

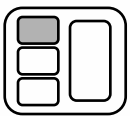
A Life Cycle Assessment (LCA) and Eco-Efficiency analysis of one-way versus reusable drinking cups

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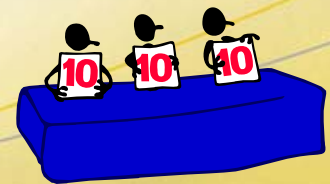
LCM 2007 conference, 27-29 August 2007, Zurich

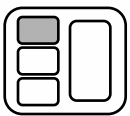




Goal and scope definition

- Goal:
 - to gain insight in **environmental** and **economical** aspects of using drinking cups on events
 - to reconsider environmental **policy**
 - LCA-part: conform **ISO** 14040-series
 - EE-part: in line of reasoning of ISO 14040
 - **publicly** available
- **Critical review** by third party
 - simultaneously with study
 - 4 review moments

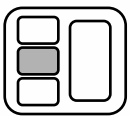




Goal and scope definition

- Functional unit:
 - recipients needed for serving 100 liter beer/soft drinks on a **small-scale indoor** (2 000-5 000 visitors) resp. a **large-scale outdoor** (> 30 000 visitors) event
- **4 alternative types** of cups:
 - reusable PC-cup
 - one-way PP-cup
 - one-way cardboard cup with PE-coating
 - one-way PLA-cup
- Scope:
 - from “cradle to grave”
 - no streamlining

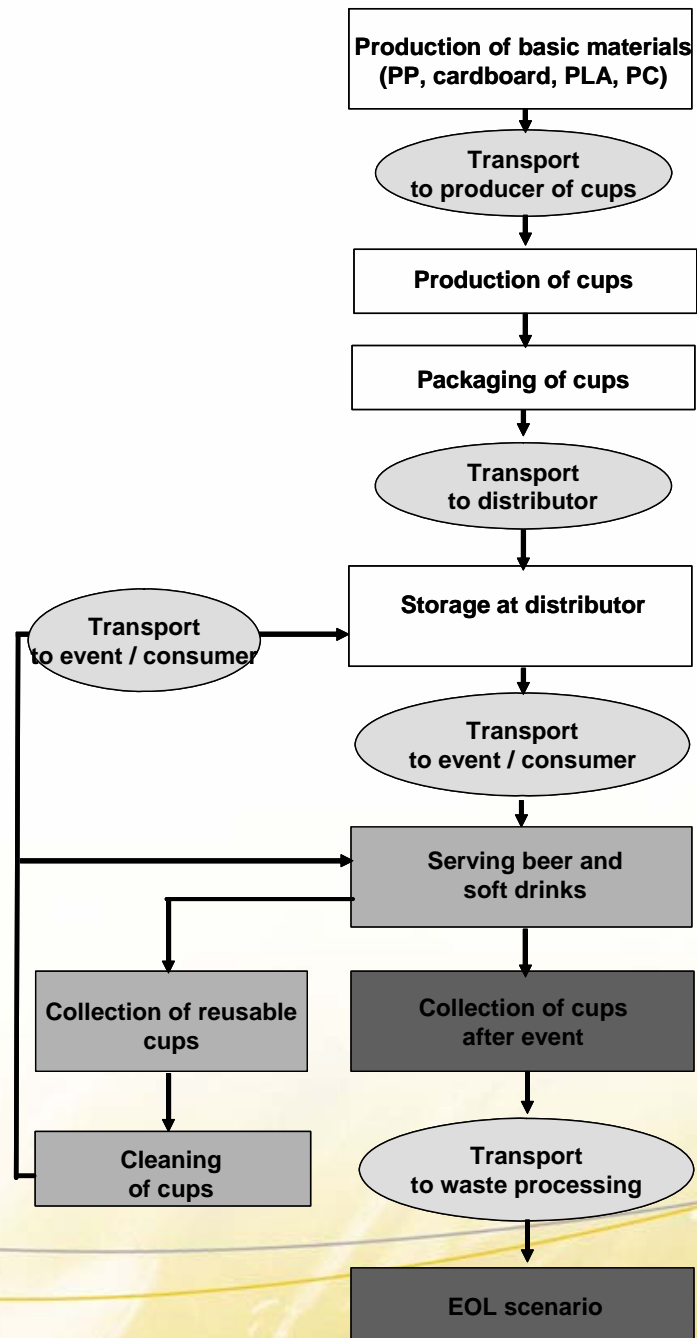
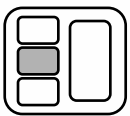




