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Life Cycle Assessment as a Decision Tool in Environmental Policy

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Life Cycle of LCA Phase I:
The Early Years

LCA have a long tradition in Switzerland: In 1984 the then Federal Office for the Protection of the Environment published

“Ökobilanzen von Packstoffen”

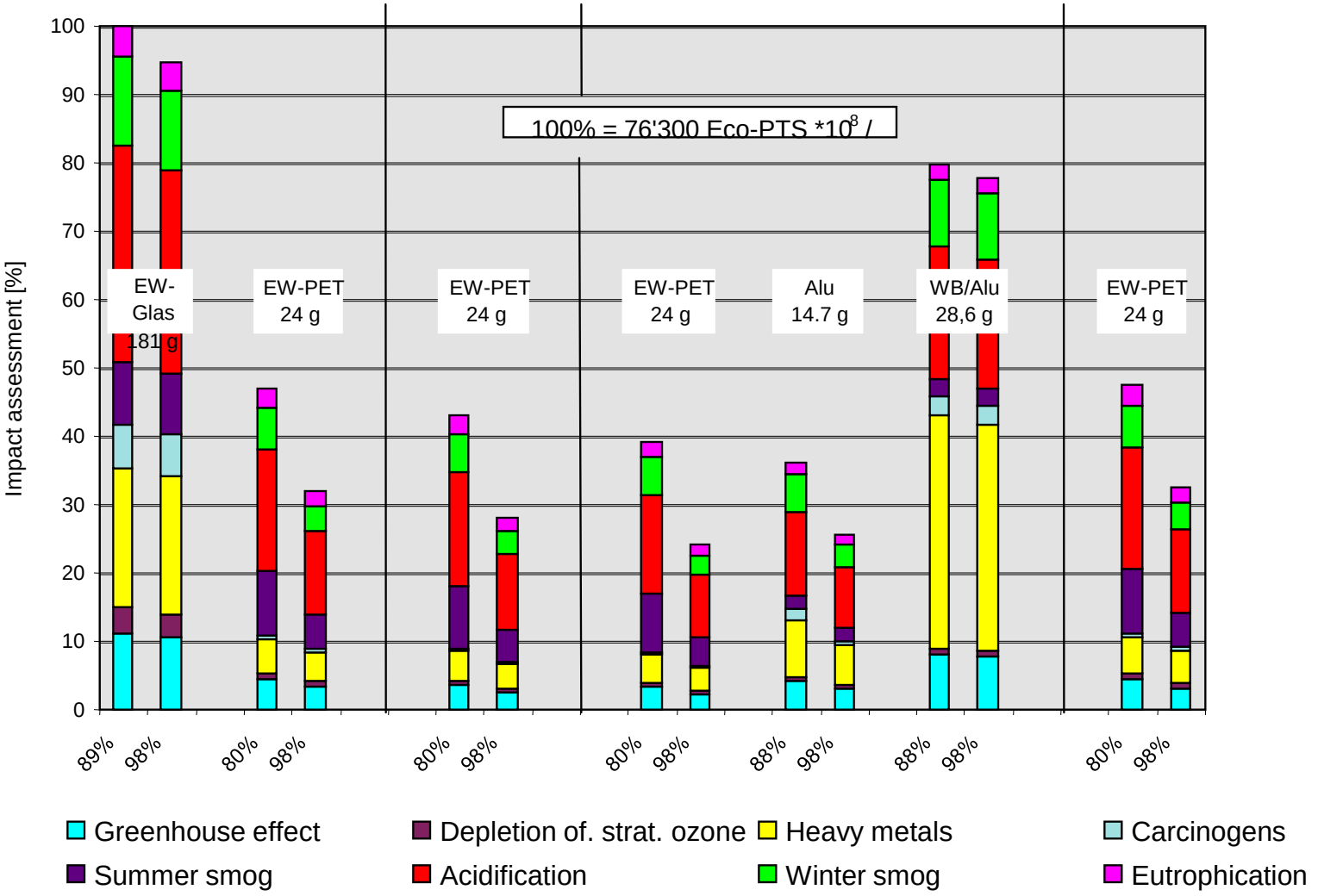
a booklet with inventories and assessments for different packaging materials, e.g. tin plate, glass, paper and cardboard and several plastics (LD-PE, HD-PE, PS, PVC) .

For the aggregation of the environmental impact of different pollutants to air or to water the tool of critical volumes was used. It is calculated by dividing the mass of the pollutant by the concentration limit stipulated by the law for the same pollutant.

Life Cycle of LCA Phase I:
LCA as an instrument for optimizing packaging

- Since 1985, the Federal Environment Office, together with interest groups of industry, commerce and science, has supported design and development of the instrument of LCA.
- The goal was to reduce the environmental impact of packages over the whole life cycle. Therefore the Office opted for fully aggregated methods (eco-scarcity, eco-indicator).
- By applying it, producers and retailers were able to optimize the most important packaging designs. The result were light weight packaging (reduced material consumption and waste quantities).
- Private companies, producers of packaging material and retailers became acquainted with LCA and began to use it in environmental areas other than waste and packaging.

Small beverage containers (33 cl)
impact assessment with eco-indicator



Life Cycle of LCA Phase I:

LCA as a decision tool in Waste Management

In 1986, a panel of scientist, administration, NGOs and representatives from economy proposed to the Government the "**Guidelines for waste management in Switzerland**".

