Beitrag zur Ökobilanz-Werkstatt 2007

Bitte schicken Sie das ausgefüllte Formular bis spätestens **16. Juli 2007** an lca-werkstatt@netzwerk-lebenszyklusdaten.de !

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Titel:

Nachhaltigkeit von Verpackungssystemen für Obst- und Gemüsetransporte in Europa basierend auf einer Lebenszyklusanalyse

Abstract: (max. 1000 Zeichen)
Frisches Obst und Gemüse ist aus europäischen Supermärkten und Einzelhandelsgeschäften nicht mehr wegzudenken. Deren ganzjährige Bereitstellung erfordert ein komplexes logistisches System. Als Transportverpackung für Obst und Gemüse finden hauptsächlich Kunststoffkisten, Kartonverpackungen und Holzkisten Verwendung. Kunststoffkisten werden dabei als Mehrwegverpackung eingesetzt, Kartonverpackungen und Holzkisten als Einweglösung.
Die Stiftung Initiative Mehrweg hat im April 2005 den Auftrag erteilt, die gebräuchlichen Verpackungssysteme für Obst und Gemüse in Europa auf die, mit ihrer Verwendung verbundenen, Umweltauswirkungen zu untersuchen und miteinander zu vergleichen. Darüber hinaus sollen Erkenntnisse zu den Kosten und zu ausgewählten sozialen Faktoren gewonnen werden, um dem Nachhaltigkeitsaspekt gerecht zu werden.
Verglichen werden Mehrwegkunststoffkisten, Einwegkartonverpackungen und Einwegkisten aus Holz. Besonderer Wert wird in dieser Studie darauf gelegt, eine für Gesamteuropa repräsentative Situation des Obst- und Gemüsetransports abzubilden und nicht eine einzelne, sehr spezifische Situation.

Stichwörter zum Anwendungsfeld:

(hier müssen Sie genau **drei** Stichwörter angeben, wobei mindestens **eins** aus der vorgegebenen Liste ausgewählt werden muss; bis zu zwei Stichwörter können frei formuliert werden.)

☐ Gebäude und Bauprodukte
☐ Biomassenutzung
☐ Konsumgüter
☒ Transport und Verkehr
☐ Abfallwirtschaft und Entsorgung
☐ Materialentwicklung
☐ Energieträger, Energiewandlung und –distribution
☐ Infrastrukturen und Investitionsgüter
☐ chemische Grundstoffe und Erzeugnisse
☐ metallische Roh- und Werkstoffe, Halbzeuge

(eigene Stichworte):
☒ Mehrwegverpackungen
☒ Nachwachsende Rohstoffe

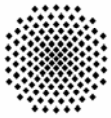
Stichwörter zur Methodik:

(auch hier müssen sie genau **drei** Stichwörter angeben, wobei mindestens **eins** aus der vorgegebenen Liste ausgewählt werden muss; bis zu zwei Stichwörter können frei formuliert werden)

☐ Sachbilanz (LCI)
☐ Wirkungsabschätzung (LCIA)
☒ Allokation / Systemraumerweiterung
☐ Datenqualität
☐ Datenhaltung und Datenverarbeitung
☐ Lebenszyklusbetrachtungen im betrieblichen Umfeld
☐ Ökobilanzen für Produktgestaltung und -auszeichnung
☐ Lebenszykluskosten und Ökoeffizienz
☐ Datenintegration und Umgang mit Datenlücken
☒ Szenarien

(eigene Stichworte):
☒ Lebenszyklusbetrachtung für Mehrwegsysteme
☐

The Sustainability of Packaging Systems for Fruit and Vegetable Transport in Europe based on Life-Cycle-Analysis



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The Sustainability of Packaging Systems for Fruit and Vegetable Transport in Europe based on Life-Cycle-Analysis

A sustainability case study

Stefan Albrecht, Dept. LCE (GaBi), University of Stuttgart
Leif-Patrik Barthel, Dept. LCE (GaBi), University of Stuttgart
Martin Baitz, PE International GmbH
Sabine Deimling, PE International GmbH

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Content

Introduction

Goal and scope of the study

- Partners involved
- Regarded packaging systems
- Functional unit
- Regarded scenarios

Life cycle model and system boundaries

Selected results

- Environmental
- Economic
- Social

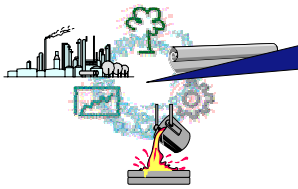
Parameter variation

Conclusions

Lehrstuhl für Bauphysik – Abteilung Ganzheitliche Bilanzierung

- Gründung 1989 – Prof. Dr.-Ing. Peter Eyerer (IKP), seit 2006 Lehrstuhl für Bauphysik (LBP) bei Prof. Dr.-Ing. Dipl.-Phys. Klaus Sedlbauer
- Interdisziplinäres Team, 12 wiss. Mitarbeiter (Umweltschutztechnik, Verfahrenstechnik, Maschinenbau, Geoökologie)

