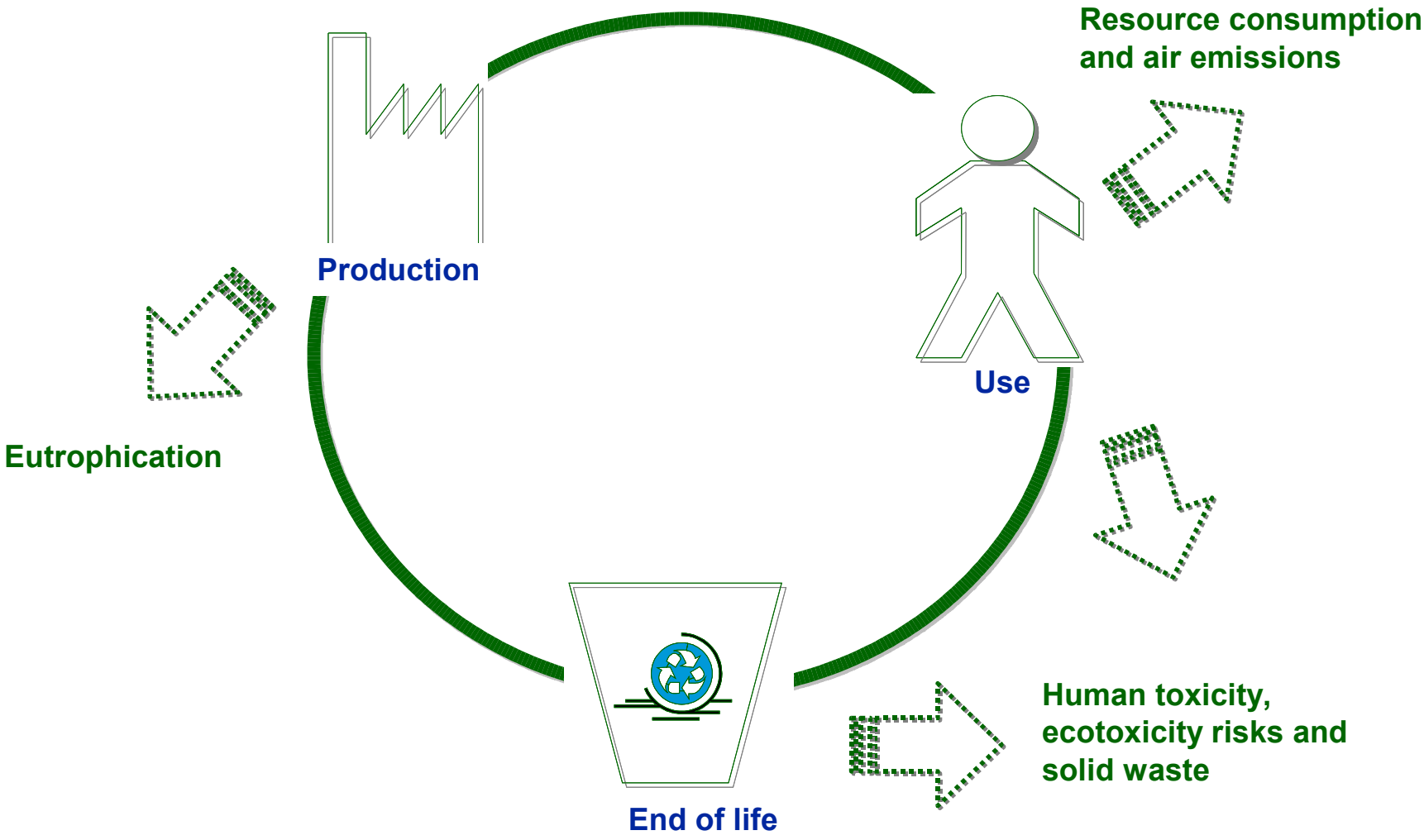
Environmental representativeness of the results

