TECNOLÓGICO DE MONTERREY®

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TECNOLÓGICO DE MONTERREY®

Aalto University Design Factory

Proyecto Integrador 1
Aaltonaut program

Sustainable Product Design

TEC innov action gym
MINDSET MAKERS

Aaltonaut

Session 02

Sustainability Tools

Teams

Configuration:

- 1 Team leader (10 extra points)
- 5 team members
- 7 teams in total

Team leaders:

Send CV to azael.capetillo@itesm.mx

07 August – 17 August

Teams

Session 20 August:

- Team leaders Pitch
- Team interviews and assembly

Next steps

Session 20 August:

- Introduction to Aalto platform

Course format:

- Lecture sessions every two weeks.
- Project revisions every two weeks.

i.e. one week for lectures of sustainability, following week for Project revision.

Course scope

Sustainable Product Design is an interdisciplinary and international course on sustainable product development.

It is organized by **Aaltonaut-program** of **Aalto University** together with **Innovaction GYM** of **TEC de Monterrey**. The course focuses in the sustainability topics which are important in product development process:

- eco-design,
- material efficiency,
- product life cycle and
- user approach.

Course project

Student teams will develop green alternative for products of a company **(BigCo).**

Due to time pressure, the teams will make collaboration with a nominated team from Aalto/TEC. During the process the teams will study the product sustainability improvement from different approaches:

Eco-design guidance, Material choices and efficiency, Product life cycle impacts and User centred approach.

The final outcome is the market launch of a new, more sustainable product.

Whiteboard question.

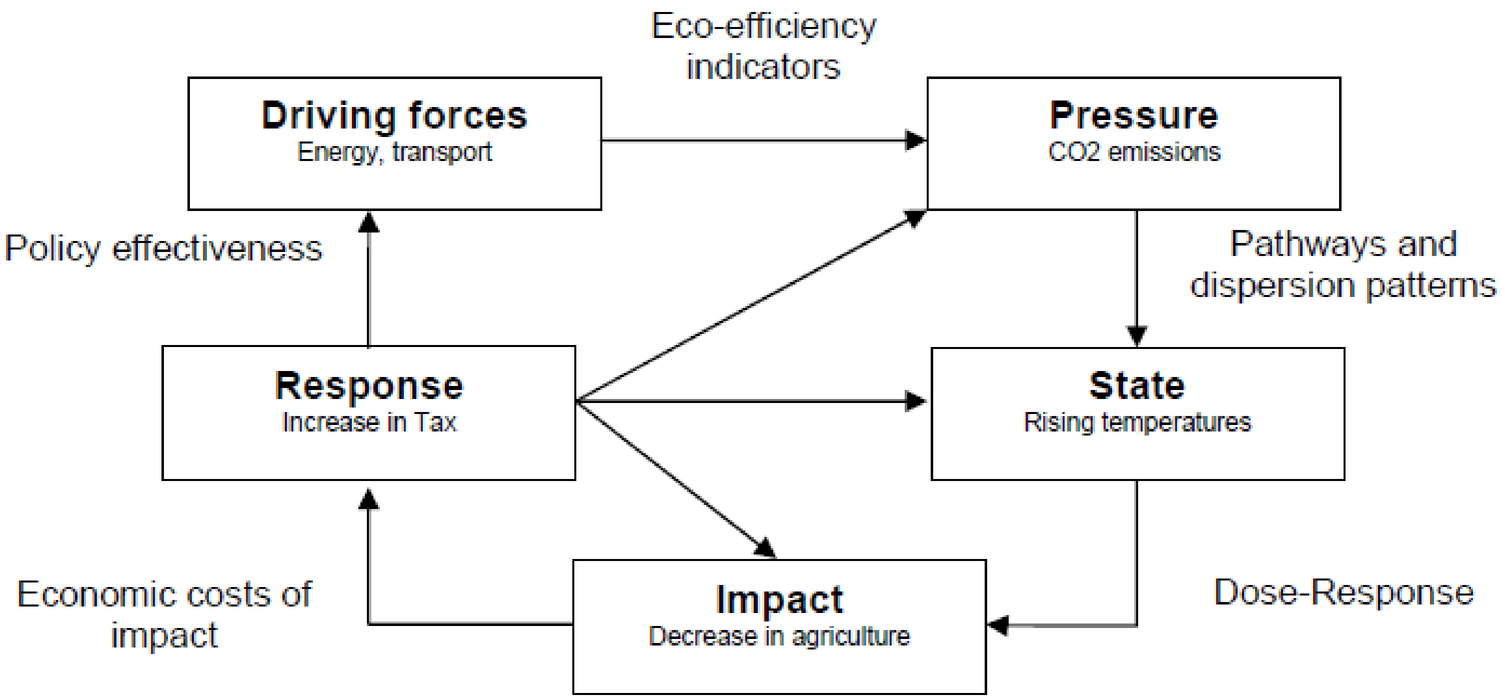
Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

1987, Brundtland. Our common Future: The world Commission on Environment and development.

