

# INTEGRATED LIFE CYCLE BASED TOOL FOR A STRATEGIC ENVIRONMENTAL MANAGEMENT

Manuele Margni,  
Michaud, R., Chayer, J.A., Clément, E., Samson, R.

[manuele.margni@polymtl.ca](mailto:manuele.margni@polymtl.ca)



[www.](http://www.ciraiq.org)

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Centre interuniversitaire de recherche sur le  
cycle de vie des produits, procédés et services

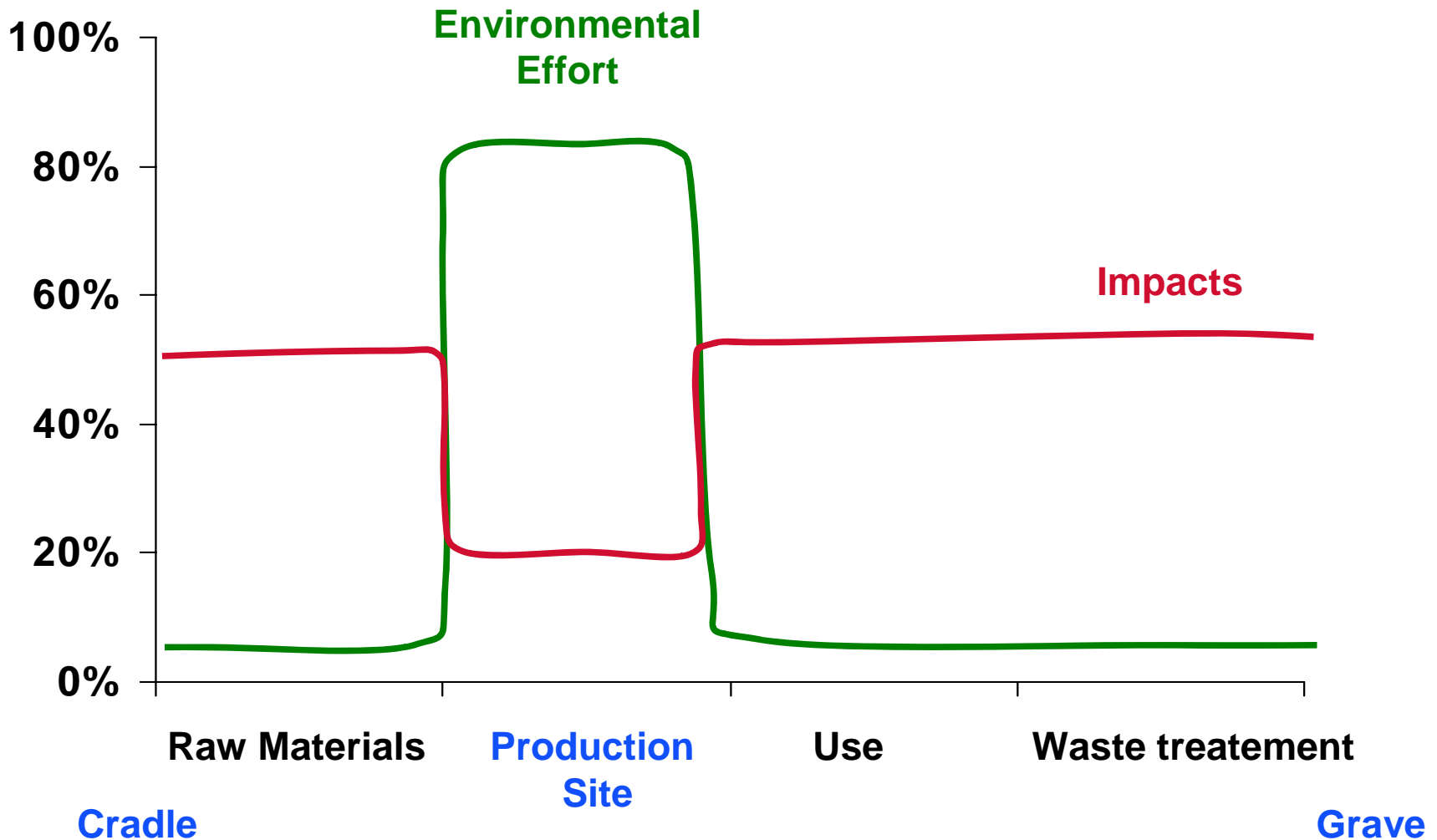


# Presentation overview

- Introduction: problem setting
- Methodology to identify company's environmental priorities based on a LC approach
- Case studies
  - Furniture producing company
  - Dairy company
- Conclusions
- Perspectives



# Environmental efforts: a shift vs. to the impacts!



# How to...

- ..determine the key performance indicators on an holistic perspective (direct vs. indirect)?
- ..compare the environmental cost of e.g. electric consumption vs. paper purchase vs. distribution?
- .. consistently evaluate environmental impact and associated economic costs?
- .. assess good environmental practices of e.g. green purchasing, end-of-life management, etc.?
- ... integrate life cycle thinking and LCA for a strategic company management?