Environmental impacts *Per capita per year*	Results obtained in the study Total of all the categories studied – see §5.1.3	Data from Annual European Community Emission Inventory Source: Environmental European Agency, 2002	"Environmental Representativeness" of the results
	a	*b*	*a/b*
Primary energy consumed (MJ)	1,6E+05	1,7E+05	**97%** **Good**
Depletion of non renewable resources (kg antimony eq.)	5,3E+01	6,8E+01	**77%** **Good**
Greenhouse effect (kg CO2 eq.)	8,9E+06	1,1E+07	**82%** **Good**
Air acidification (kg SO2 eq.)	4,7E+04	5,5E+04	**86%** **Good**

Environmental impacts generated in the EU

Functional unit: Consumption per Capita per Year in Europe		Total	Production stage		Use stage		End of life stage	
A/ Environmental Impacts								
		Values	Values	%	Values	%	Values	%
Linked to resources consumption								
Depletion of non renewable resources	kg antimony eq.	52	9,0	17%	42,9	83%	0,0	0%
Linked to air emissions								
Greenhouse effect (direct, 100 yrs)	g CO2 eq.	8 736 520	1 656 095	19%	6 573 436	75%	506 989	6%
Stratospheric Ozone Depletion	g CFC-11 eq.	3	0,6	21%	2,3	79%	0,008	0%
Air acidification	g SO2 eq.	46 916	13 445	29%	33 166	71%	200	0%
Photochemical oxidation	g ethylene eq.	15 084	5 787	38%	8 484	56%	813	5%
Linked to water effluents								
Eutrophication	g PO4 eq.	6 870	5 219	76%	368	5%	1 279	19%
Linked to human health								
Human Toxicity	eq. 1-4-dichlorobenze	4 917 008 223	917 484 817	19%	105 104 461	2%	3 894 417 787	79%
Years of Life Lost	year	0,003	0,001	23%	0,002	75%	0,00005	2%
Linked to ecotoxicological risk								
Aquatic Ecotoxicity	eq. 1-4-dichlorobenze	883 620 066	78 839 920	9%	20 731 271	2%	784 048 723	89%
Sediment Ecotoxicity	eq. 1-4-dichlorobenze	2 844 196 998	253 195 311	9%	66 344 722	2%	2 524 656 575	89%
Terrestrial Ecotoxicity	eq. 1-4-dichlorobenze	323 062	85 180	26%	204 202	63%	33 680	10%
B/ Other Environmental Indic								
		Values						
Primary energy	MJ	160 060	35 028	22%	124 102	78%	695	0%
Dusts	g	7 009	1 826	26%	4 545	65%	601	9%
Dioxins	g	0,0000006	0,0000001	18%	0,0000001	18%	0,0000004	65%
Metals into air	g	858	29	3%	820	96%	9	1%
Metals into water	g	5 407	733	14%	4 446	82%	228	4%
Metals into soil	g	155	6	4%	45	29%	103,631	67%
Municipal and industrial waste	kg	1 187	176	15%	3	0%	1 008	85%
Hazardous waste	kg	17	10	57%	1	7%	6	36%
Inert waste	kg	1 290	192	15%	2	0%	1 096	85%