Inventory phase

- **Data quality requirements**
 - geographical: Flanders
 - time: 2000-2005
 - current technology
- **No case-specific data**
 - average within the range of visitors numbers
- **Important factors**
 - number of cups related to functional unit
 - **trip rate** (basic, best case, worst case)
 - cleaning of cups (before, during and after event)
 - EOL-scenario







Impact assessment and interpretation

- Eco-Indicator 99 (Hierarchist)
- 9 damage categories

<i>Environmental Impact Categories</i>	<i>Unit</i>
<i>HH Carcinogenics</i>	<i>DALY</i>
<i>HH Respiratory effects caused by organics</i>	<i>DALY</i>
<i>HH Respiratory effects caused by inorganics</i>	<i>DALY</i>
<i>HH Climate change</i>	<i>DALY</i>
<i>HH Ozone layer</i>	<i>DALY</i>
<i>EQ Ecotoxic emissions</i>	<i>PAF*m²yr</i>
<i>EQ Acidification/Eutrophication</i>	<i>PDF*m²yr</i>
<i>R Extraction of minerals</i>	<i>MJ surplus</i>
<i>R Extraction of fossil fuels</i>	<i>MJ surplus</i>





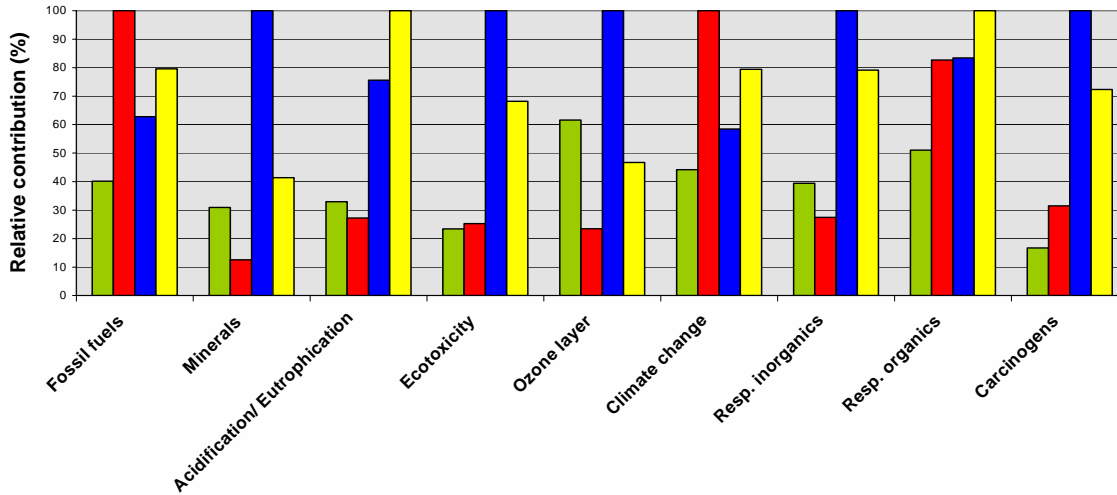
Comparative environmental profiles

BASIC scenario	Small event	Large event
PC-cup -Trip rate -Cleaning after event -EOL	45 trips manually 100% MSWI	20 trips machine 100% MSWI
PP- and cardboard cup -EOL	100% MSWI	50% MSWI / 50% cement
PLA-cup -EOL	50% MSWI / 50% composting	50% MSWI / 50% composting