Sustainability Tools

DPSIR: Driving forces, Pressure, State, Impact, and Response framework

DPSIR framework describes the interaction between society and the environment, was adopted by the European Environmental Agency as a sustainability model.



EEA, E. E. A. (2009). "Dose/response relationships." Retrieved 10 July 2009, from http://ew.eea.europa.eu/greenland_ia/resources/slides/dpsir-folder/doseresponserelationships

Life Cycle Assessment (LCA)

Life Cycle Assessment (LCA) is a method to analyse the environmental impacts of products (Rebitzera, Ekvallb et al. 2004).

BS ISO 14040 defines LCA as “the compilation and evaluation of the inputs outputs and the potential environmental impacts of a product system throughout its life cycle” (BSi 2006)

Rebitzera, G., T. Ekvallb, et al. (2004). "Life cycle assessment Part 1: Framework, goal and scope definition, inventory analysis, and applications." Environment International 30: 20.
BSi (2006). BS EN ISO 14041:2006 Life cycle assessment — Goal and scope definition and inventory analysis. UK, BSi British Standards.

Life Cycle Assessment (LCA)

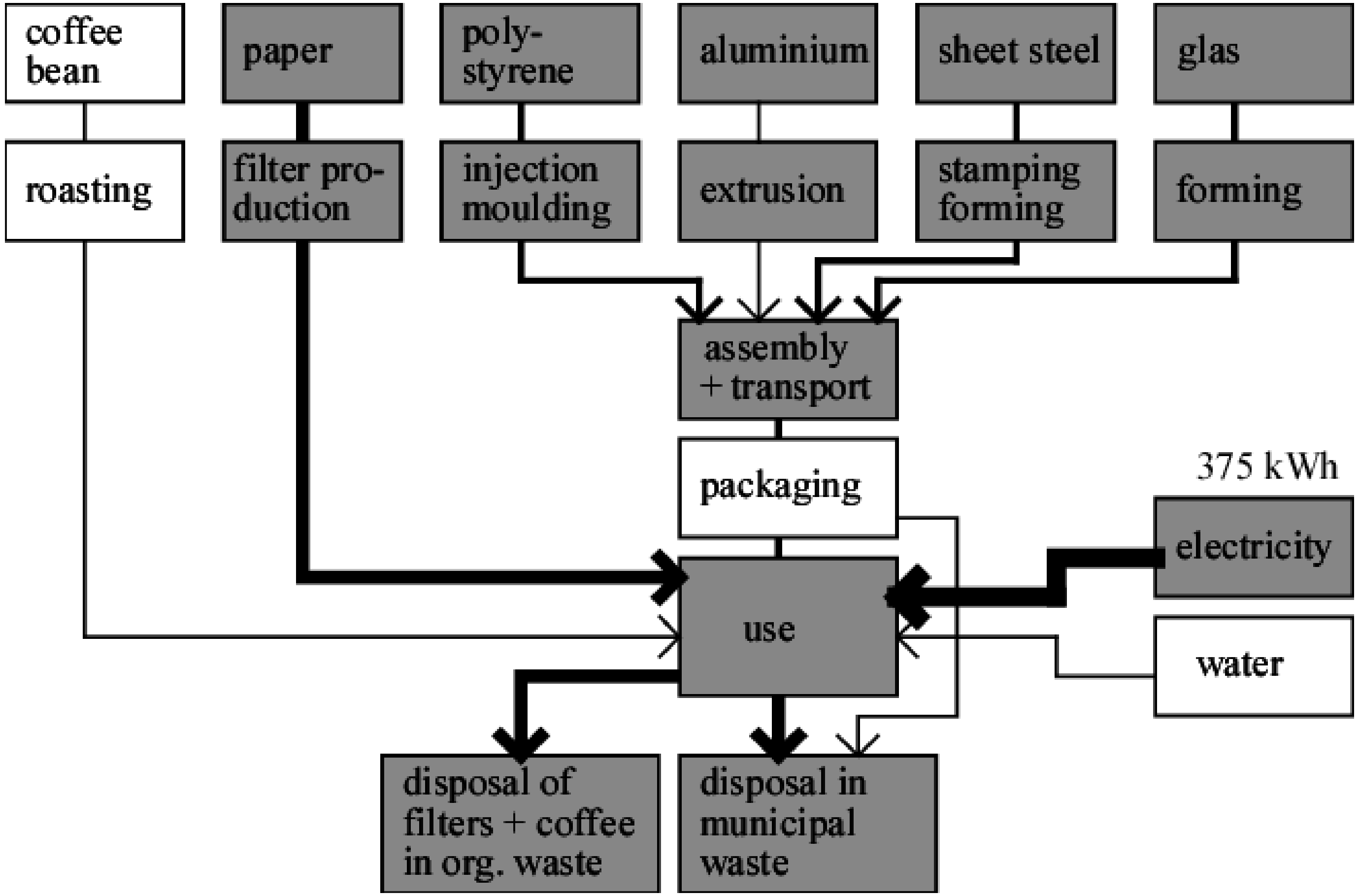
The first recognised LCA study was carried out by the Coca-Cola Company in 1969.