Industrie- und Forschungsprojekte der ökologisch-ökonomisch-technischen Analyse von Produkten, Prozessen und Dienstleistungen zur Entscheidungsunterstützung

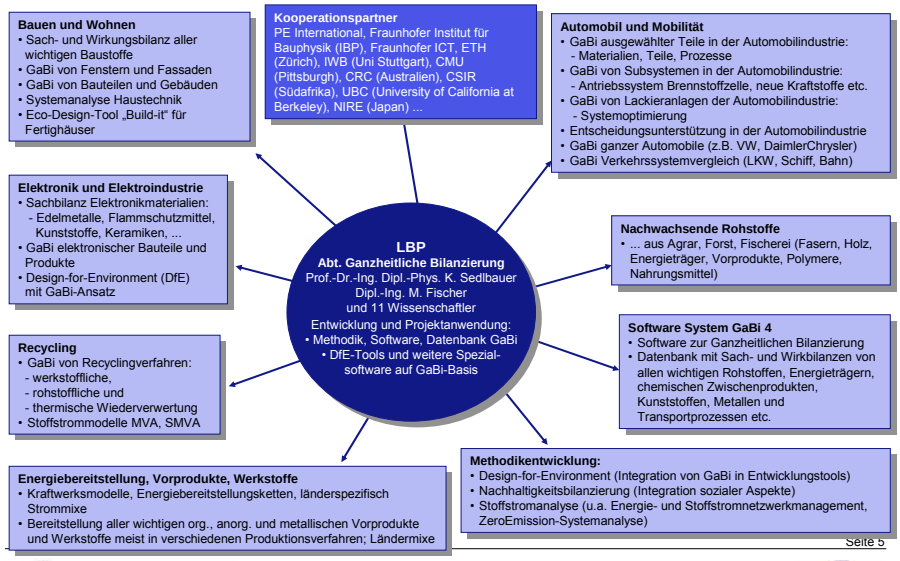


Methodenentwicklung (Ganzheitliche Bilanzierung, Materialflussanalyse, Nachhaltigkeitsindikatoren,)

GaBi Software
PRODUCT SUSTAINABILITY

Software, Datenbankentwicklung und -pflege (GaBi-Software, DfE-Tools)

LBP-GaBi – Arbeitsgebiete



Goal and scope of the study

Goal of the project:

- Life Cycle Assessment (LCA) study to analyse and compare the common transport packaging systems for fruit and vegetables in Europe with respect to the environmental impacts related to their use
- Knowledge to be gained on costs and selected social aspects within the same system boundaries (Results presented on 9th February, 2007 in Berlin – Germany)

Partners of the project:

Goal and Scope
Regarded transport packaging systems

Wooden boxes
(One way)

Foldable plastic crates
(Multi way)

Cardboard boxes
(One way)

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Goal and Scope
Regarded transport packaging systems

	Wooden boxes	Plastic crates	Cardboard boxes
Production	Wood	Polypropylene Polyethylene	Cardboard
Transport	One way	Multi way	One way
End of Life	Energy recovery material recycling	Energy recovery material recycling	Energy recovery material recycling
Weight of boxes [kg]	0,9	2	0,785
Dimension exterior [mm]	600x400x240	600x400x240	600x400x240
Producer countries (Fruit & Vegetable)	Spain, Italy, France, The Netherlands, Germany		
Consumer countries (Fruit & Vegetable)	France, The Netherlands, Germany, Great Britain		

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Goal and scope
Functional Unit

The functional unit

Is the distribution of 1.000 tons of fruit/vegetables either transported in wooden boxes, cardboard boxes (both one-way systems) or in plastic crates (multi way system).

The extended functional unit

is the distribution of 3.333.350 filled boxes/crates, each with 15 kg of fruit/vegetables, either transported in wooden boxes, cardboard boxes (both one-way systems)or in plastic crates (multi way system).

Goal and scope
The two regarded scenarios

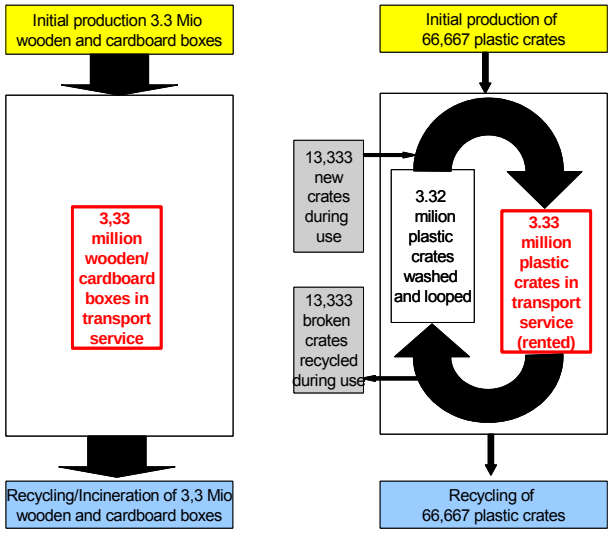
Conservative scenario

- 10 years lifetime of plastic crates
- 50 rotations of plastic crates
  - » 66,667 * 50 = 3,333,350 fillings