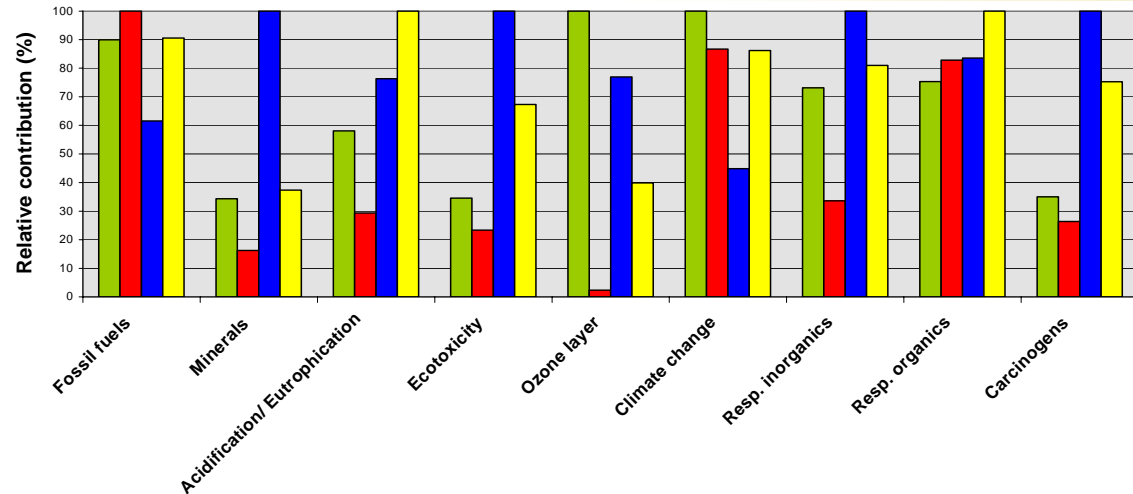




Comparative environmental profiles



Large outdoor events



(Intermediary) Conclusions

- Environmental burden of **reusable PC-cups** increases moving to larger scale events
- Based on **LCA-results**:
 - none of the 4 alternative cup systems has highest or lowest overall score
 - **no arguments** for environmental policy



Eco-efficiency analysis

- Methodology:
 - **environmental** indicator
 - EI-99 hierarchist version
 - expressed in ecopoints (Pt)
 - +/- 20% uncertainty margins
 - **cost** indicator
 - societal perspective
 - expressed in Euro
 - +/- 10% uncertainty margins
 - **portfolio**
- “In line of reasoning of ISO”



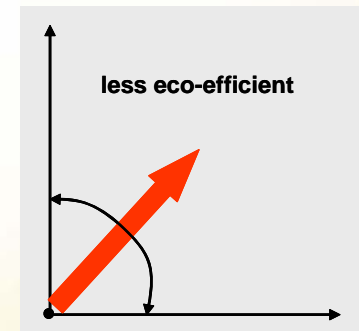
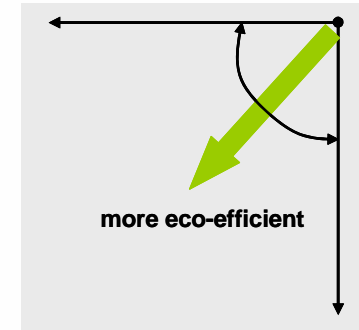
EE-analysis: portfolio

- **No standard methodology** for “translating” absolute values to portfolio
- Methodology chosen within framework of this project:
 - midpoint (zero): average
 - axes: number of standard deviations
 - to focus on differences between points
 - uncertainty margins
- **Comparative**, not absolute