One of its key principles states:

- Waste should only be *recycled* if this results in ***less environmental pollution*** than disposal of the waste and manufacture of a new product.
- Recycling needs to be economically viable in the long term.

This wording stipulates the application of life cycle assessment for decisions in waste management.

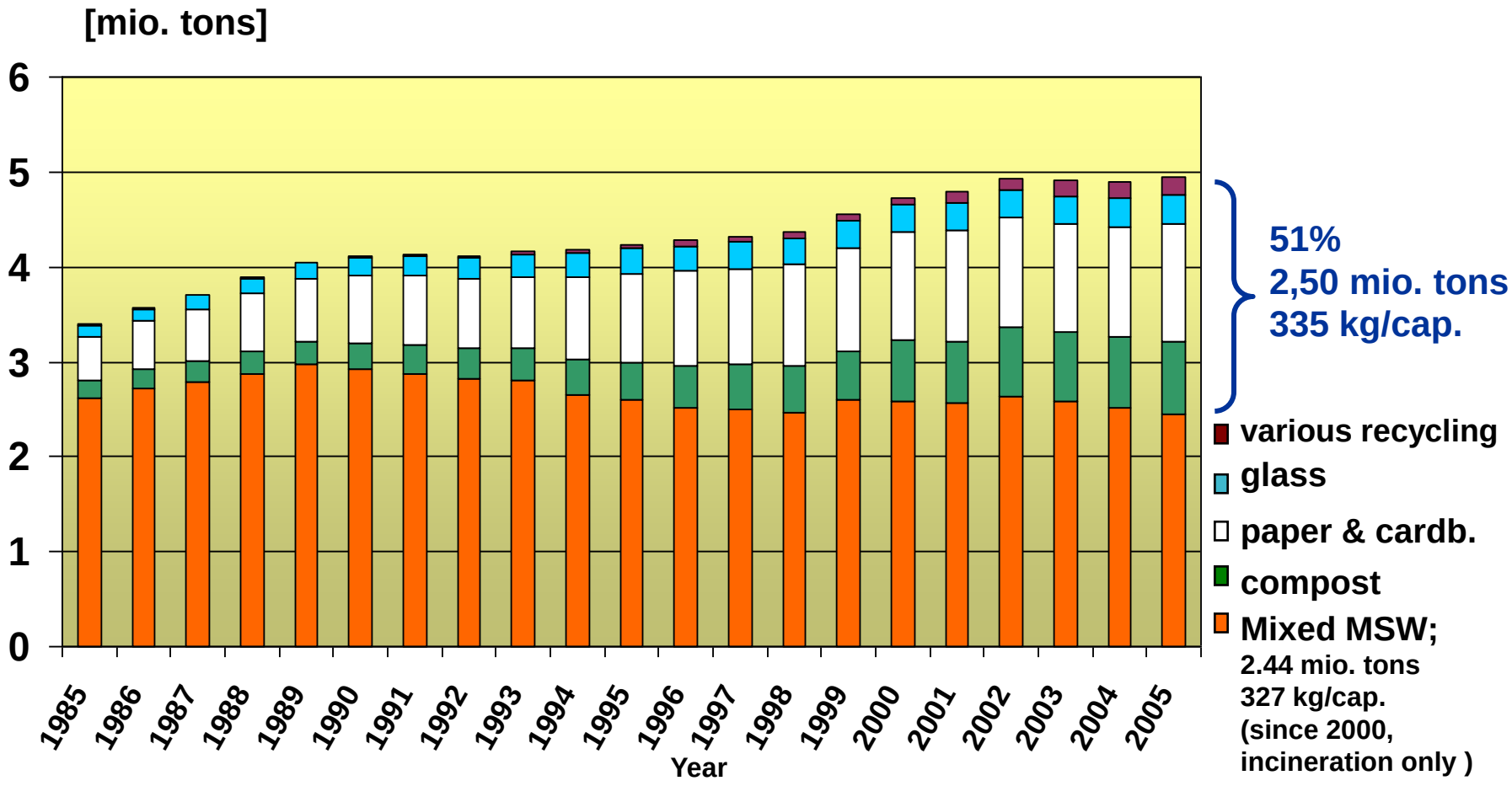
One important Decision:

Recycling or Elimination of Specific Waste Streams?

- Should used paper be incinerated with energy recovery in Municipal Solid Waste Incinerators MSWI or rather be recycled in order to produce cardboard and recycled paper ?
- Is it better, from an ecological point of view, to burn motor oil in cement kilns as an alternative fuel, or should we recycle it ?
- Similar question for spent solvents: recycling or burning as a fuel in specially equipped incinerators ?

