Life Cycle Assessment as a Decision Tool in Environmental Policy

Mathias Tellenbach

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Life Cycle Assessment as a Decision Tool in Environmental Policy

Structure of the Presentation

1. The Life Cycle of LCA Phase I: The Early Years
2. The Life Cycle of LCA Phase II: From Waste Management towards an Integrated Product Policy
3. The Life Cycle of LCA Phase III: LCA Goes Legal
4. LCA as a Decision Tool: Selecting the Right Tool
5. Eco-inventories: The Importance of the Workbench
6. Conclusions
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 lightweight 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

100% = 76'300 Eco-PTS *10^8 /

Impact assessment [%]

- Greenhouse effect
- Depletion of. strat. ozone
- Heavy metals
- Carcinogens
- Summer smog
- Acidification
- Winter smog
- Eutrophication

LCA as a decision tool in environment policy
Mathias Tellenbach FOEN-CH
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) and recycling paper

relative environmental impact

large
medium
small

RP RP RP FF/RP RP RP RP RP FF
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

<table>
<thead>
<tr>
<th>Marke</th>
<th>Typ</th>
<th>Treibstoff</th>
<th>Hubraum</th>
<th>Leistung in Kw</th>
<th>Verbrauch</th>
<th>Plätze</th>
<th>Effizienzkategorie</th>
<th>Umweltbelastungspunkte</th>
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<tbody>
<tr>
<td>Toyota</td>
<td>Prius</td>
<td>Benzin</td>
<td>1497</td>
<td>57</td>
<td>4.3 l/100km</td>
<td>5</td>
<td>A</td>
<td>76</td>
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<tr>
<td>Fiat</td>
<td>Punto 1.2 Bipower</td>
<td>Erdgas</td>
<td>1242</td>
<td>44</td>
<td>6.2 m³/100km</td>
<td>5</td>
<td>A</td>
<td>80</td>
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<tr>
<td>Fiat</td>
<td>Panda 1.2 Bipower</td>
<td>Erdgas</td>
<td>1242</td>
<td>44</td>
<td>6.4 m³/100km</td>
<td>4</td>
<td>A</td>
<td>81</td>
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<tr>
<td>Daihatsu</td>
<td>Cuore</td>
<td>Benzin</td>
<td>998</td>
<td>51</td>
<td>4.4 l/100km</td>
<td>4</td>
<td>A</td>
<td>82</td>
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<td>Citroen</td>
<td>C3 1.4i Gnv</td>
<td>Erdgas</td>
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<td>6.6 m³/100km</td>
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<td>Opel</td>
<td>Corsa C10 Eco</td>
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<tr>
<td>Opel</td>
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<td>Erdgas</td>
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<td>Honda</td>
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<td>Aygo 1.0</td>
<td>Benzin</td>
<td>998</td>
<td>50</td>
<td>4.6 l/100km</td>
<td>4</td>
<td>A</td>
<td>85</td>
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<tr>
<td>Citroen²</td>
<td>C11.0i</td>
<td>Benzin</td>
<td>998</td>
<td>50</td>
<td>4.6 l/100km</td>
<td>4</td>
<td>A</td>
<td>85</td>
</tr>
<tr>
<td>Peugeot</td>
<td>107 1.0i</td>
<td>Benzin</td>
<td>998</td>
<td>50</td>
<td>4.6 l/100km</td>
<td>4</td>
<td>A</td>
<td>85</td>
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<tr>
<td>VW</td>
<td>Polo Blue Motion</td>
<td>Diesel</td>
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<td>86</td>
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</tbody>
</table>
Criteria for ecological and efficient cars