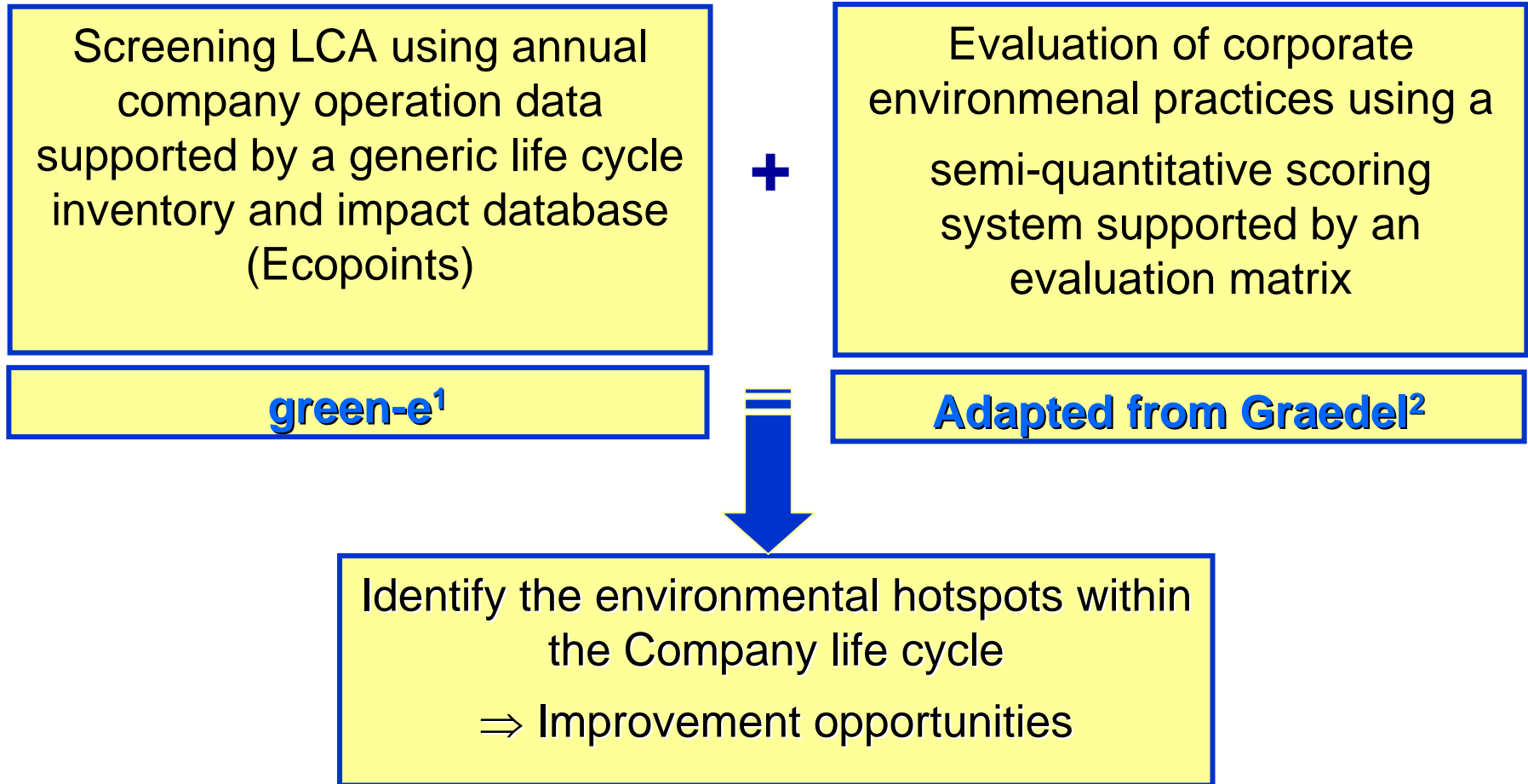


# What type of Evaluation?

- What can be quantified? (screening LCA)
  - Energy and material supply, purchased services, direct emissions, generation of waste, product specifications
- What can be qualified? (semi-quantitative)
  - The deviation to good environmental practices (working procedures, green purchasing, pollution emission control, management practices, etc.)



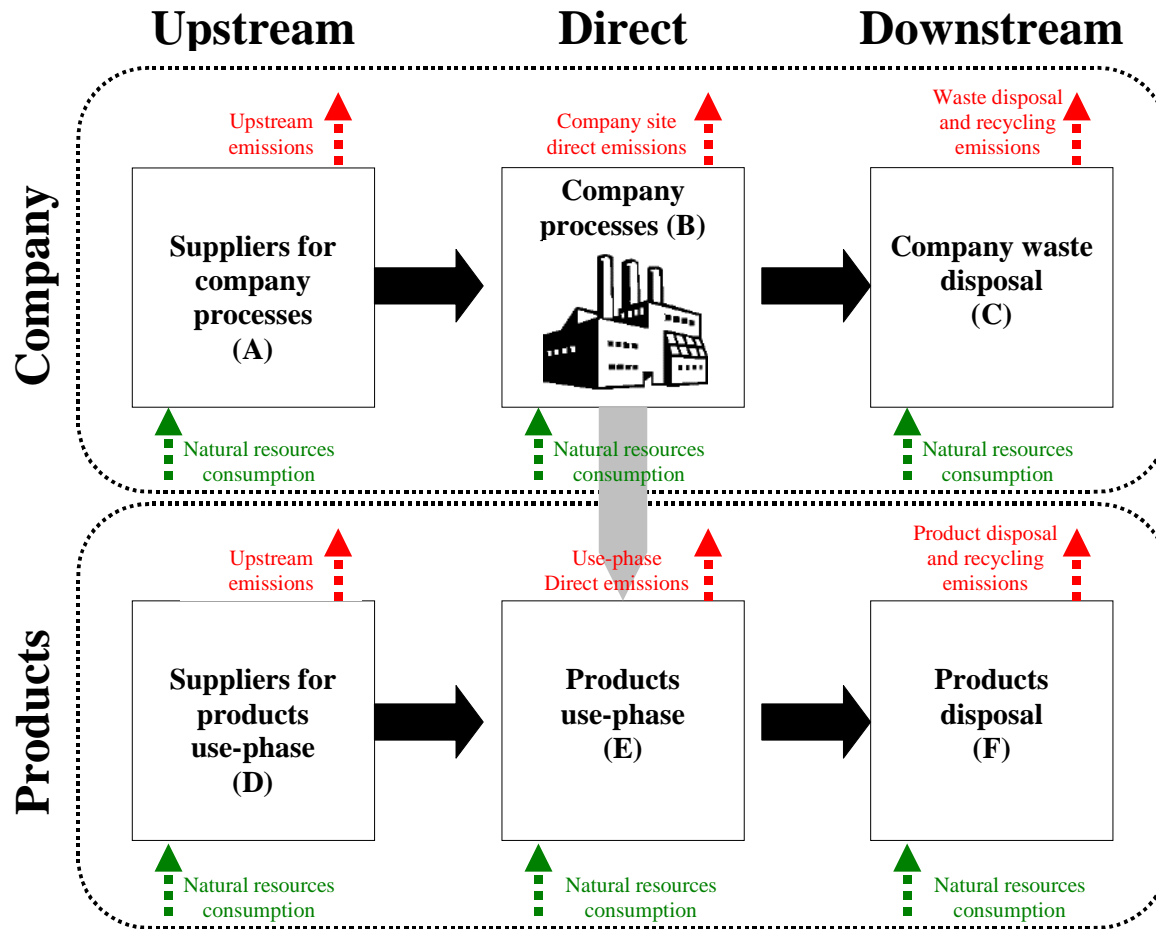
# Combining Life Cycle Thinking & Screening LCA



<sup>2</sup>[www.ecointesys-lcs.ch/green-e](http://www.ecointesys-lcs.ch/green-e)

<sup>1</sup>GRAEDEL, T.E. (1998). Streamlined Life-cycle Assessment, Prentice Hall, 310 p.