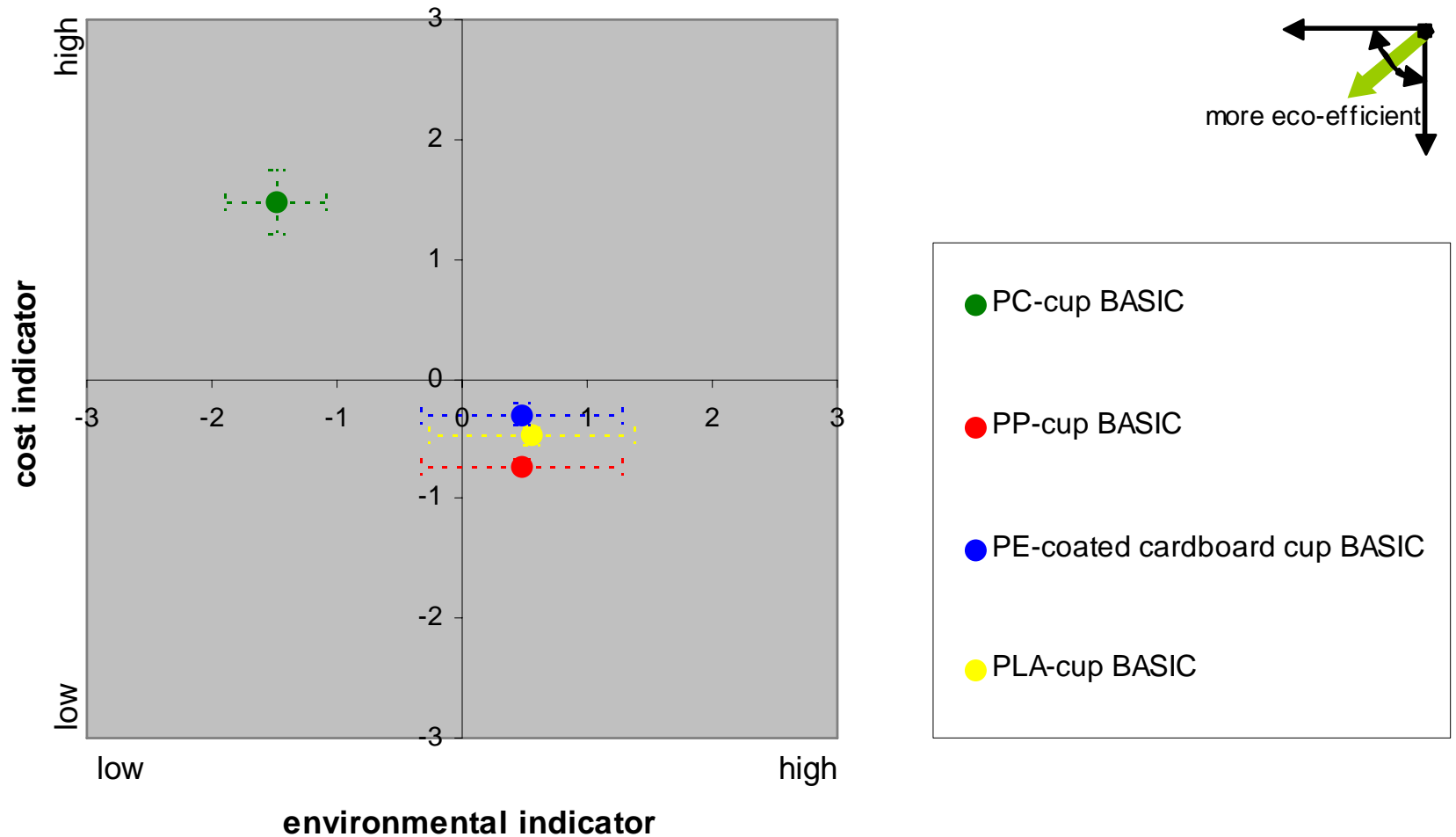
EE-analysis: portfolio

- Most eco-efficient =
 - option with simultaneously
 - lowest cost score
 - lowest environmental score
- Least eco-efficient =
 - option with simultaneously
 - highest cost score
 - highest environmental score
- Compass needle