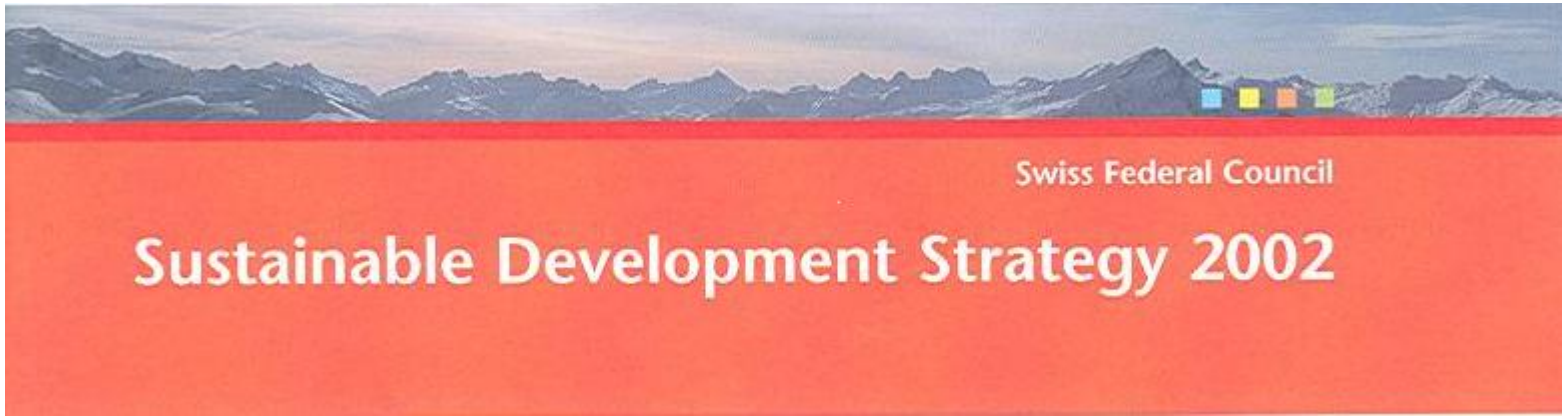
One result: High rate of separately collected and recycled material out of Municipal Solid Waste

Total MSW in 2005: 4.94 million tons (662 kg/cap.)



The Life Cycle of LCA Phase II:

From Waste Management towards an Integrated Product Policy



Sustainable Development Strategy 2002 of the Swiss Government

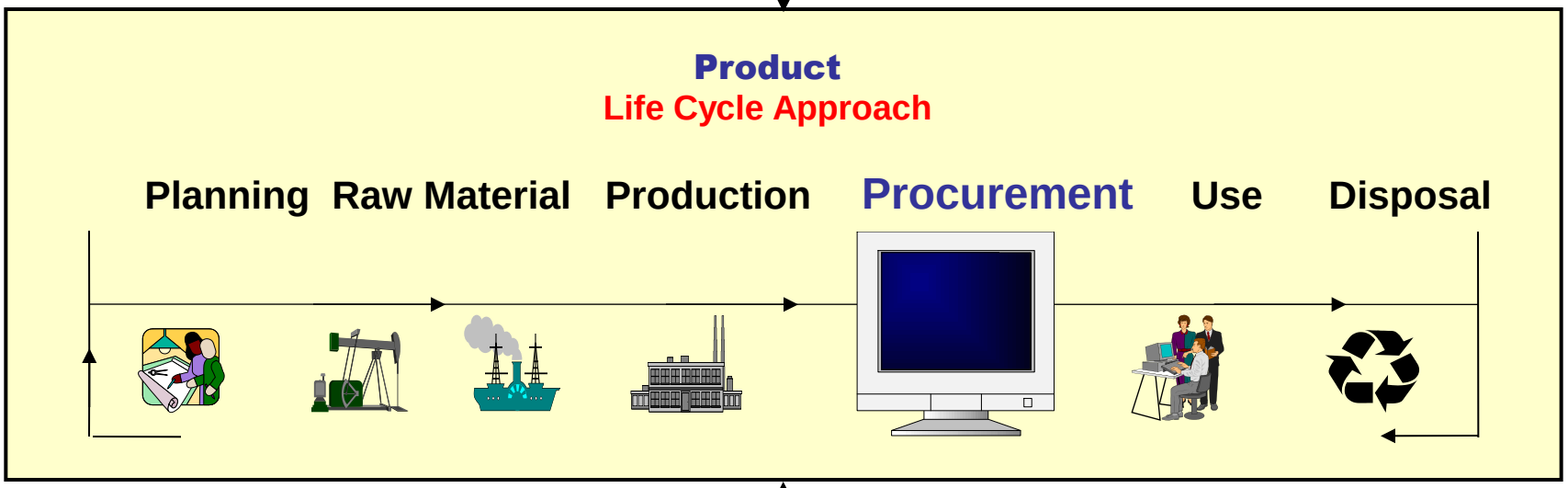
Area of action: financial policy

Measure 4*:* **Introduction of an integrated product policy IPP**
To ensure that the principles of sustainable development are also put into practice in relation to products (goods and services), the Federal Council supports the introduction of an **integrated product policy (IPP).** Through the creation of a more favourable national and international framework, **the Federal Council is seeking to shift public sector and consumer demand towards products that meet high economic, environmental and social standards**. Throughout **their life cycle** (planning, production, use and disposal), products and services are to comply with stringent economic, environmental and social requirements. .....

Integrated Product Policy IPP

Civil society (supply and demand side)

manufacturing industry, financial world, trade and industry, consumers



Government/ Administration (regulation)

environmental policy, procurement policy, economy and trade policy, finance policy, agricultural policy, product liability and standards policy, development policy, social policy, energy policy, transport policy, etc.