# Company's Life Cycle Burdens



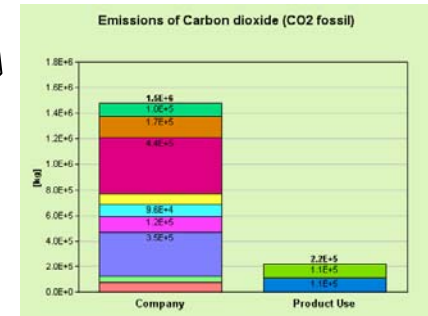
# green-e: Company screening-LCA

www.ecointesys-lcs.ch

Data collection



Results



$$R_c^{up+down} = V(I - A)^{-1}Y_c$$

$$R_p^{dir} = \sum_k m_k R_{pk}^{dir}$$

$$R_p^{up+down} = V(I - A)^{-1}Y_p = TY_p$$

$$R^{tot} = R_c^{up+down} + R_c^{dir} + R_p^{up+down} + R_p^{dir}$$

- Overall purchased quantity  
Physical units or \$)
- On site direct emission
- Products specifications
- Amount of product and services sold

- Identification of key environmental points
- Benchmark

- Cost associated

- Improvement and cost saving

# GRAEDEL: Evaluation procedure & Matrix

Data collection with forms  
(interview)

Evaluation: discrepancy to  
good environmental practices

1 = best score  
(less harmful for the  
environment)

4 = worst score  
(more harmful for the  
environment)

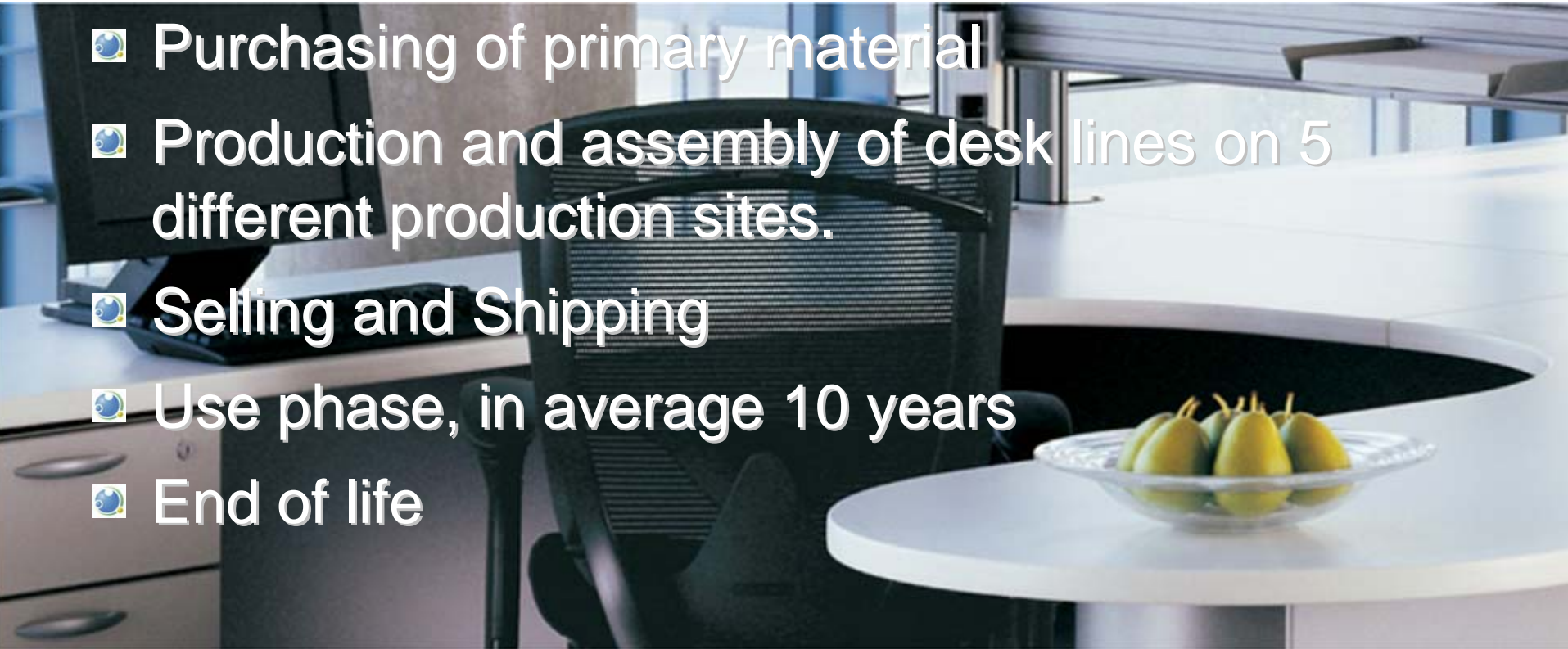
Life Cycle stages	Criteria		
	1- use of resources	2- Emissions	3- EMS
1- Pre-production			
2- Production			
3- Distribution			
4- Use phase			
5- End of Life			

**GRAEDEL, T.E. (1998).  
Streamlined Life-cycle  
Assessment, Prentice Hall, 310 p.**

# Case study I: Furniture manufacturing company

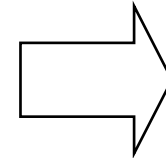
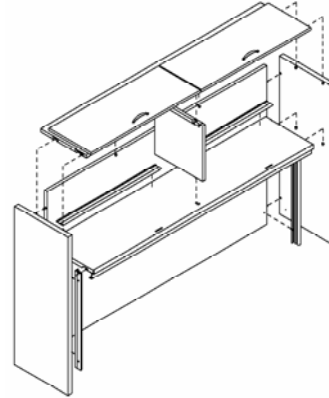
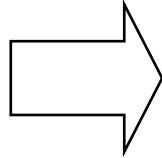
## Main company activities:

- Purchasing of primary material
- Production and assembly of desk lines on 5 different production sites.
- Selling and Shipping
- Use phase, in average 10 years
- End of life

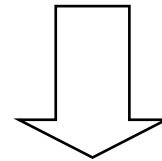


# Life cycle perspective and data collection

Wood, steel,  
Chemical products,  
Electricity, fuel,  
transport  
commuting  
...