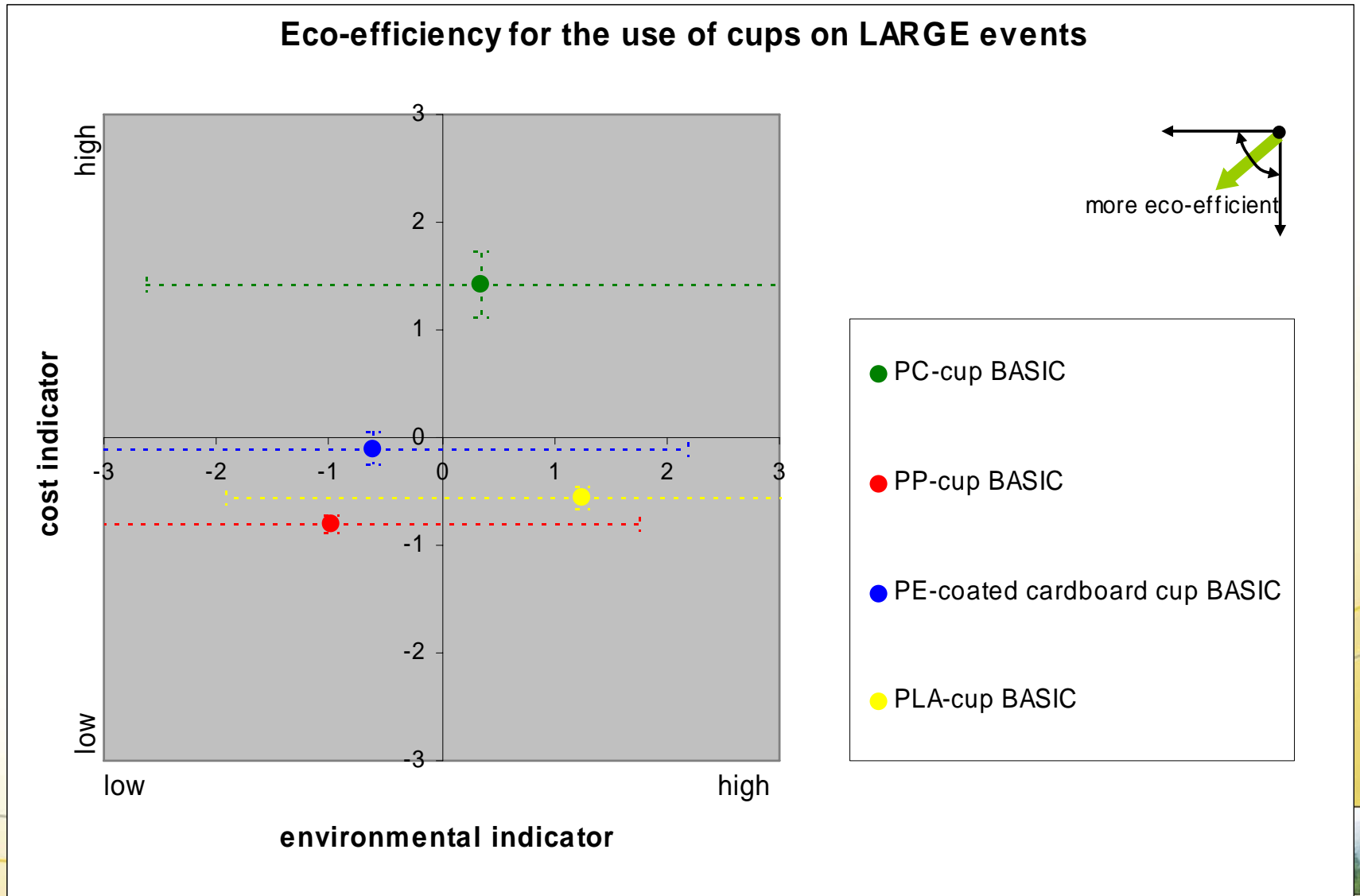


Small events - basic scenario

Eco-efficiency for the use of cups on SMALL events



Large events - basic scenario



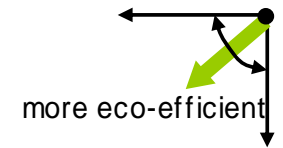
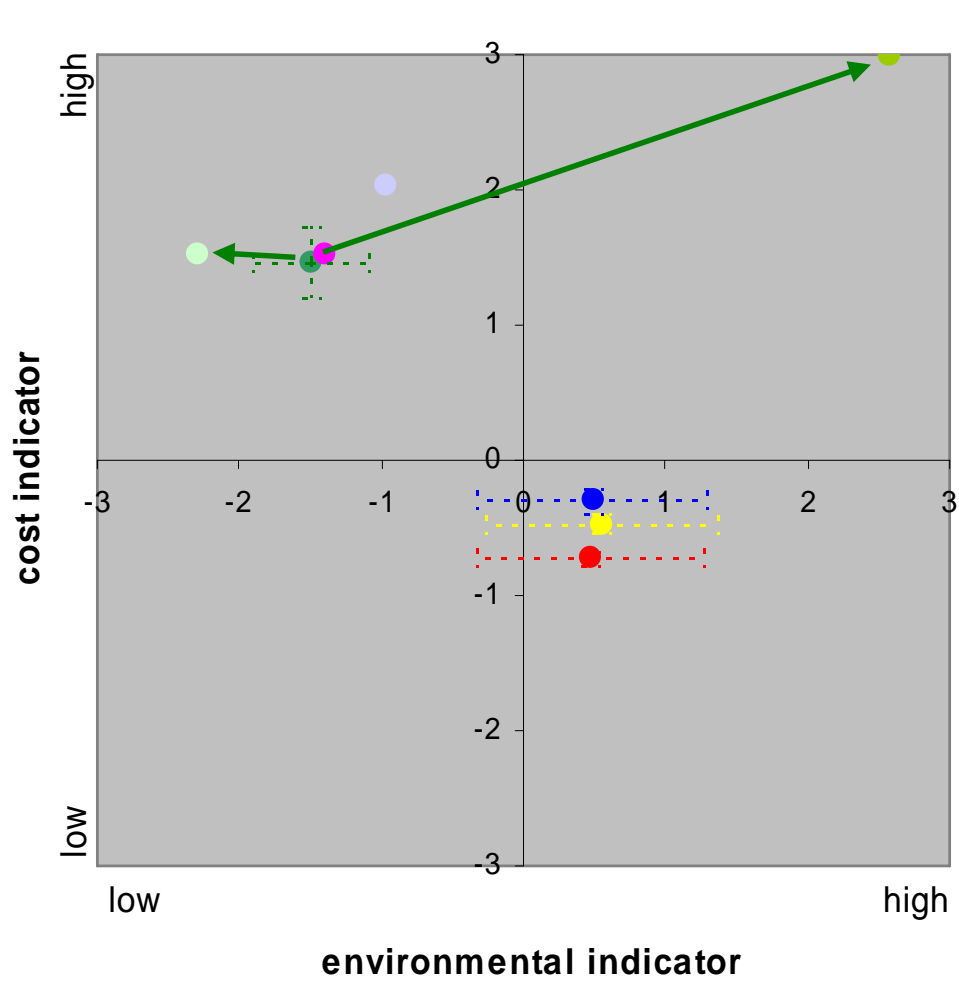
Sensitivity analyses