Integrated Product Policy:
The Role of the Federal Administration

- To gain and improve the knowledge of production processes, material flows and use of resources
- To evaluate the effects of production and consumption of goods and services on the environment, society and economy
- To sensitize Politics, Economy and Civil Society for sustainable product design
- To propose and to implement measures for an optimization of products and services towards Sustainability

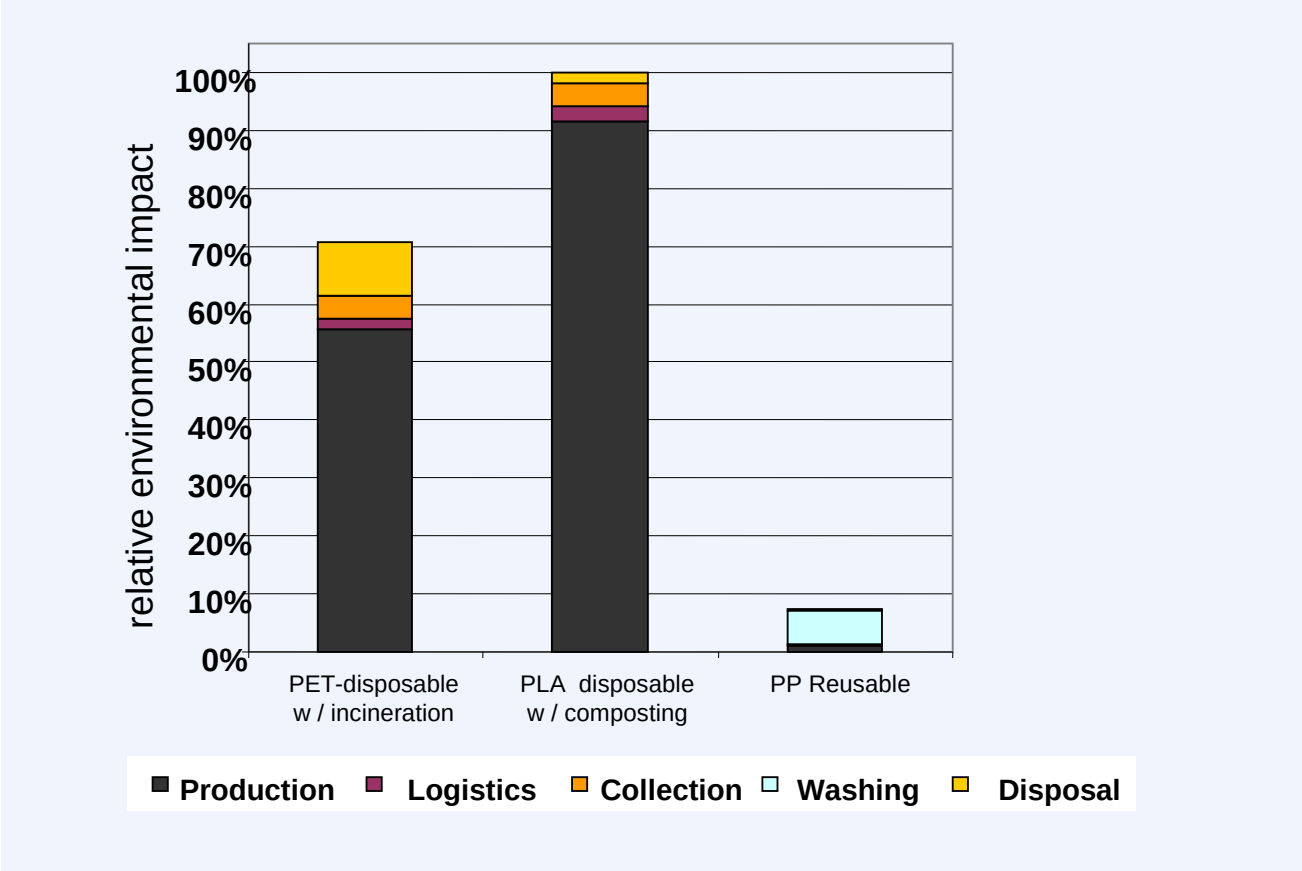
The importance of LCA for implementing an Integrated Product Policy

- Product design and development, Eco-Design and analysis of critical points (“Schwachstellenanalyse”)
- Strategic planning
- Public Policy making
- Marketing; product information for consumers (in order to compare products)

Adapted from: Frischknecht, R., Methoden der Umweltbewertung Technischer Systeme, Lecture Notes, Zurich 2005