Distribution across the various stages



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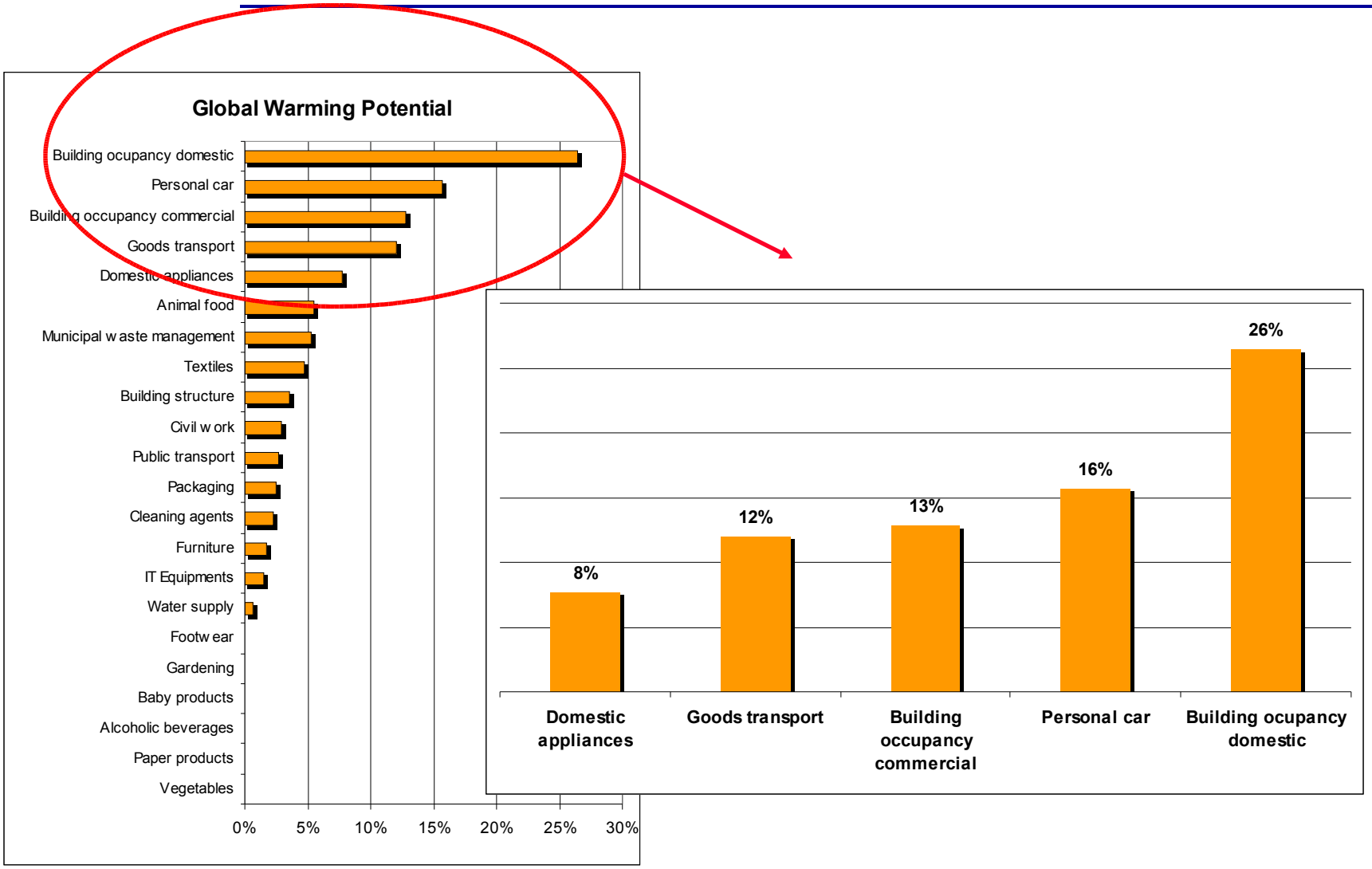
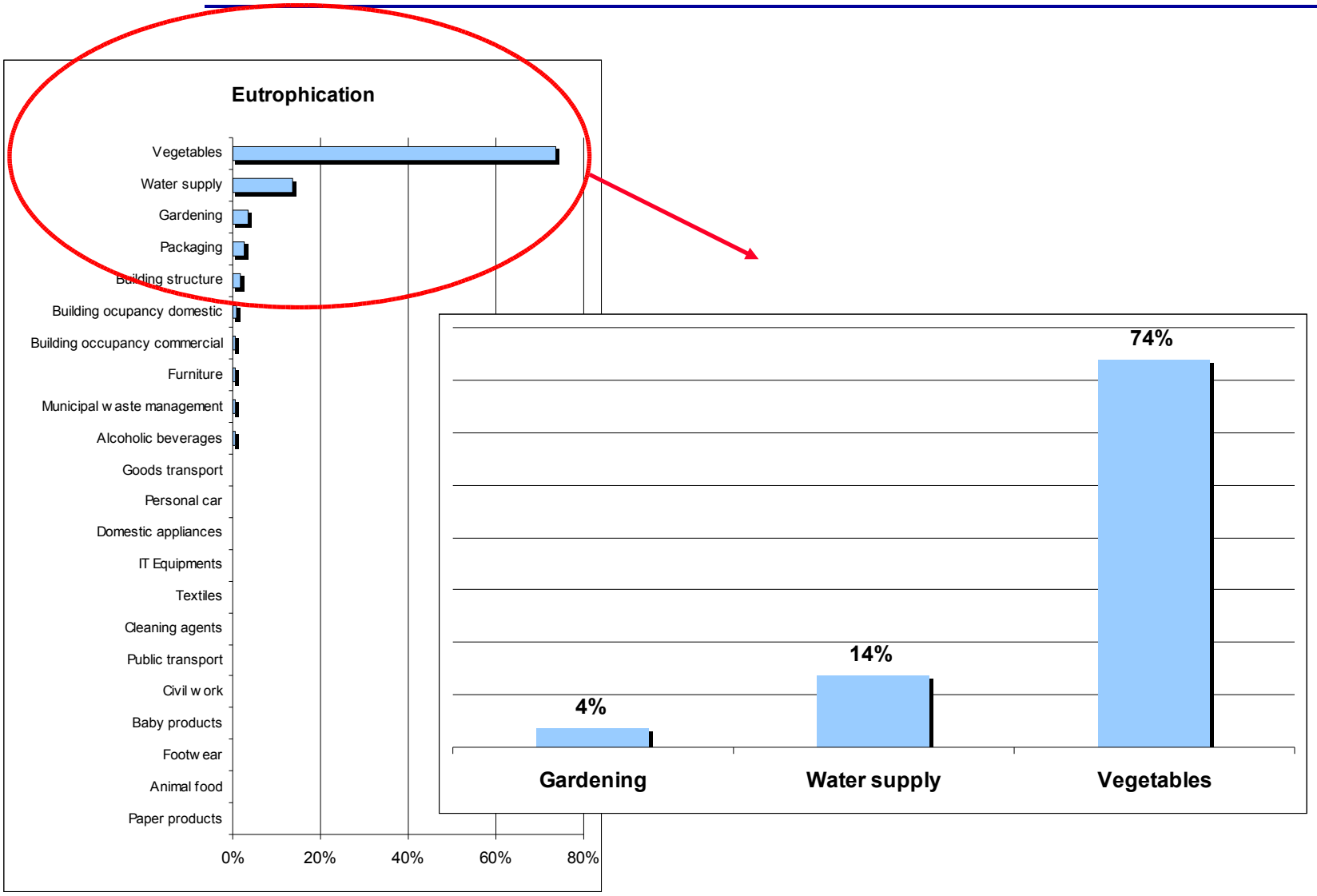
Details for some environmental impacts