Technical scenario

- 20 years lifetime
- 100 rotations
  - » 66,667 * 100 = 6,666,700 fillings

Life Cycle Model



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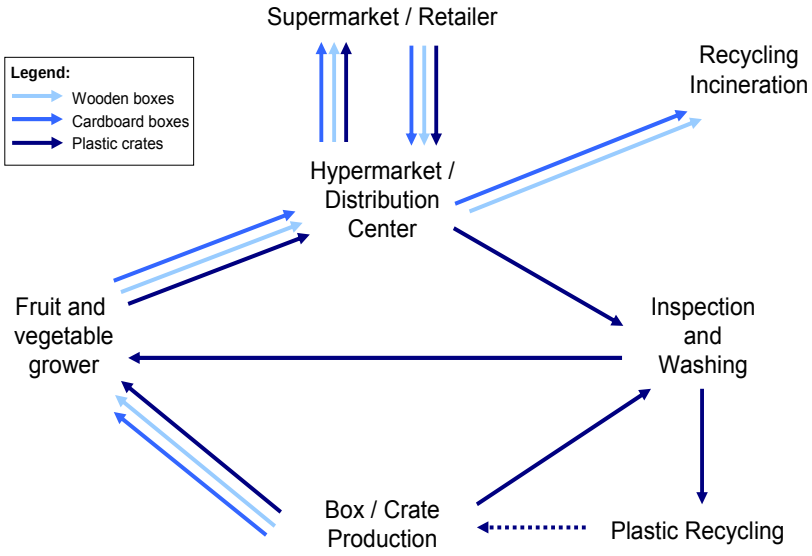
Life Cycle Model



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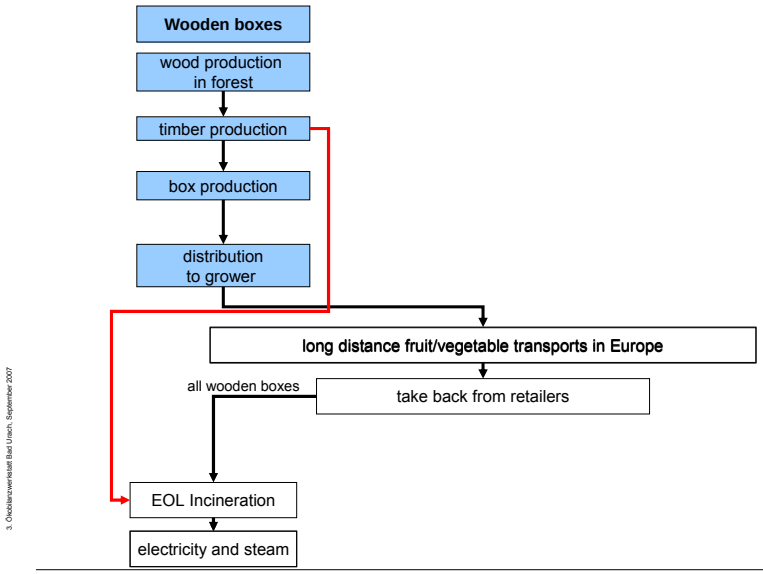
System and System boundaries



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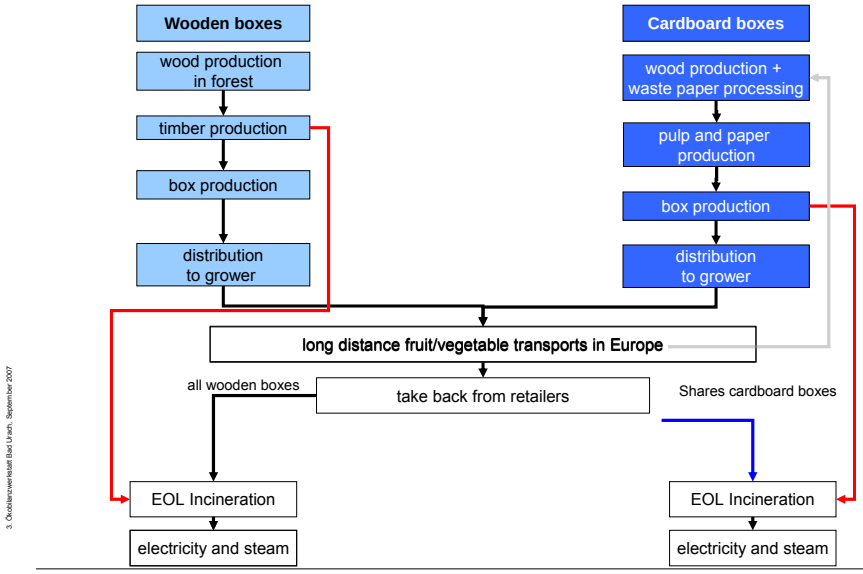
System and System boundaries