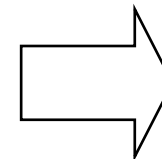
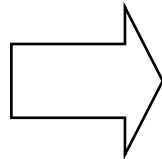


Waste



distribution

Electricity  
consumption

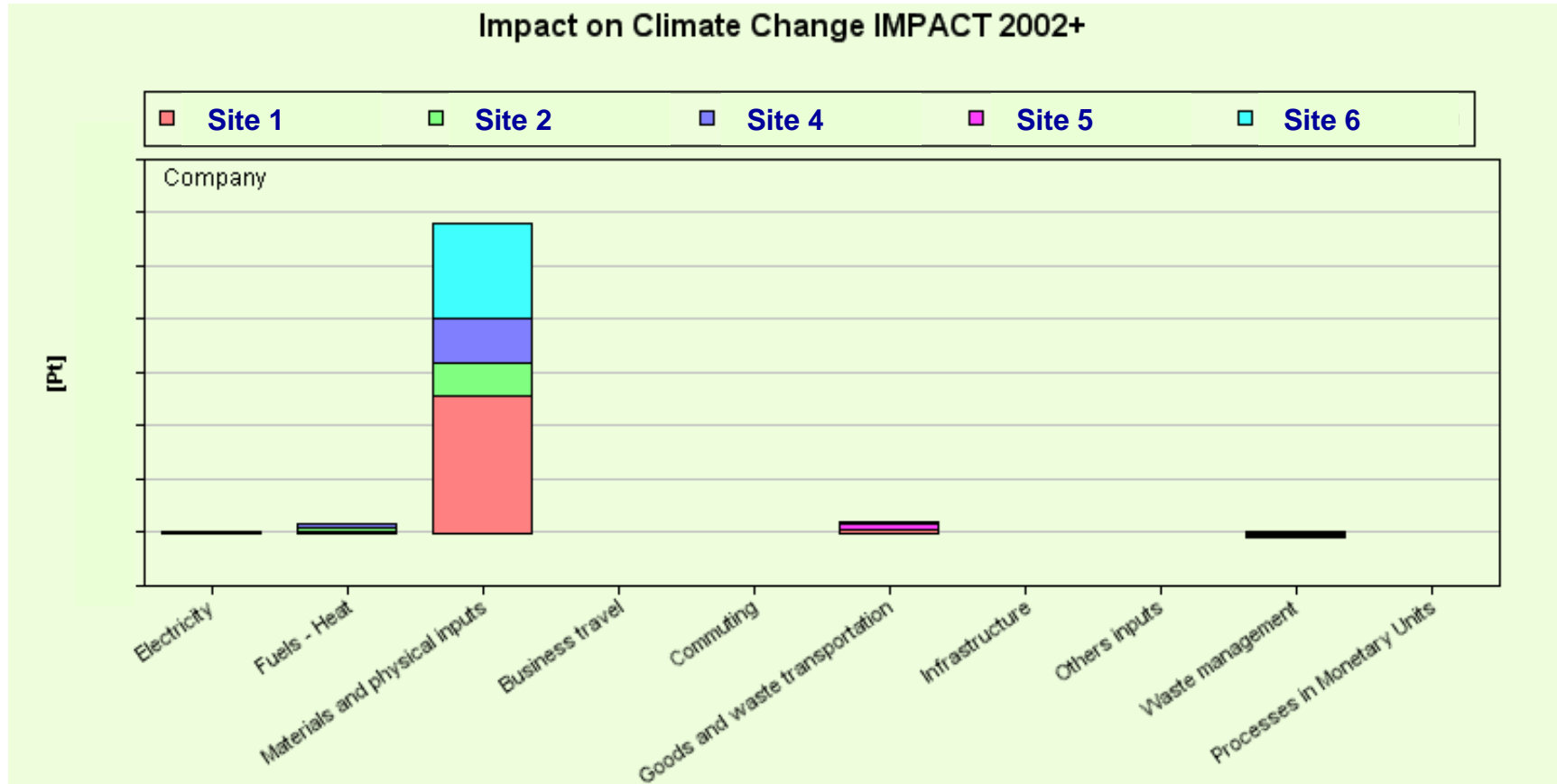


EOL

Annual operational data



# Results: Overall life cycle performances

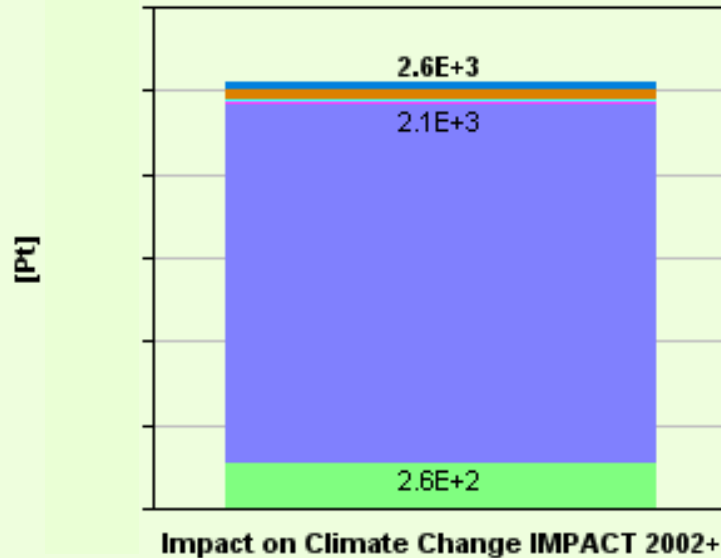


Company activities



# Details on Site #1

Detail of Materials and physical inputs



Impact on Climate Change IMPACT 2002+

- Massonite (Fibrex)
- Visserie
- Charnière coulissante
- Poignée (Zinc)
- Coulisse
- Charnière
- Palette
- Bumper de caoutchouc
- Carton
- Plastique d'emballage, procédé
- Bande (PVC) 20mm x 1mm
- **Mélamine 11/16**
- **Mélamine 1"**
- Plastique d'emballage, matière première

# Semi-quantitative Results

Étape du cycle de vie	Critère d'évaluation			Score total de l'étape (/12)
	1) Utilisation des ressources	2) Gestion des rejets	3) SGE	
1) Pré-production	3,3	3,6	4,0	10,9
2) Production	2,3	2,3	2,0	6,6
3) Distribution	2,1	2,3	1,8	6,2
4) Utilisation	1,8	2,1	3,7	7,6
5) Fin de vie	2,8	3,0	3,9	9,7
Score total du critère (/20)	12,3	13,3	15,4	Score total de la matrice (/60)
				41

Légende :

Low contribution to the overall environmental impact

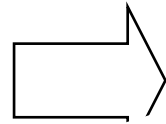
Middle contribution

High contribution

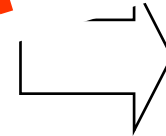


# Case study II: Dairy Product Industry

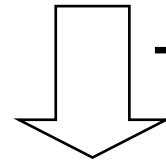
(Milk)  
Packaging  
Energy carriers  
commuting  
...