- **Trip rate:**
 - Small events: 14 – **45** - 100 trips
 - Large events: 7 – **20** - 40 trips
- **Cleaning:**
 - Small events: machine (conform large events)
 - Both types of events: double amount of water
- **Future PLA-developments (2008):**
 - weight reduction
 - optimised production process
 - production facility in Europe
 - anaerobic digestion instead of composting
- **EOL-scenario:**
 - PP- and cardboard cup: ratio cement kiln / MSWI
 - PLA-cup: ratio composting / MSWI



Sensitivity analysis: trip rate cleaning

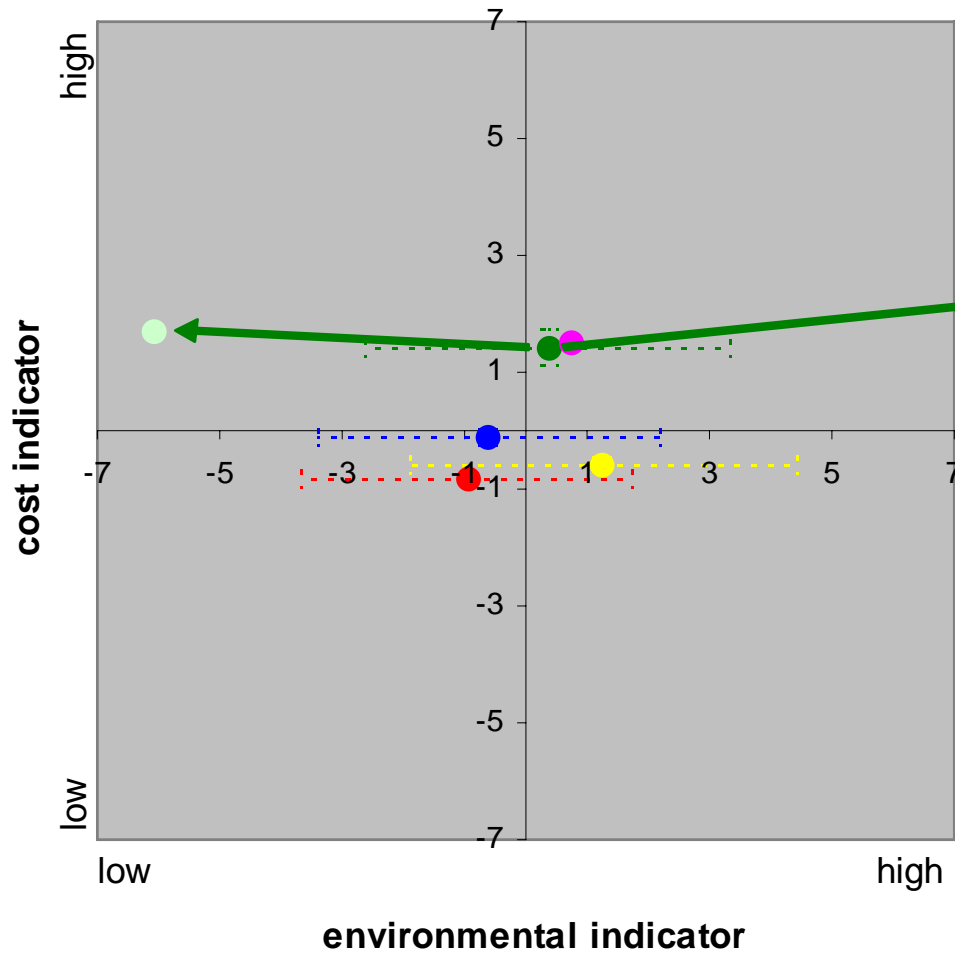
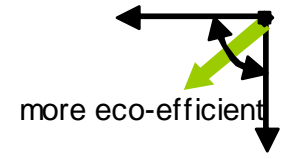
Eco-efficiency for the use of cups on SMALL events