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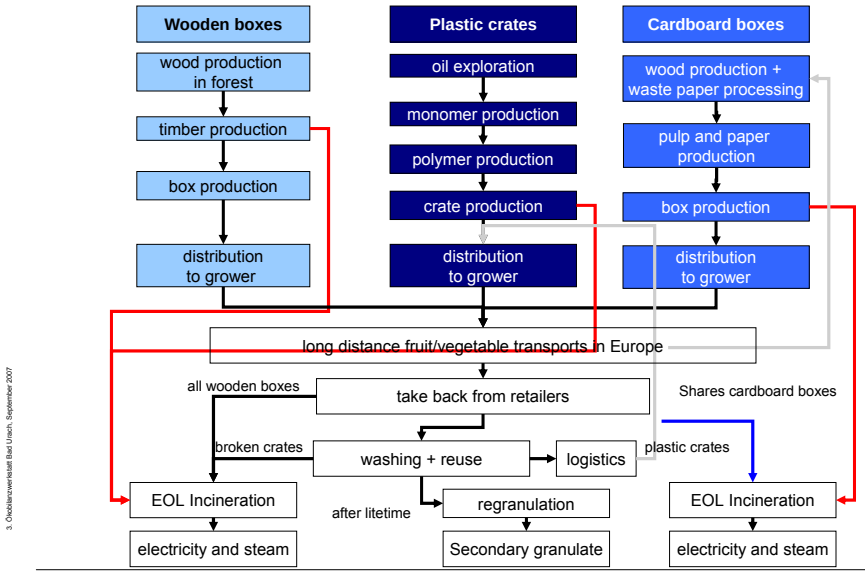
System and System boundaries



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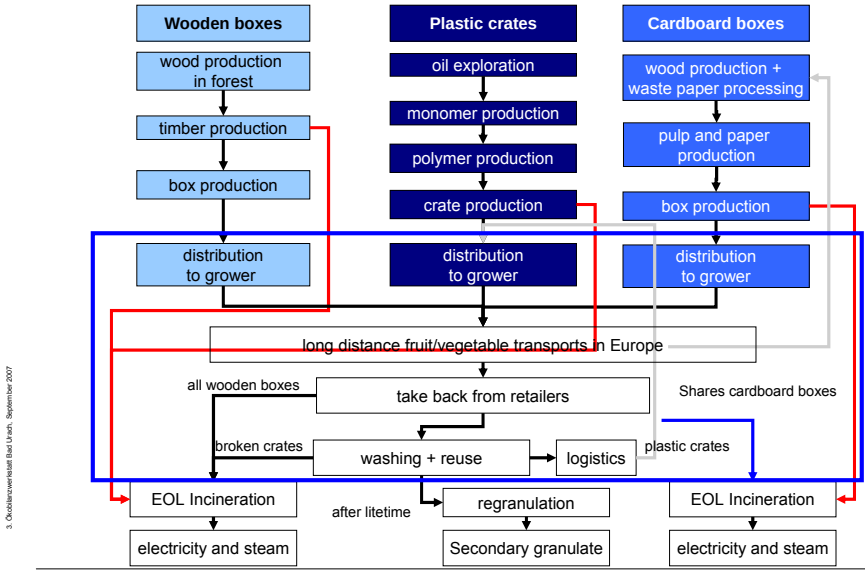
System and System boundaries



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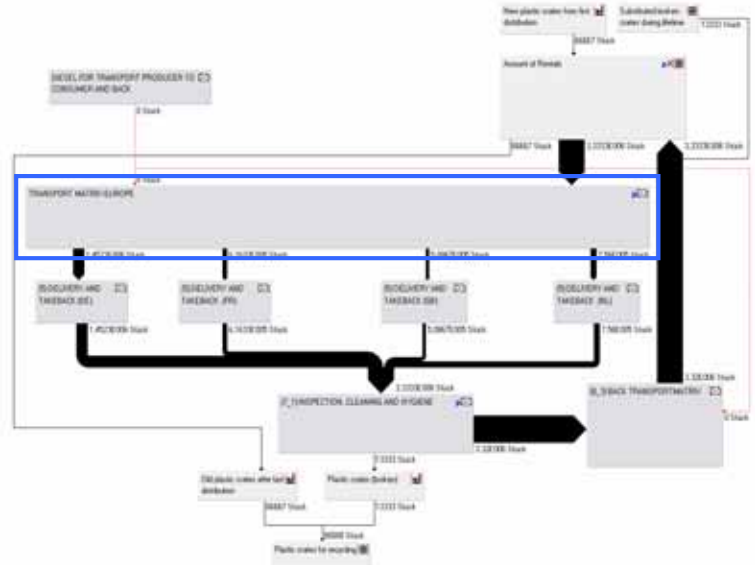
LCA-Software model (GaBi) use phase plastic crates