**Annual operational data**

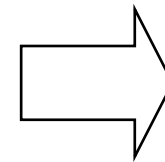
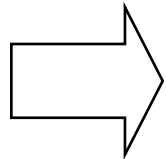


**Waste**



**Transport**

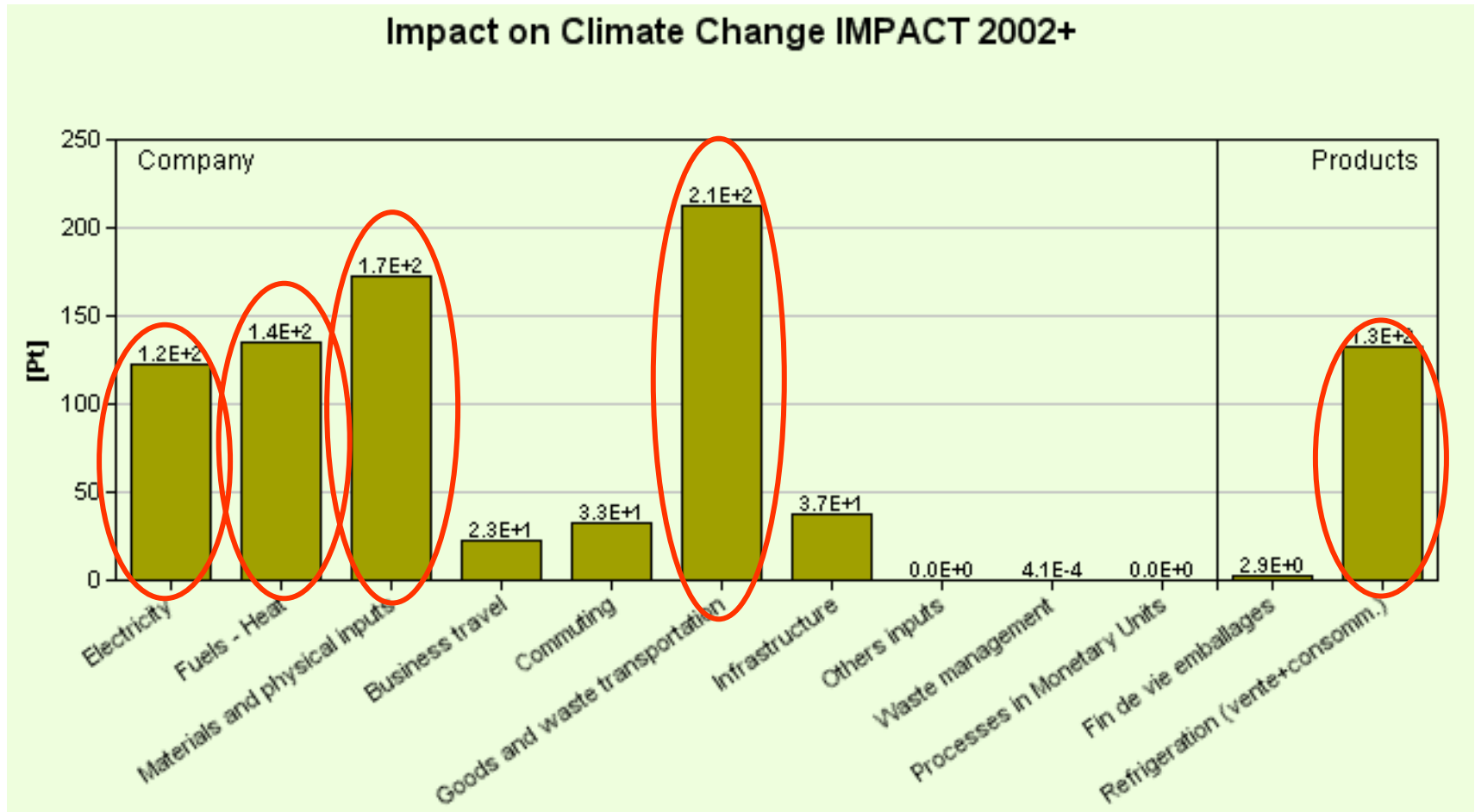
**Electricity for  
cooling**



**Packaging  
Waste**

(1766 kWh/m<sup>3</sup>/an  
Lifetime 1 month)

# Results: Overall life cycle performances



# Environmental Priorities

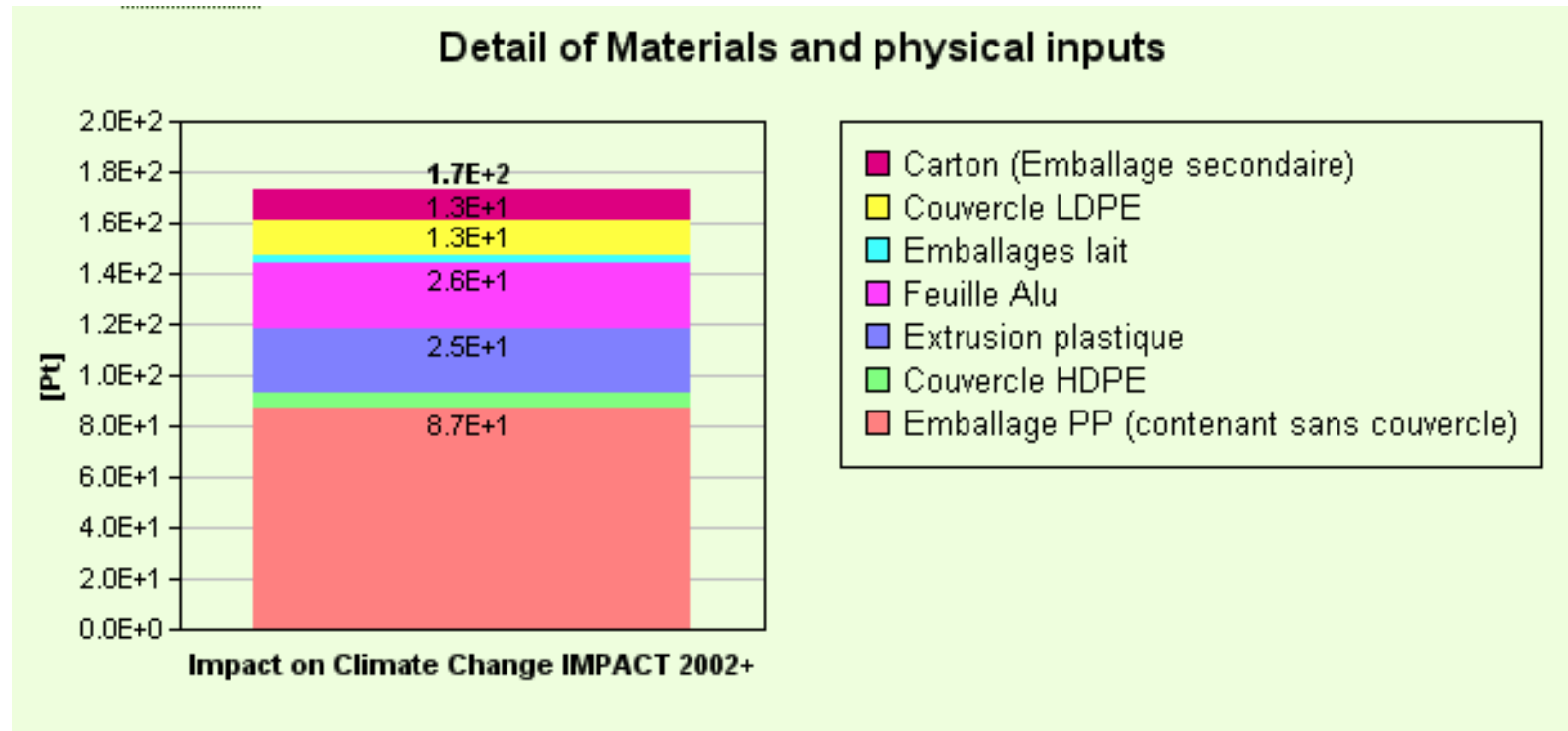
- Transport for product distribution
- Packaging
- Heat production / electricity consumption
- Electricity for refrigeration (sales + consumer)