The analysis was used to select between cans, glass bottles or plastic bottles (Hunt and Franklin 1996) The **inclusion of energy** in the natural resources category was an innovative part of the study at that time.

Hunt, R. G. and W. E. Franklin (1996). "LCA - How it came about." The International Journal of Life Cycle Assessment 1(1): 4.

Life Cycle Assessment (LCA)

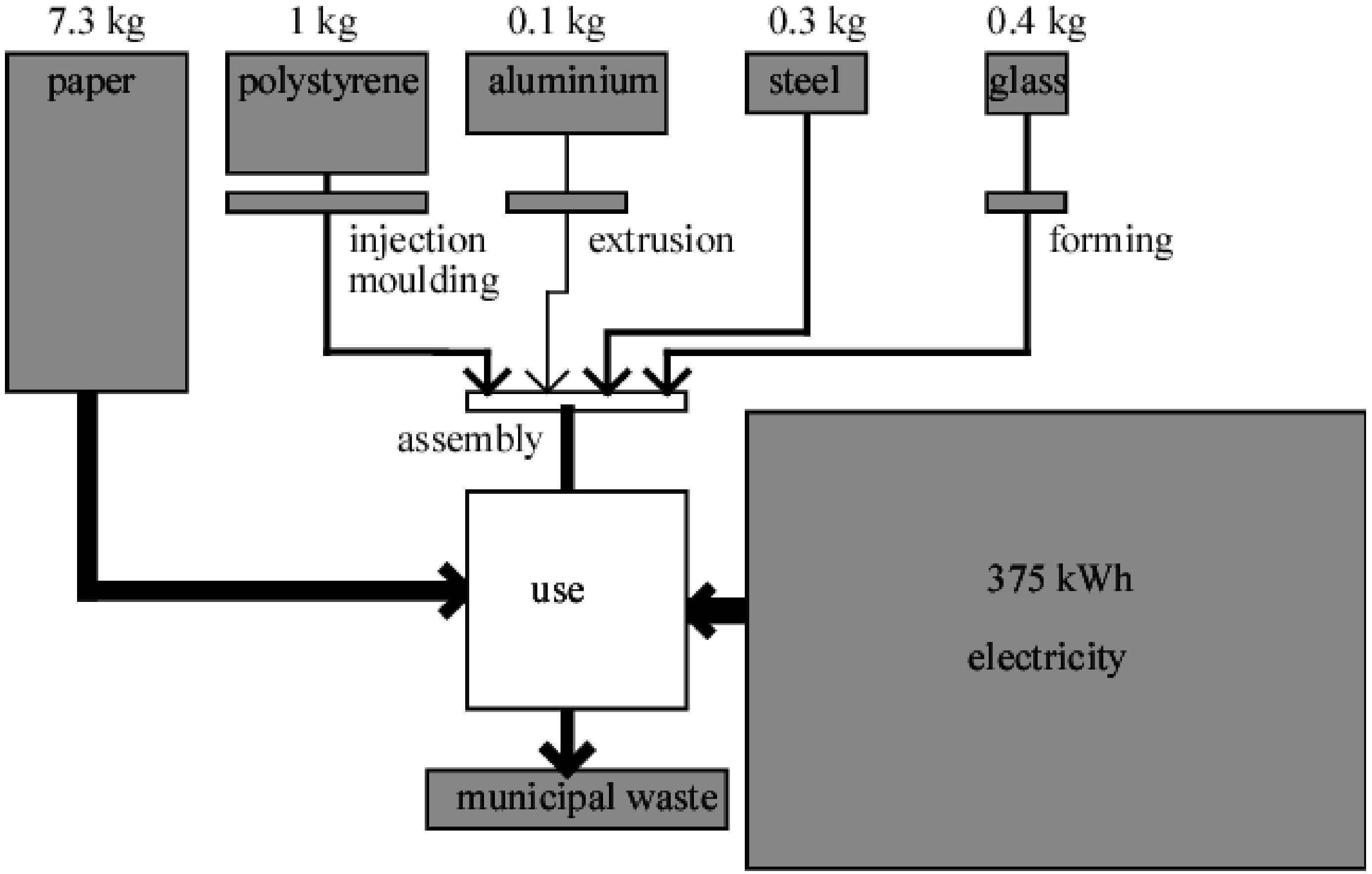
Process tree of a simplified coffee machine model with amounts and assumptions.