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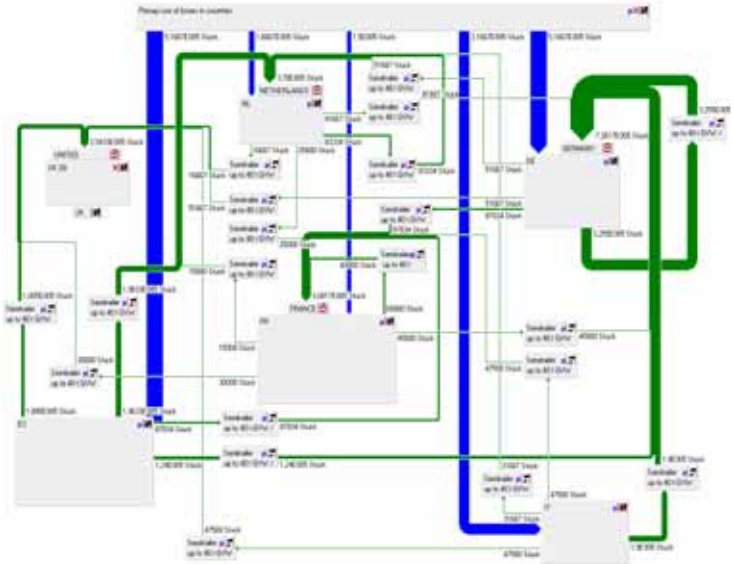
LCA-Software model (GaBi) Transportation matrix



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Regarded impact categories
Environmental impact categories

Environmental indicators and impact categories:

The Primary Energy Demand [MJ]

The Global Warming Potential – “greenhouse effect“ [kg CO_2-Equiv]

The Ozone Depletion Potential – “impact on the ozone layer” [kg R11-Equiv]

The Acidification Potential – contribution to “acid rain” [kg SO_2-Equiv]

The Eutrophication Potential – contribution to “over-fertilisation” [kg PO_4-Equiv]

The Photochemical Ozone Creation Potential – contribution to “summer smog” [kg C_2H_4-Equiv]

Regarded impact categories
Economic and social indicators

Economic Indicators:

The Life Cycle Costs [€]

Social Indicators:

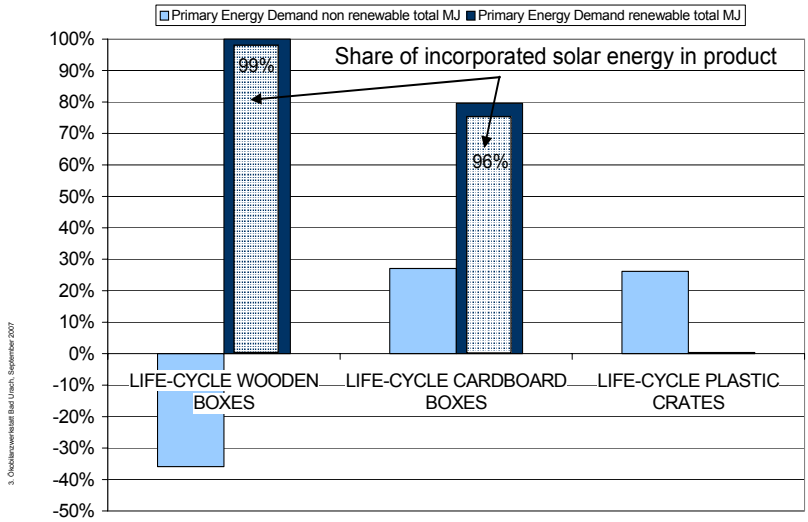
The total time of work [sec]

The total time of women work [sec]