Where along the life cycle chain?

ca. 40% direct (on site) vs. 60% indirect (up & downstream)



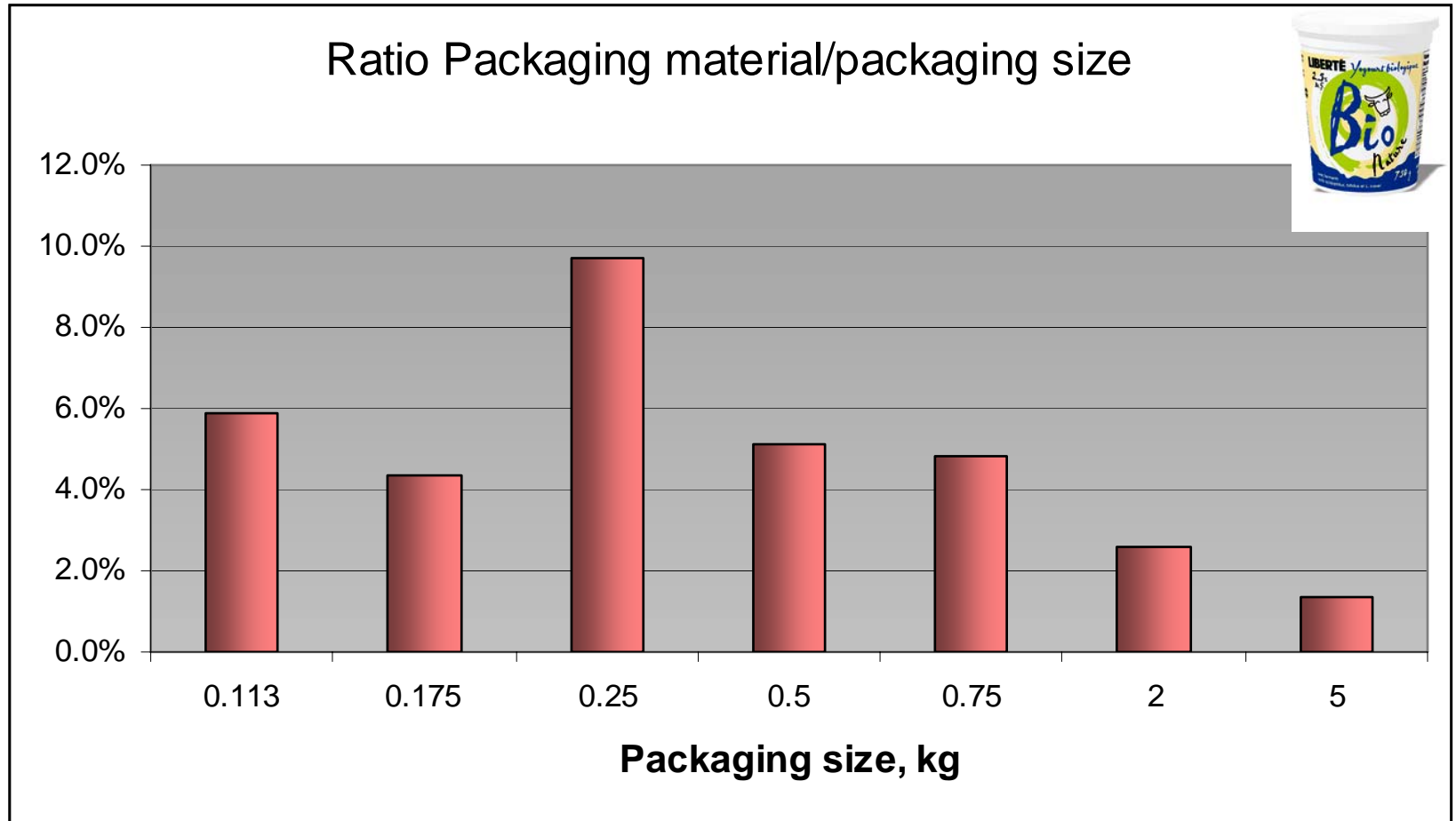
# Details on Packaging



Plastic pots > Aluminium sheet > secondary packaging



# Improvement potential for packaging



# Recommendations for improvements

## Transport optimization

favour low consumption trucks,

re-thinking the logistic, eco-driving, etc.



## Re-design the packaging

modifying the shape:  
potential for material  
reduction up to a factor of 2

Choose substitution  
materials (LCA)