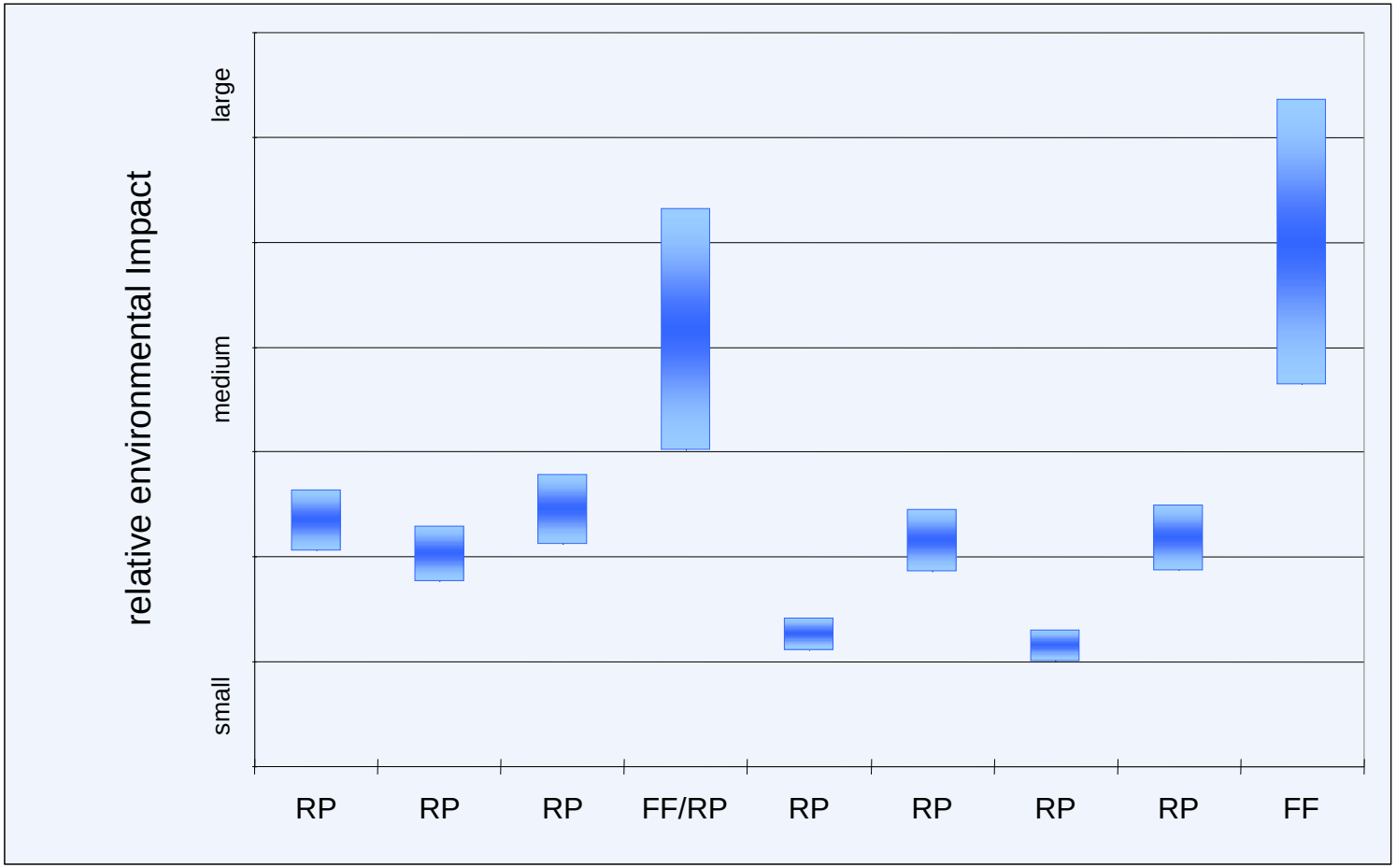
Waste Minimization during EURO 08
The ecologically best cup for catering drinks?

LCA for one specific scenario:



LCA of Printing Paper

Comparison of paper from fresh fiber (FSC) und recycling paper



Project: Eco-label for cars

- Goal: Comprehensive information on energy use and on other relevant environment and health factors (e.g. air pollution, noise) during operation of a car

- Possible applications
  - Transparent and comprehensive information for the car-buyer
  - Ecological differentiation of the federal car-tax on importation
  - Ecological differentiation of the cantonal car-tax
  - Ecological differentiation for possible future Road-pricing

Criteria for ecological and efficient cars

The 12 cars with lowest ecopoints

Die erstplacierten auf der Liste des Bundes

Marke	Typ	Treibstoff	Hubraum	Leistung in Kw	Verbrauch	Plätze	Effizienzkategorie A–G	Umweltbelastungspunkte²
Toyota	Prius	Benzin	1497	57	4.3 l/100km	5	A	76
Fiat	Punto 1.2 Bipower	Erdgas	1242	44	6.2 m³/100km	5	A	80
Fiat	Panda 1.2 Bipower	Erdgas	1242	44	6.4 m³/100km	4	A	81
Daihatsu	Cuore	Benzin	998	51	4.4 l/100km	4	A	82
Citroen	C3 1.4i Gnv	Erdgas	1360	54	6.6 m³/100km	5	A	82
Opel	Corsa C10 Eco	Benzin	998	44	4.8 l/100km	5	A	83
Opel	Astrag16 Cng Cvan	Erdgas	1598	71	6.7 m³/100km	5	A	83
Honda	Civic Hybrid	Benzin	1339	70	4.6 l/100km	5	A	84
Toyota	Aygo 1.0	Benzin	998	50	4.6 l/100km	4	A	85
Citroen¹	C1 1.0i	Benzin	998	50	4.6 l/100km	4	A	85
Peugeot	107 1.0i	Benzin	998	50	4.6 l/100km	4	A	85
VW	Polo Blue Motion	Diesel	1422	59	4.1 l/100km	5	A	86

Criteria for ecological and efficient cars

The 12 cars with most ecopoints

Die umweltschädlichsten Autos

Die letztplacierten auf der Liste des Bundes

Marke	Typ	Treibstoff	Hubraum	Leistung in Kw	Verbrauch	Plätze	Effizienzkategorie A–G	Umweltbelastungspunkte[1]
Renault	Espace 3.0 Dci	Diesel	2958	133	9.5 l/100km	7	D	771
Ssangyong[1]	Kyron M270xdi FI	Diesel	2696	121	9.5 l/100km	5	E	773
Ssangyong	Rodius 270xdi4wd	Diesel	2696	121	9.3 l/100km	7	D	775
Land Rover[1]	Discov.2.7td V6	Diesel	2720	140	10.2 l/100km	7	D	780
Jeep	Cherokee 2.8 Crd	Diesel	2776	120	10.5 l/100km	5	F	790
Fiat[1]	Ducato	Diesel	2999	115	8.6 l/100km	9	C	833
Citroen[1]	Jumper	Diesel	2999	115	8.6 l/100km	9	C	833
Peugeot[1]	Boxer	Diesel	2999	115	8.6 l/100km	9	C	833
VW[1]	T5	Diesel	1896	62	8.5 l/100km	9	C	842
Ford[1]	Transit	Diesel	2402	85	10.3 l/100km	9	E	858
Ford[1]	Transit 4x4	Diesel	2402	103	11.2 l/100km	9	F	867
Nissan[1]	Patrol Gr 3.0 Dci	Diesel	2953	118	10.9 l/100km	7	E	919