The differentiation of the working time into qualification levels

The number of lethal and non-lethal accidents

Selected results
Primary energy demand



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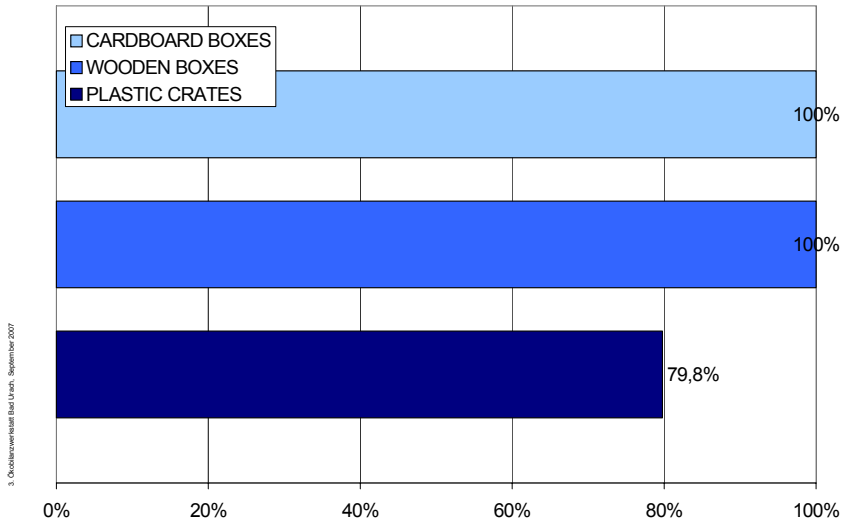
Selected results
Primary energy demand: Increase due doubling transport task



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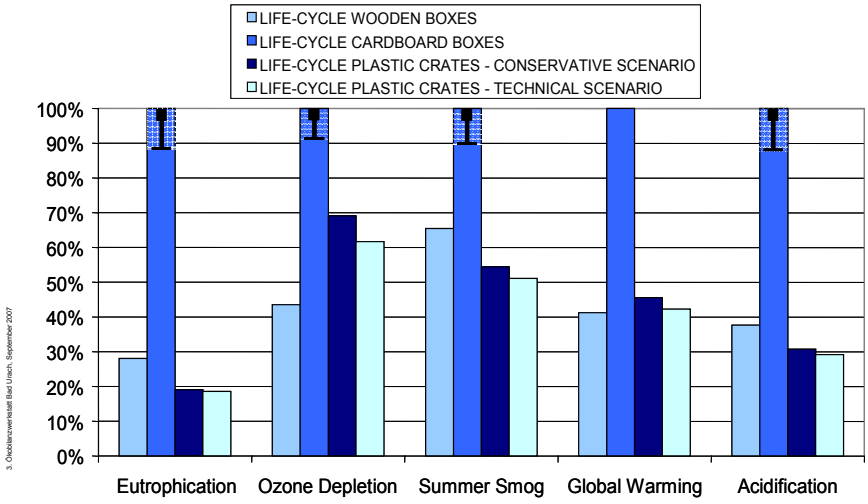
Selected results
Environmental impacts: related to the biggest contributor



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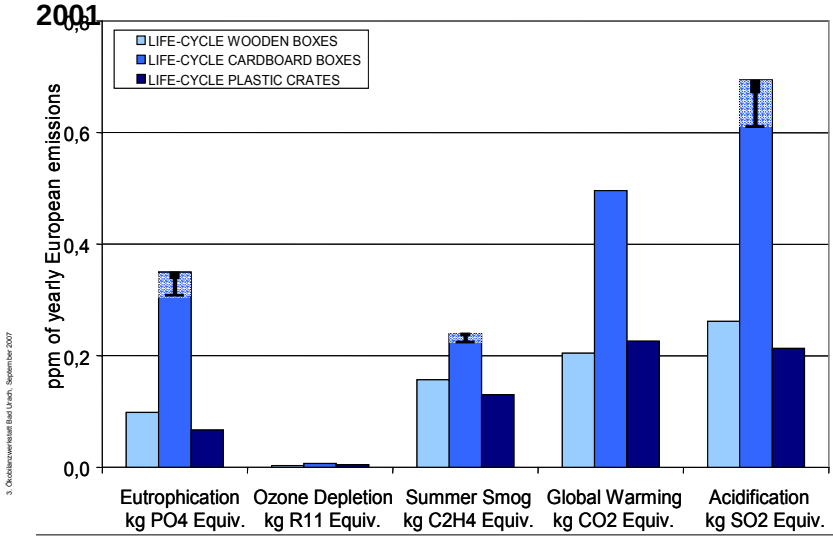
Selected results
Environmental impacts: contribution to European emissions 2001



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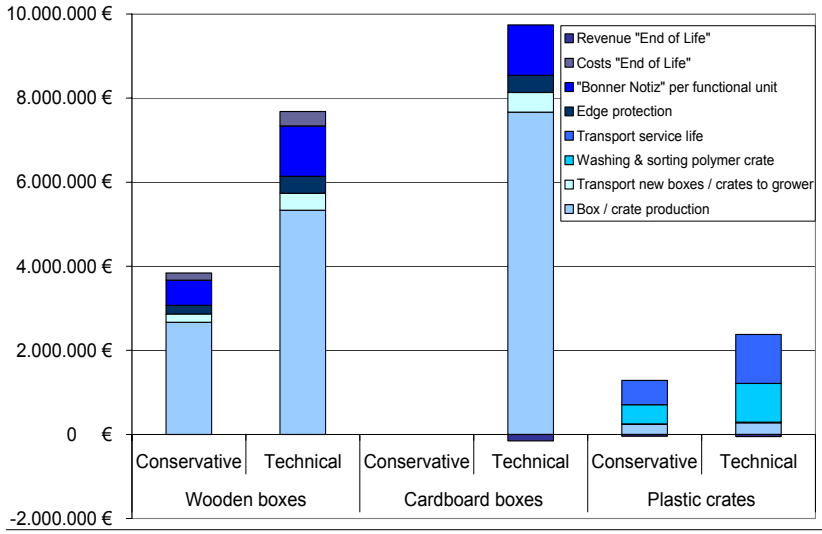
Selected results
Life Cycle Costs: conservative and technical scenario