Chain process energy  
optimization at the  
production site

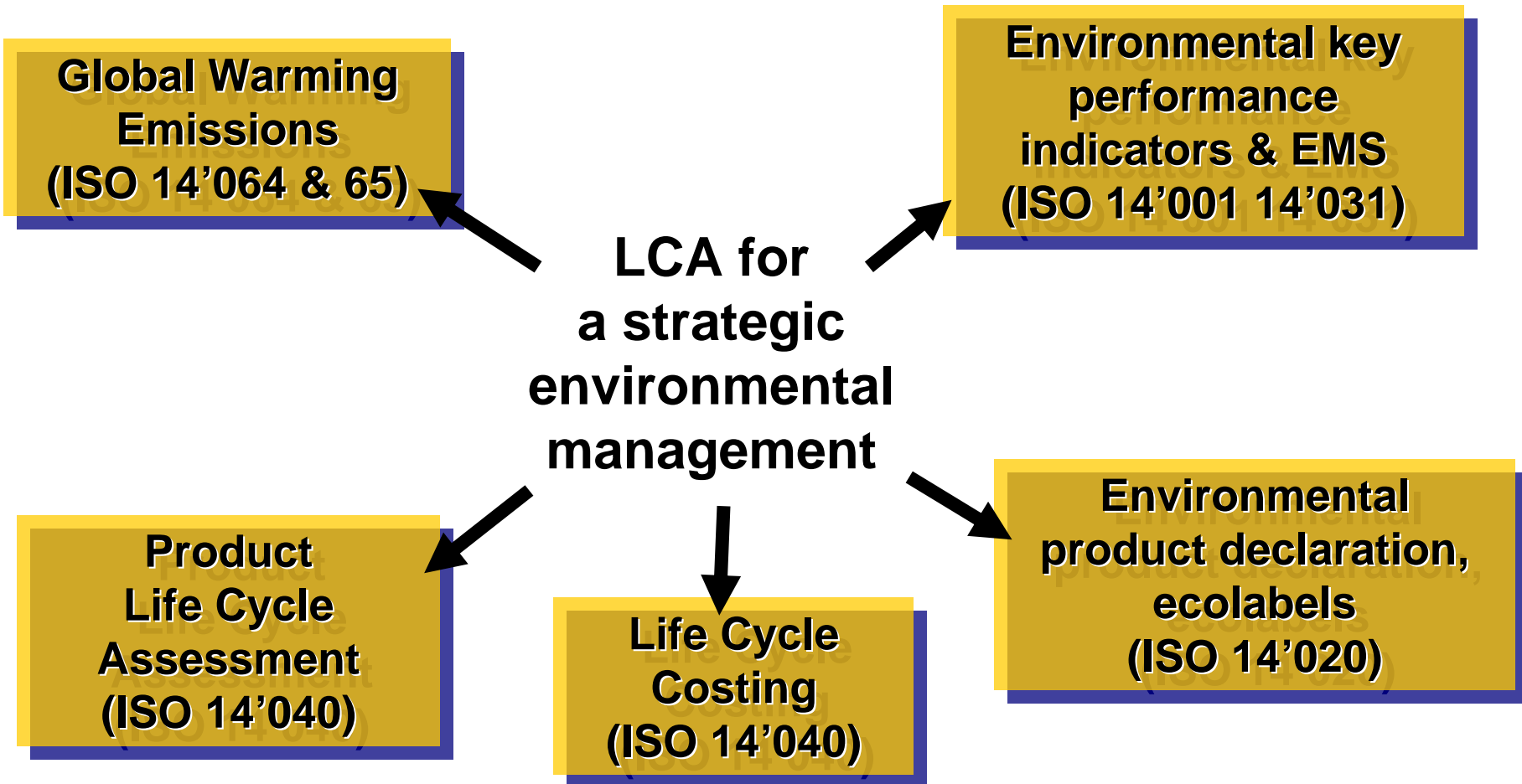


# Conclusions

- LCA on a company basis is a useful approach for a strategic EMS:
  - enables the decision maker identifying the right priorities (often outside the classical company burdens)
  - Support new action, such as procurement policies or eco-design
  - enable improvement of the overall product portfolio
  - results in tremendous impacts on the perception of environmental performance realigning priorities of the EMS