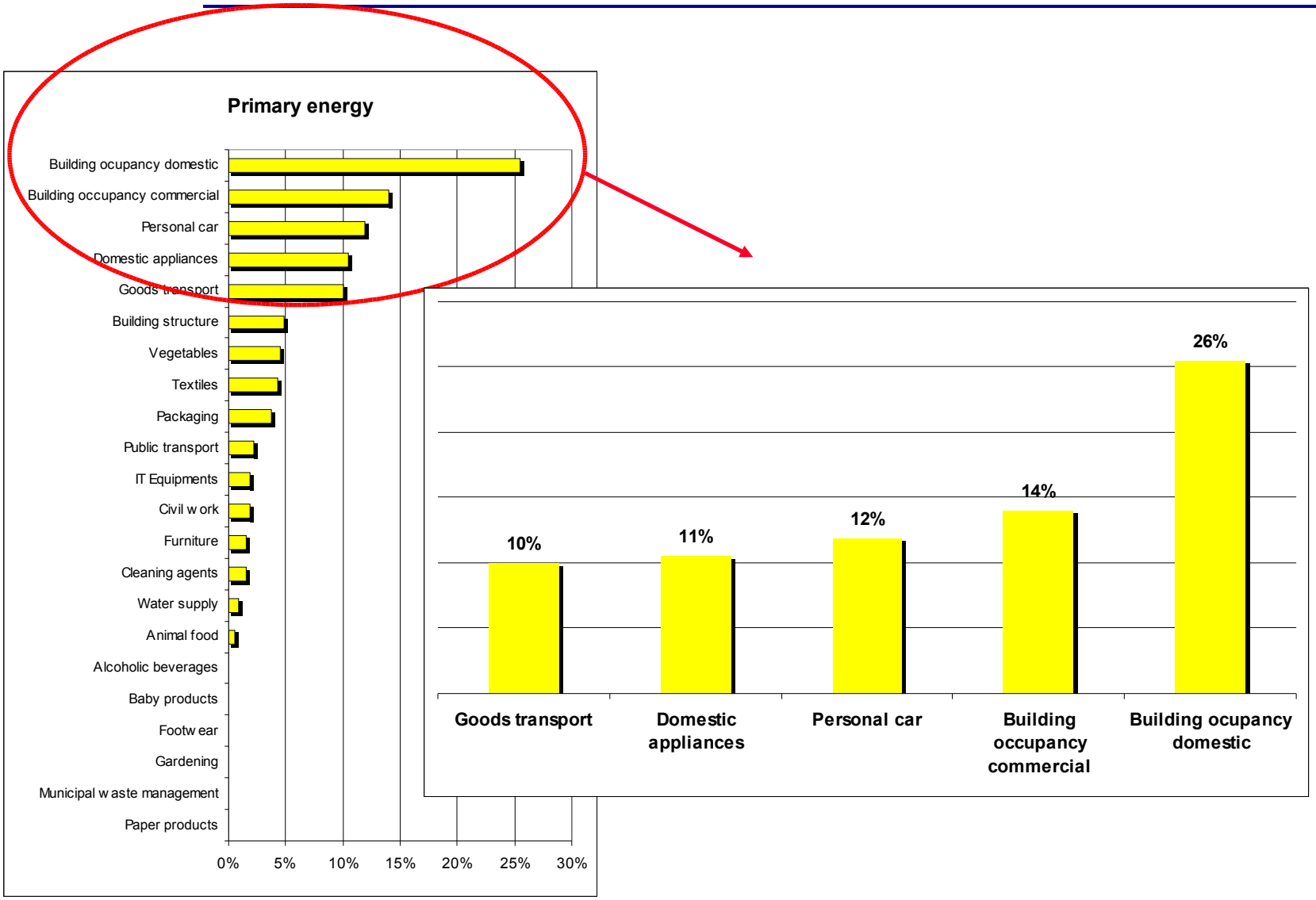
Global Warming



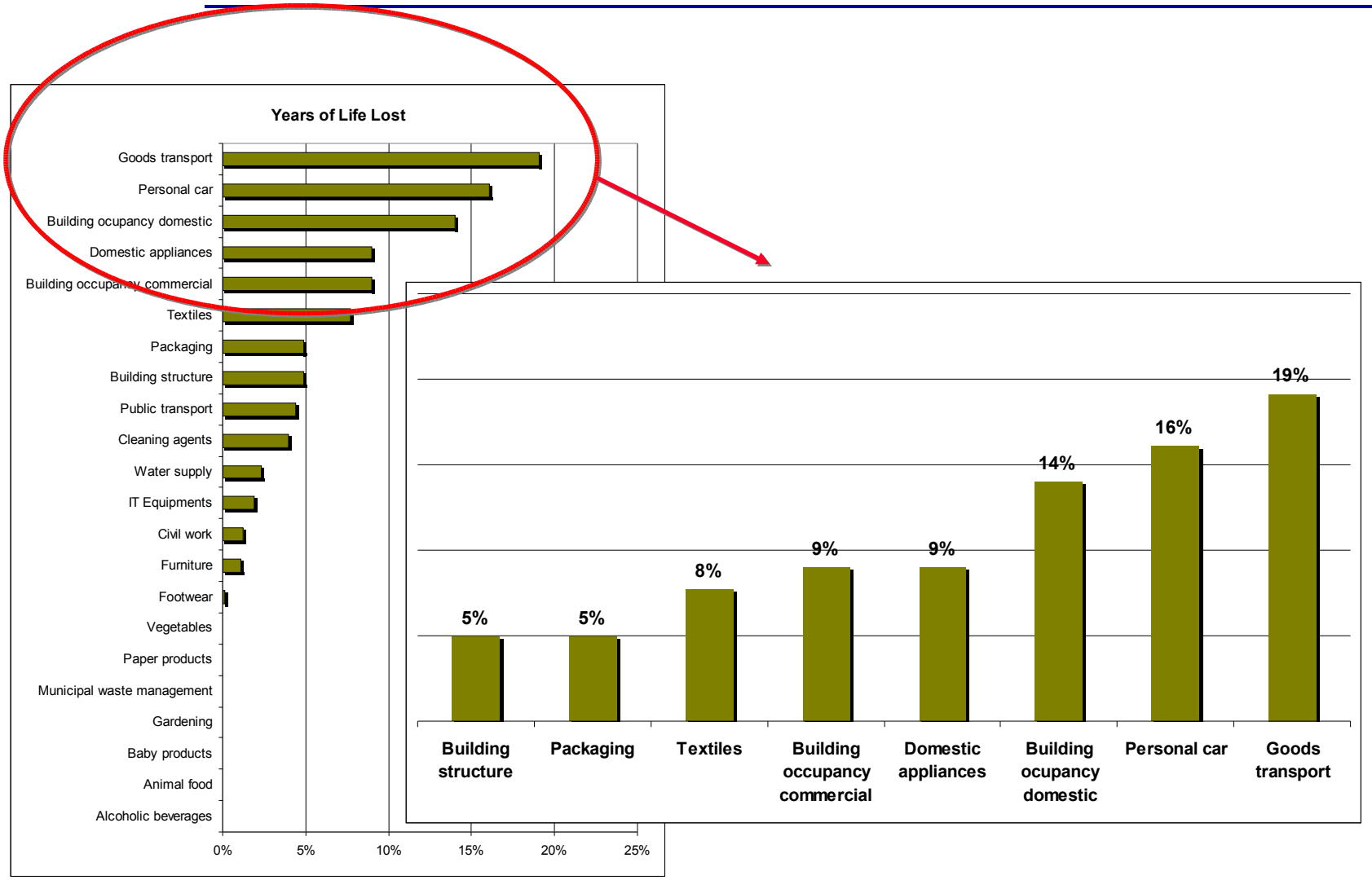
Eutrophication



Primary energy

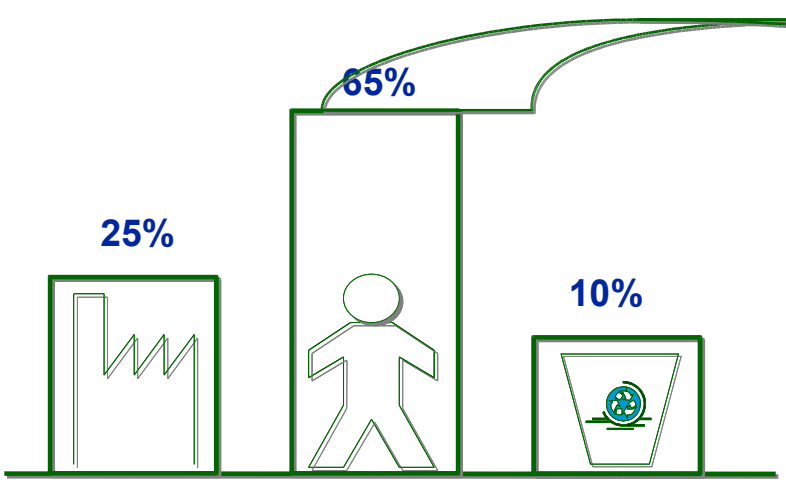


Years of Life Lost



External costs generated in the EU

- 220 < € per capita per year < 960



Mainly due to

- *Global warming*
- *Human health effects caused by dusts*

Mainly due to

Space heating

Goods transport

Personal car

Conclusion

- **LCA is powerful tool**
  - results are in accordance with macro-economic tendencies already known ;
  - can give priorities for IPP and for sustainable consumption.
- **But**
  - proliferation of LCA data on the information market has lead to problems with data quality, comprehensiveness, comparability.

  ⇒ Need of a European database of good quality
- **LCA usable for other ends**
  - Evaluation of external costs …