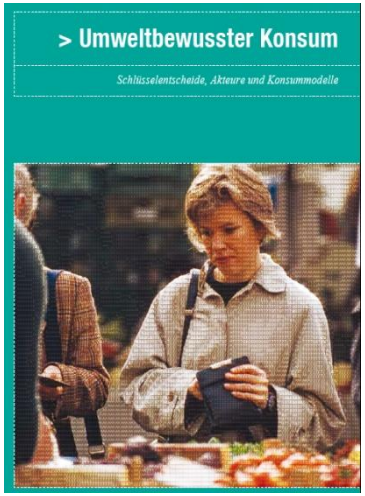
Sustainable consumption

The informed consumer can make his/her contribution to a lower energy- and material-use!

Tabelle 3: Übersichtstabelle: Umweltwirkungen nach Bereich und nach Lebenszyklusphase.

Bereich	Wirkung nach Lebenszyklusphase		
	Herstellung	Gebrauch	Entsorgung
Wohnen [1]			
Private Mobilität [1]	[2]	Aktive Produkte [3]	[2]
Konsumgüter und Dienstleistungen		Passive Produkte [2]	
Ernährung [4]			
Öffentliche Dienste und Versicherungen [5]			

Legende:	Sehr bedeutend	Bedeutend	Sekundär	Unbedeutend

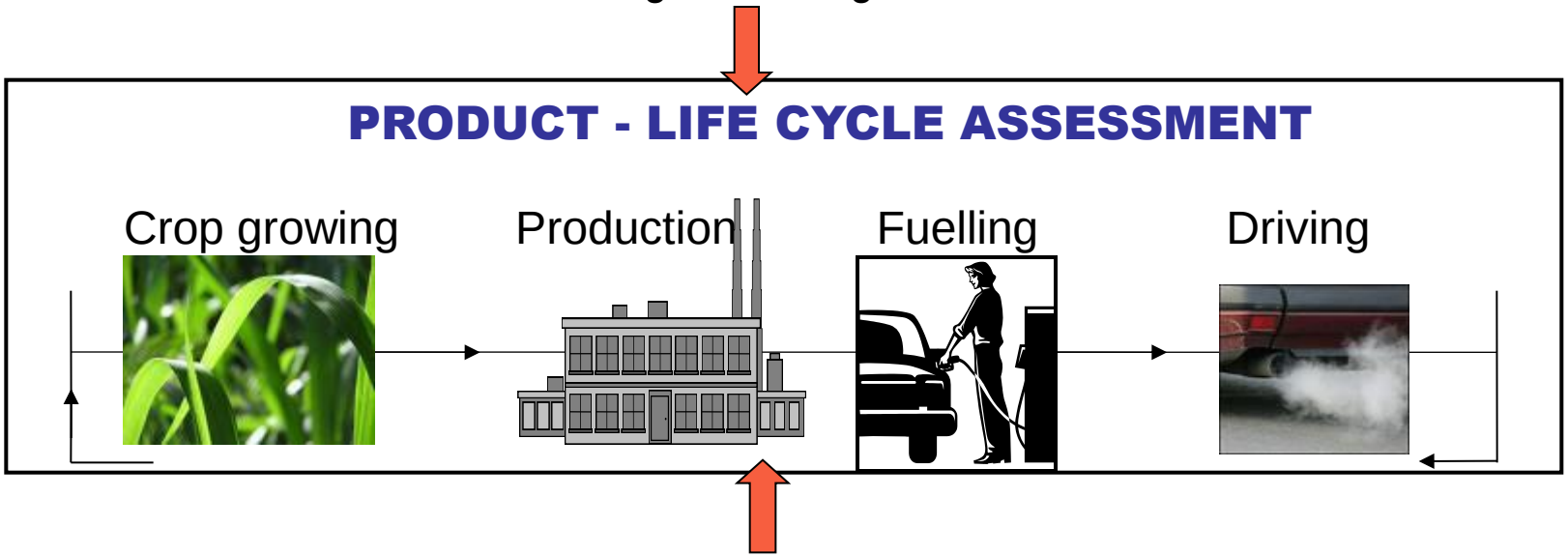


Life Cycle of LCA Phase III:

LCA Goes Legal: The Example of Biofuels

Society (supply and demand)

Climate change, growing energy demand, sustainable use of resources, diversification of agriculture, „green“ consumers, etc.