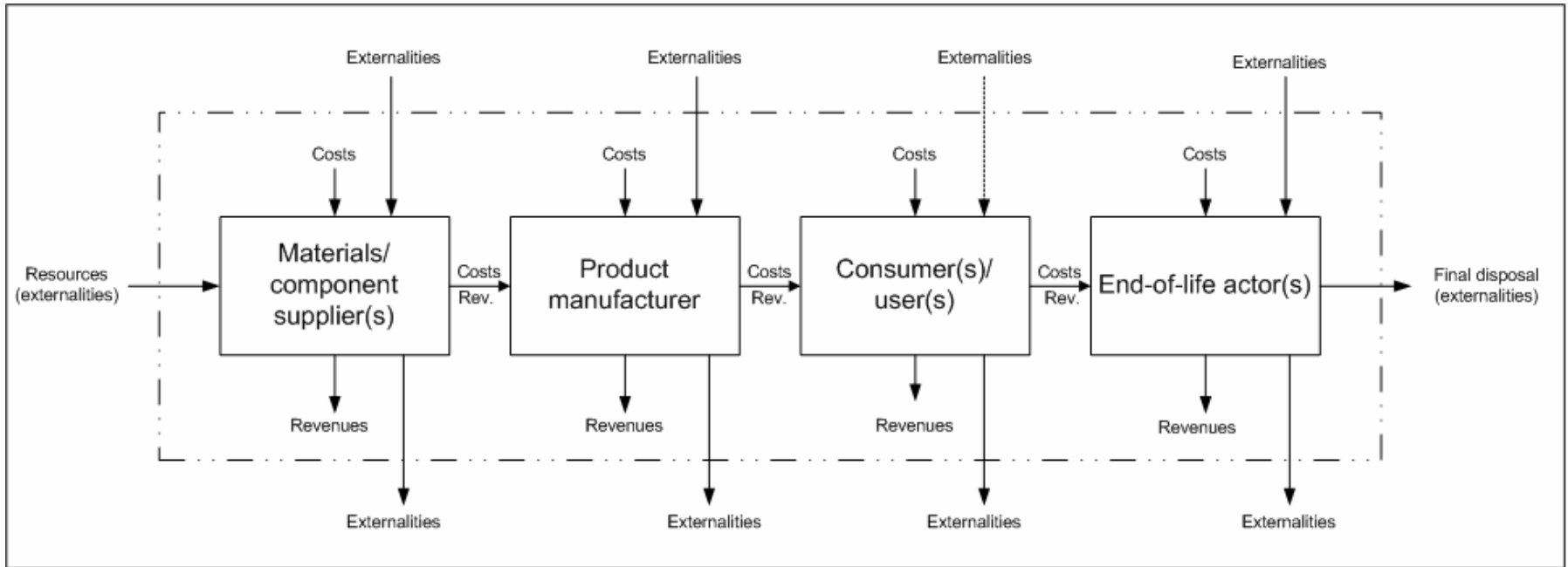
# Perspectives

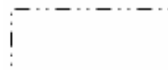



# Thank you, any questions?



# Life Cycle Cost boundaries



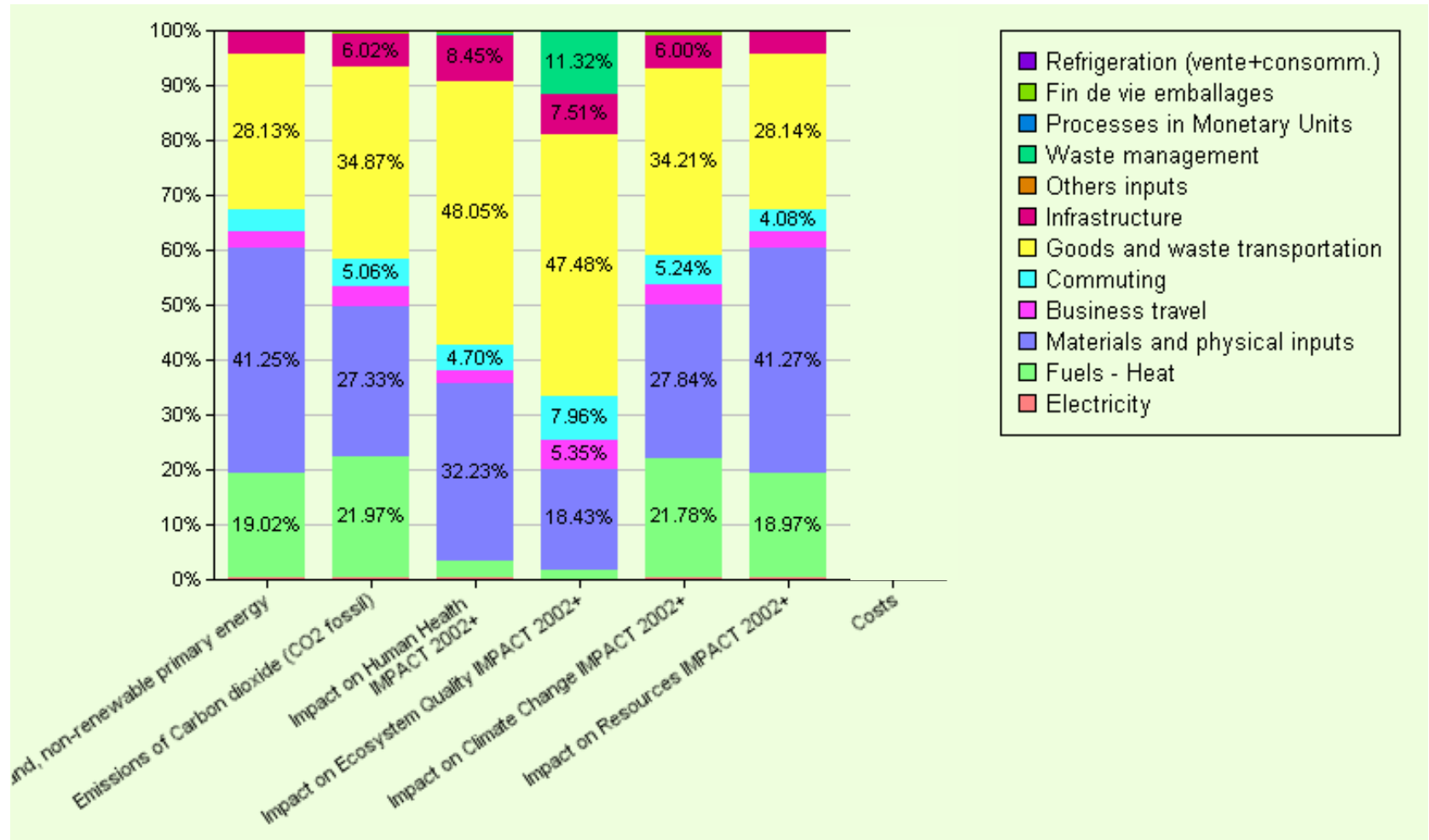
 Economic system = boundaries of LCC

 Social and natural system:  
boundaries of social and environmental assessment

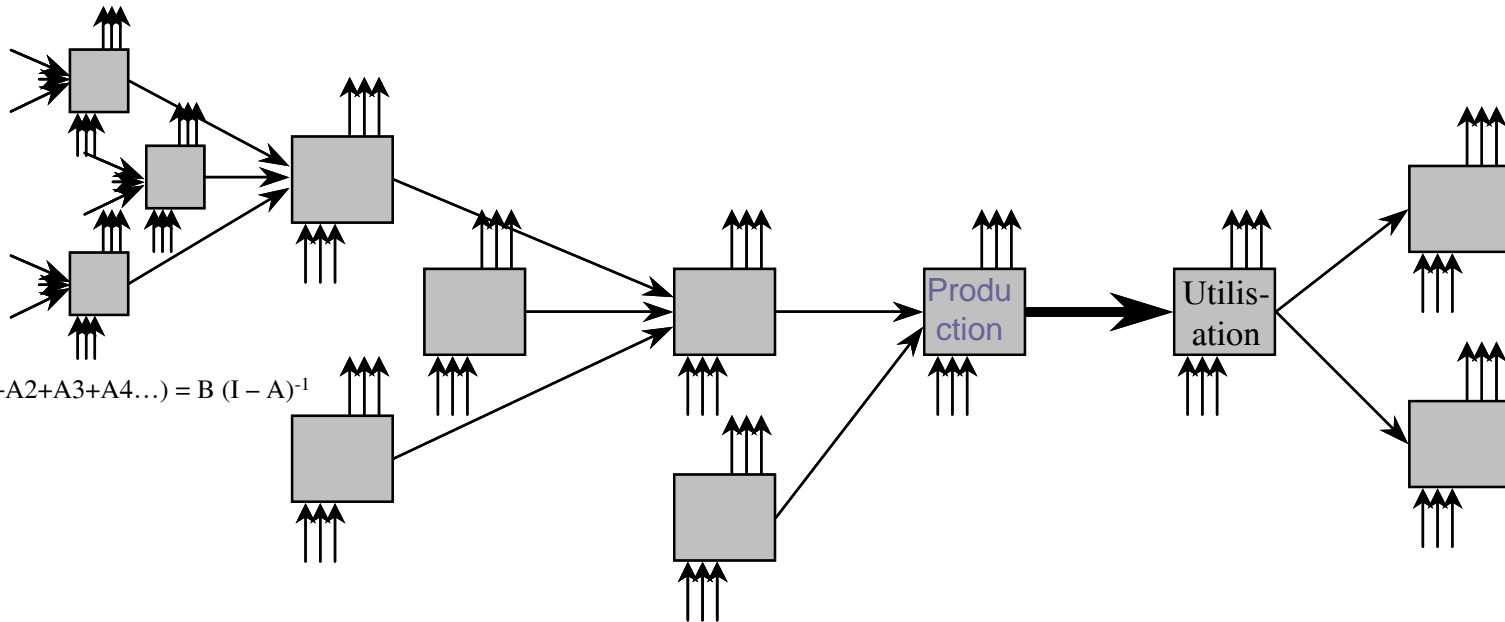
(Rebitzer and Hunkeler, 2003)



# Further environmental indicators are available



# Upstream supply chain



$$E = B(I + A + A^2 + A^3 + A^4 \dots) = B(I - A)^{-1}$$

$$b = E \cdot p = B(I - A)^{-1} \cdot p$$

A = Technological coeff. (input) matrix

B = Matrix of burden intensities for each process

E = Emission/extraction matrix

b = production inventory

p = Vector of company related flows (inventory)