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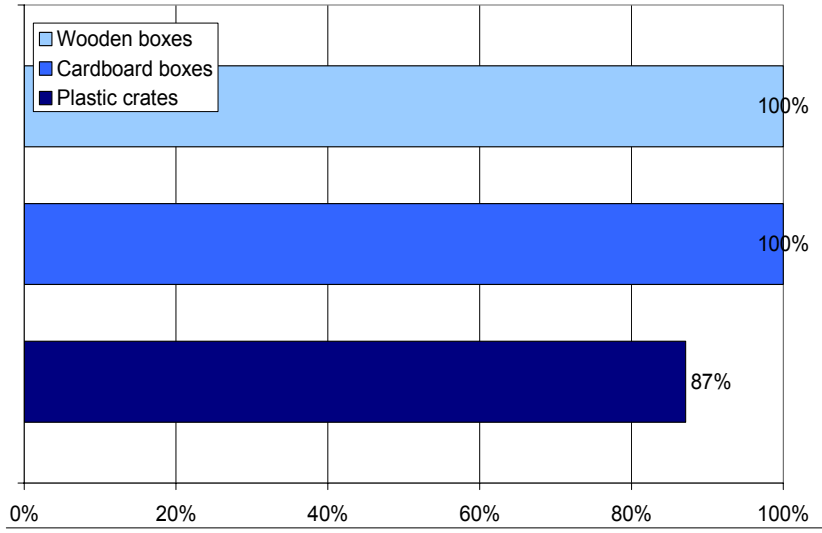
Selected results
Life Cycle Costs: Reduction of costs due to a higher life time



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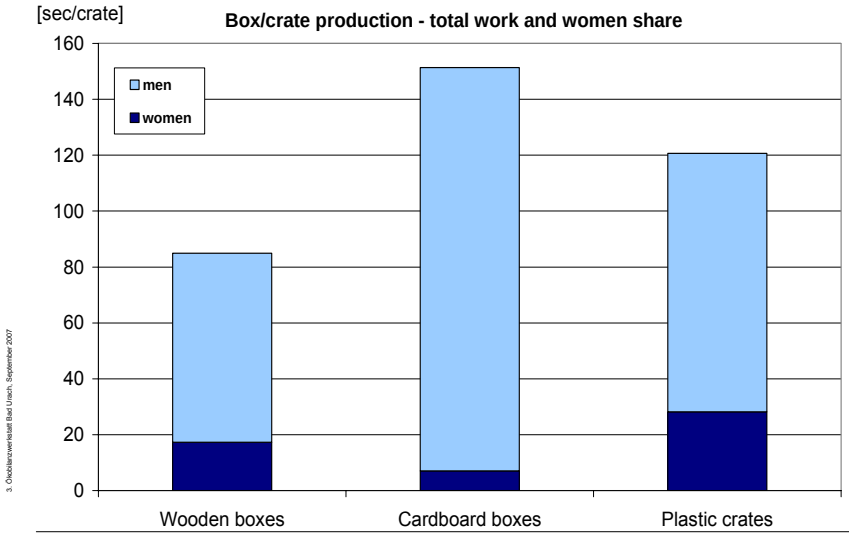
Selected Results
Social aspects: Human labour per box/crate



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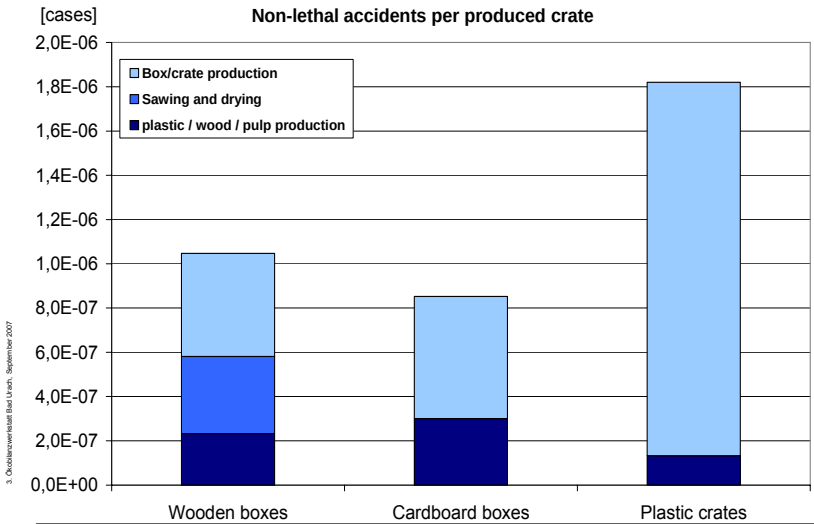
Selected Results
Social aspects: Non-lethal accidents per produced box/crate