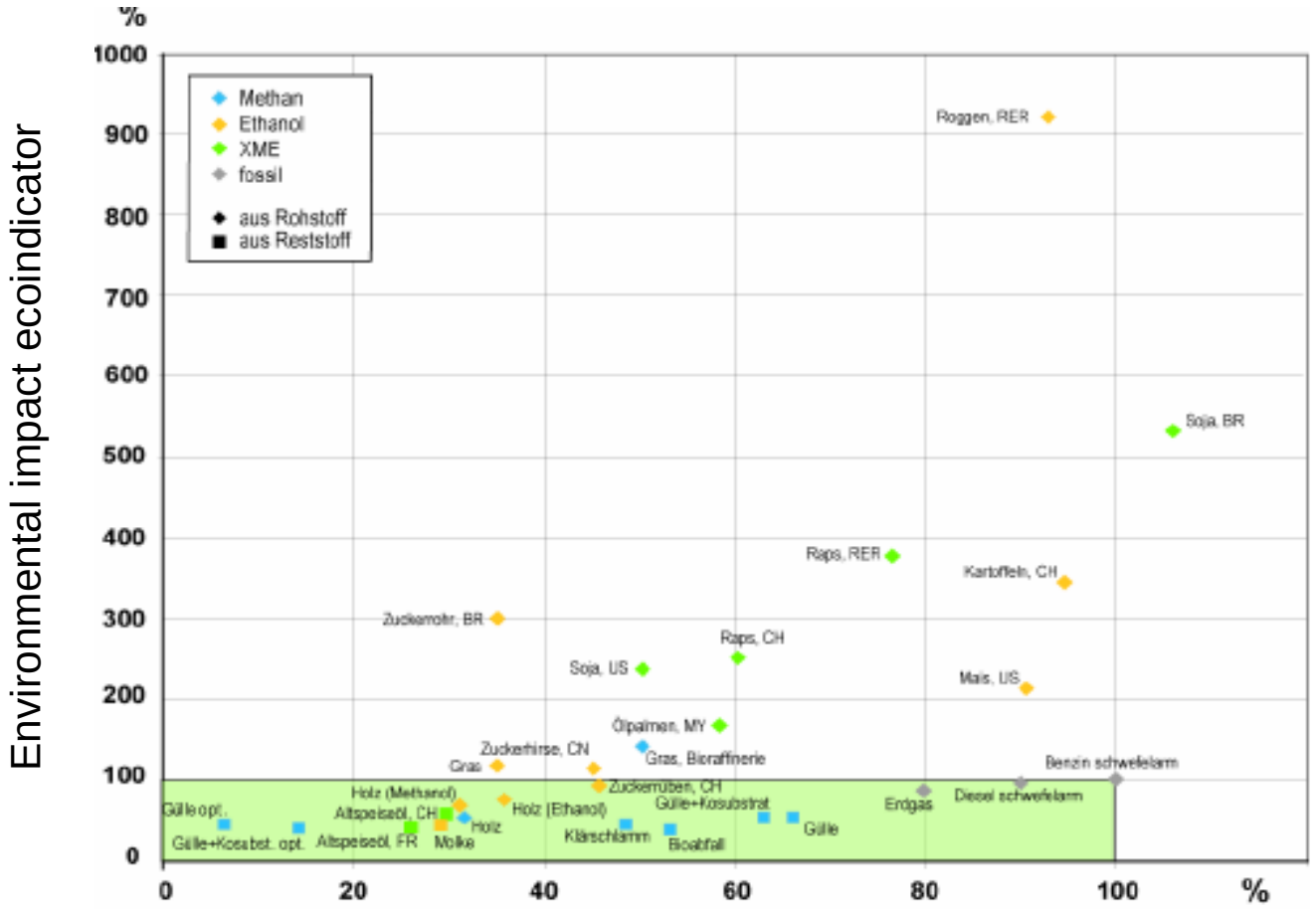


Government/ Administration

environmental policy, procurement policy, economy and trade policy, finance policy, agricultural policy, product liability and standards policy, development policy, social policy, energy policy, transport policy, etc.

Biofuels – as ecological as stated ?

EMPA-study: Ökobilanz von Energieprodukten: Ökologische Bewertung von Biotreibstoffen



Environmental impact ecoindicator

Emissions of greenhouse gas relative to gasoline

What is the political impact of the study on biofuels ?

The Federal Government has decided in January 2008 on an ordinance on tax exemption for fuel derived from biomass (to specify a law already decided by the Swiss parliament).

Biofuels may profit from tax exemption:

- if they effect a reduction of greenhouse gas emissions of at least 40%, as compared to fossil fuel, and
- if they don't cause an environmental impact which is substantially bigger than the impact of fossil fuels (as a rule not more than 125% of the ecopoints of fossil fuel).

- There will be no tax exemption if the production of the biofuel causes deforestation of rainforests or endangers biodiversity in the countries of origin.
- Tax exemption will only be granted if the fuels are produced according to minimum labour standards

Life Cycle Assessment – Which Assessment Method is the Correct One?

- Ecological Footprint?
- Cumulated Energy Consumption?
- Aggregated Environment Impact?
  - If Yes: Which aggregation? UBP 06? Ecoindicator 99? Impact 2002+ ?
- Greenhouse Gas Emissions?

Life Cycle Assessment – Which Assessment Method is the Correct One?

- Ecological Footprint?
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- Greenhouse Gas Emissions?

→ Wrong question! The problem defines the tool! We need specifically adapted methods in order to get an answer to our questions.

The Importance of the Workbench: Data Quality for Eco-inventories

- Accurate
- Complete
- Representative
- Consistent
- Comprehensible and traceable
- Critically Reviewed

- Genauigkeit (Wie gross ist der Schwankungsbereich der einzelnen Datenpunkte?),
- Vollständigkeit (Welcher Anteil des interessierenden Prozesses wird durch die Daten abgedeckt?),
- Repräsentativität (Wie gut spiegeln die Daten den interessierenden Prozess wieder?),
- Konsistenz (Wie einheitlich wird die Methode angewendet?), und
- Nachvollziehbarkeit (In welchem Umfang können die Resultate nachvollzogen werden?)