- PC-cup BASIC
- PP-cup BASIC
- PE-coated cardboard cup BASIC
- PLA-cup BASIC
- PC-cup sensitivity trip rate: best case
- PC-cup sensitivity trip rate: worst case
- PC-cup sensitivity: machine cleaning after event (basic trip rate)
- PC-cup sensitivity: cleaning during event with 2*water and soap (basic trip rate)

Sensitivity analysis: trip rate cleaning

Eco-efficiency for the use of cups on LARGE events

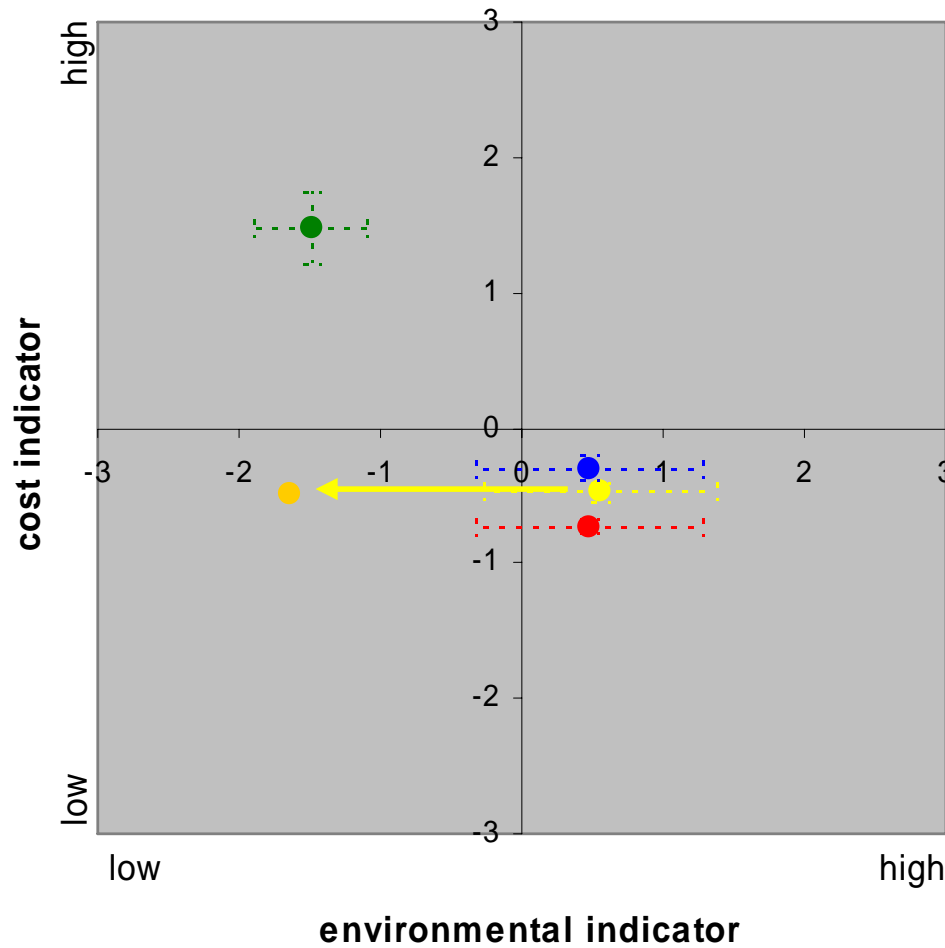


- PC-cup BASIC
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- PC-cup sensitivity trip rate: best case
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- PC-cup sensitivity: cleaning during event with 2*water and soap (basic trip rate)