The 12 cars with most ecopoints

<table>
<thead>
<tr>
<th>Marke</th>
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<th>Habraum</th>
<th>Leistung in Kw</th>
<th>Verbrauch</th>
<th>Platz</th>
<th>Klasse</th>
<th>Umweltbelastungs punkte</th>
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<tbody>
<tr>
<td>Renault</td>
<td>Espace 3.0 Dci</td>
<td>Diesel</td>
<td>2958</td>
<td>133</td>
<td>9.5 l/100km</td>
<td>7</td>
<td>D</td>
<td>771</td>
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<td>Ssangyong</td>
<td>Kyron M270xdi Fl</td>
<td>Diesel</td>
<td>2696</td>
<td>121</td>
<td>9.5 l/100km</td>
<td>5</td>
<td>E</td>
<td>773</td>
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<tr>
<td>Ssangyong</td>
<td>Rodius 270xdi4wd</td>
<td>Diesel</td>
<td>2696</td>
<td>121</td>
<td>9.3 l/100km</td>
<td>7</td>
<td>D</td>
<td>775</td>
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<tr>
<td>Land Rover</td>
<td>Discov.2.7td V6</td>
<td>Diesel</td>
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<td>7</td>
<td>D</td>
<td>780</td>
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<td>Jeep</td>
<td>Cherokee 2.8 Crd</td>
<td>Diesel</td>
<td>2776</td>
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<td>10.5 l/100km</td>
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<td>F</td>
<td>790</td>
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<tr>
<td>Fiat¹</td>
<td>Ducato</td>
<td>Diesel</td>
<td>2999</td>
<td>115</td>
<td>8.6 l/100km</td>
<td>9</td>
<td>C</td>
<td>833</td>
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<tr>
<td>Citroen¹</td>
<td>Jumper</td>
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<td>2999</td>
<td>115</td>
<td>8.6 l/100km</td>
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<td>8.6 l/100km</td>
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<td>C</td>
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<tr>
<td>VW¹</td>
<td>T5</td>
<td>Diesel</td>
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<td>9</td>
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<tr>
<td>Ford</td>
<td>Transit</td>
<td>Diesel</td>
<td>2402</td>
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<td>10.3 l/100km</td>
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<td>E</td>
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<td>Ford¹</td>
<td>Transit 4x4</td>
<td>Diesel</td>
<td>2402</td>
<td>103</td>
<td>11.2 l/100km</td>
<td>9</td>
<td>F</td>
<td>867</td>
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<td>Nissan¹</td>
<td>Patrol Gr 3.0 Dci</td>
<td>Diesel</td>
<td>2953</td>
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<td>10.9 l/100km</td>
<td>7</td>
<td>E</td>
<td>919</td>
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</tbody>
</table>
Sustainable consumption

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

<table>
<thead>
<tr>
<th>Bereich</th>
<th>Wirkung nach Lebenszyklusphase</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Herstellung</td>
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<tr>
<td>Wohnen 1)</td>
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<td>Private Mobilität 3)</td>
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<tr>
<td>Konsumgüter und Dienstleistungen 2)</td>
<td>Aktive Produkte 3)</td>
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<tr>
<td>Ernährung 4)</td>
<td></td>
</tr>
<tr>
<td>Öffentliche Dienste und Versicherungen 6)</td>
<td>Passive Produkte 2)</td>
</tr>
</tbody>
</table>

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.

PRODUCT - LIFE CYCLE ASSESSMENT

Crop growing → Production → Fuelling → Driving

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

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?
- Greenhouse Gas Emissions?
Life Cycle Assessment – Which Assessment Method is the Correct One?

• Ecological Footprint?
• Cumulated Energy Consumption?
• Aggregated Environment Impact?
• 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
Content and contributors to the ecoinvent

**EMPA SG**
- Plastics
- Paper & cardboard
- Basic chemicals
- Detergents
- Waste treatment

**EMPA Dü**
- Metals
- Build. mat.
- Wood & Forestry
- Basic chemicals

**FAL**
- Agriculture

**PSI**
- Energy supply
  - Fuels
  - Electricity
  - Heat

**ETHZ UNS**
- Transports

**ETHZ LTC**
- Basic chemicals
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.