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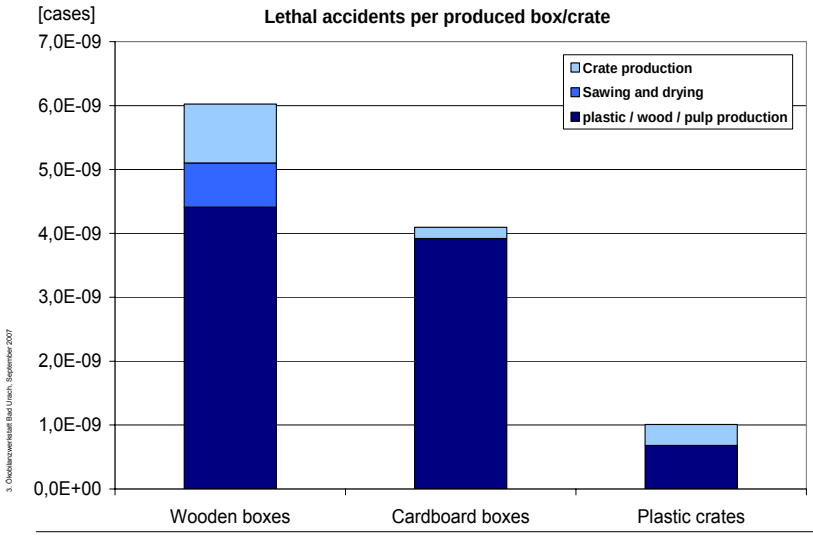
Selected Results
Social aspects: Lethal accidents per box/crate



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Influence of the most important parameter
Parameter variation

No.	Main production and EOL parameters (benchmark basis)	Representative mean value	Varied to value
1	Share of primary plastic material in production of crates	100 %	70 %
2	Value of secondary granulate in relation to primary	70 %	100 %
3	Share of primary polypropylene material in crate production	42 %	100 %
4	Share of primary polyethylene material in crate production	58 %	100 %
5a	Granulate losses during production of crates	2,75 %	1,5 %
5b	Granulate losses during production of crates	2,75 %	6 %
6a	Damaged crates in relation to total crates inspected	0,4 %	0,17 %
6b	Damaged crates in relation to total crates inspected	0,4 %	0,71 %
7a	Share of poplar in crate production	70 %	0 %
7b	Share of poplar in crate production	70 %	100 %

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Influence of the most important parameter
Parameter variation

No.	Main production and EOL parameters (benchmark basis)	Representative mean value	Varied to value
8	Sold steam products from incineration in MSWI	0 %	100 %
9	Share of Semi-chemical Fluting in cardboard	45 %	10 %
9	Share of Kraftliner in cardboard	43 %	21 %
9	Share of Testliner in cardboard	9 %	33 %
9	Share of Wellenstoff in cardboard	0 %	33 %
10	Share of wood dried during crate production	20 %	50 %
11	Share of poplar wood steamed prior to peeling	0 %	100 %
12 a	Share of wood to incineration (rest particle board industry)	100 %	0 %
12 b	Share of wood to incineration (rest particle board industry)	100 %	50 %
13	Share of plastic to secondary granulate (rest MSWI)	100 %	50 %
14	Share of cardboard to secondary pulp (rest MSWI)	20 %	60%

Conclusions

- The environmental, economic and social impacts of three different packaging systems for fruit and vegetable transport in Europe: wooden boxes, cardboard boxes and plastic crates were analysed within the same system boundaries.
- For each system the main contributors and their influence to the environmental impacts were identified and quantified
- Parameter variations has been done to quantify the influence of the most crucial parameters within each system
- Knowledge about economic and social behaviour of three different packaging systems within a life cycle view was gained
- The study was conducted in accordance with ISO 14040 and 14044 and was undertaken a Critical Review according ISO 14040/44 by
  - Angeline de Beaufort-Langeveld
    Expertise on paper and cardboard;
  - Dipl.-Ing. Sebastian Rüter and Prof. Dr. Arno Frühwald, University of Hamburg
    Expertise on wood
  - Dr.-Ing. Ivo Mersiowsky, Five Winds International
    Expertise on plastics and co-ordination

Additional Information

You can find additional information (press kit) under the following address:

german:
http://www.lbpgabi.uni-stuttgart.de/deutsch/projekte/projekt_SIM_d.html

english:
http://www.lbpgabi.uni-stuttgart.de/english/projects/projekt_SIM_e.html

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