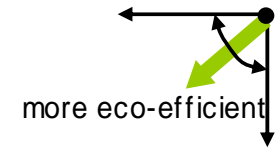


Sensitivity analysis: future developments of PLA-cup

Eco-efficiency for the use of cups on SMALL events

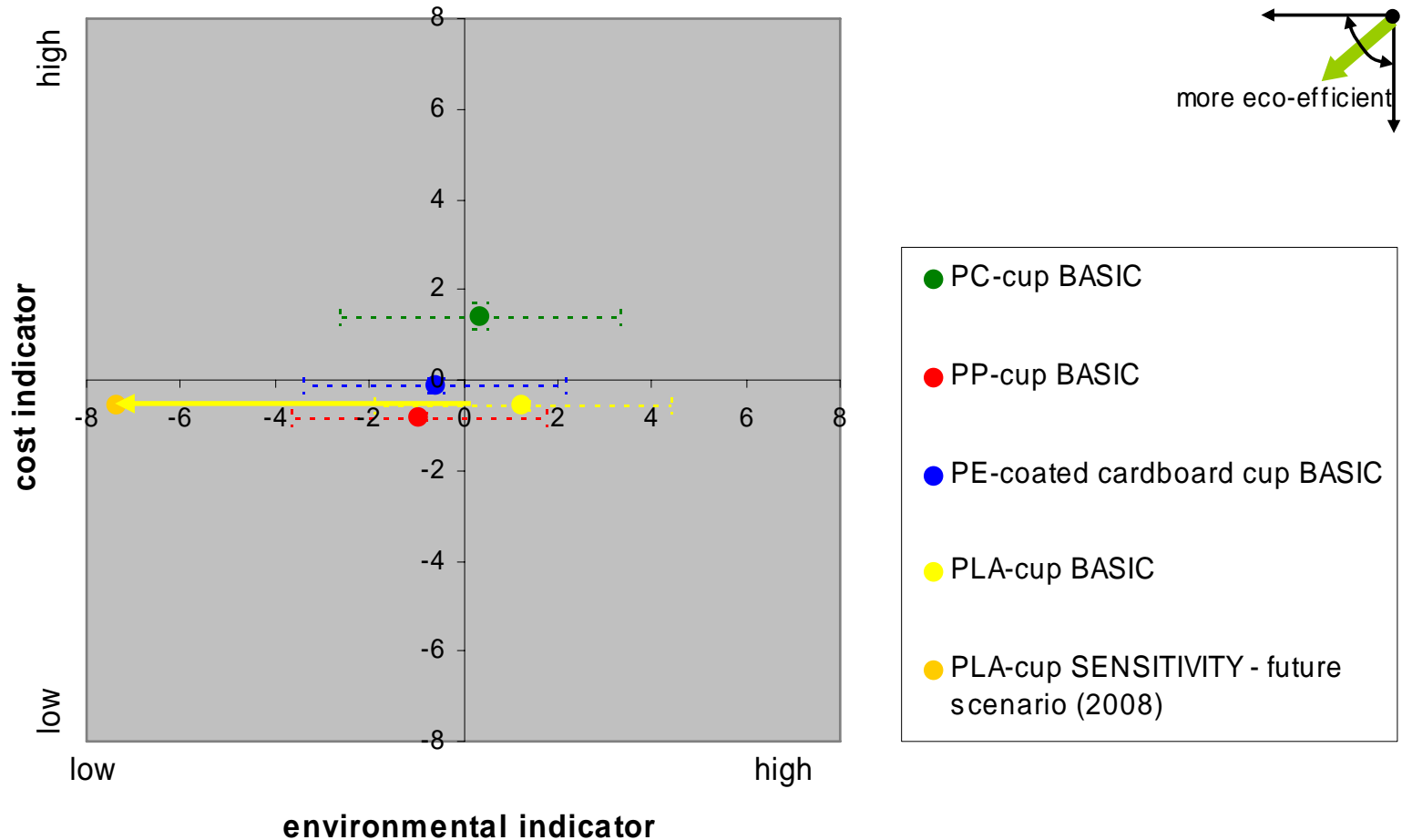


- PC-cup BASIC
- PP-cup BASIC
- PE-coated cardboard cup BASIC
- PLA-cup BASIC
- PLA-cup SENSITIVITY - future scenario (2008)



Sensitivity analysis: future developments of PLA-cup

Eco-efficiency for the use of cups on LARGE events



- PC-cup BASIC
- PP-cup BASIC
- PE-coated cardboard cup BASIC
- PLA-cup BASIC
- PLA-cup SENSITIVITY - future scenario (2008)

Conclusions

- Based on results of **EE-analysis**:
 - Small events – base case
 - reusable PC-cup: significant more favorable environmental score – higher costs
 - promotion policy can be considered
 - Both type of events – future PLA scenario
 - check assumptions PLA by 2008
 - check possible developments other cups
 - possibly reconsider promotion policy for reusable PC-cups at small events



Conclusions

- Overall quality of study improved by
 - consultation and collaboration of stakeholders
 - supply information
 - check inventory data
 - give feedback on preliminary results
 - presence of review panel
 - double-check

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Questions