From: Frischknecht, R., Methoden der Umweltbewertung Technischer Systeme, Lecture Notes, Zurich 2005

Ecoinvent is a stable and reliable “workbench” for assessing the environment impact of products and services with the appropriate LCA-methods

- Large information content with over 4000 data sets
- Widely and globally used
- Elaborate and transparent management of data quality
- Reliable and realistic standard for product-specific eco-inventories of Third Parties

ecoinvent Centre

Swiss Centre for Life Cycle Inventories

A joint initiative of the ETH domain and Swiss Federal Offices

ETH

EMPA

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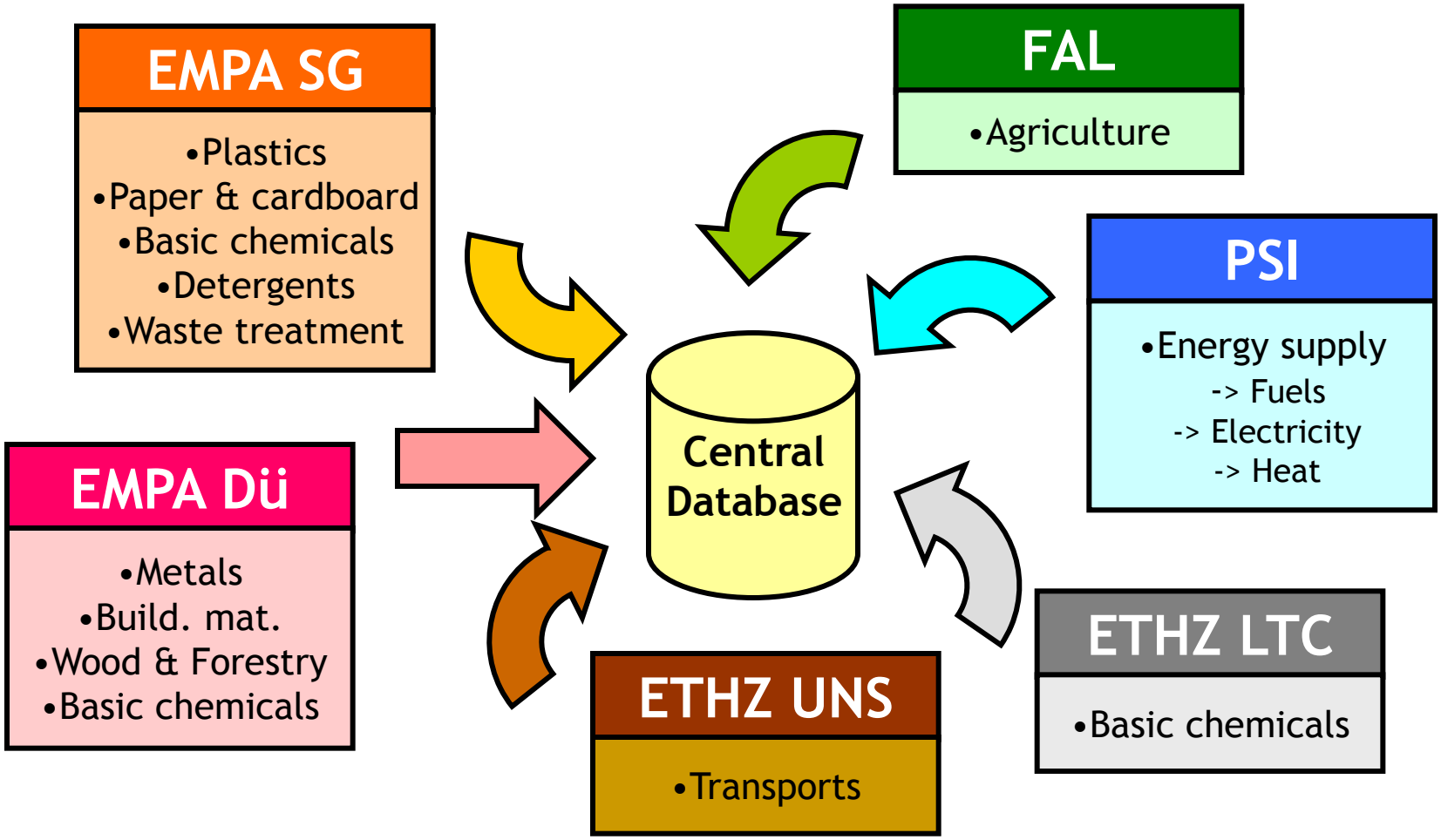

Conclusions I

- LCA provides valuable information for producers, consumers and political decision makers.
- Life cycle assessment are increasingly used in the preparation of decisions in the field of environmental policy, with legal, financial and social consequences
- LCA are a stable base for decisions only if everybody may comprehend and reproduce the results. Therefore we need:
  - clear and reliable scientific bases
  - a transparent process for calculating inventories
  - a reasonable set of methods and tools for evaluating impacts
- Fully aggregating methods may be more reliable and stay useful over a longer period of time than narrow, focused LCA.

Conclusions II

- The environmental impact as evaluated with LCA is in many cases only **one** element in decision making. The convenience for the consumer, the price of a product or logistical restrictions are other, and often more important, decision factors.
- Life cycle assessment will not answer ethical questions. We have to decide ourselves whether we will turn corn into gasoline for cars or whether we will better use it as human food or animal feed.