Goedkoop and Hofstetter (1998). "The ECO-indicator 98 explained" The International Journal of Life Cycle Assessment 3(6):352-360

Life Cycle Assessment (LCA)

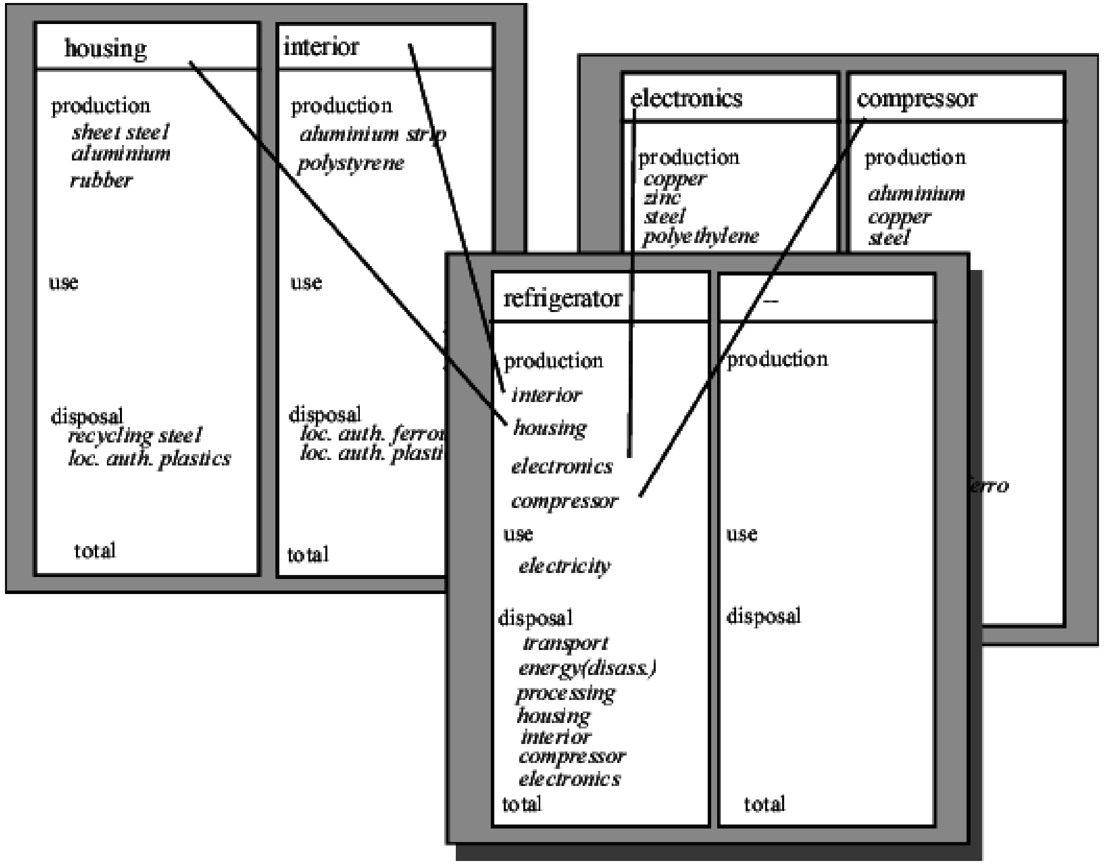
The coffee machine process tree, where the size of the process blocks is proportional to the relative importance of the process.



Goedkoop and Hofstetter (1998). "The ECO-indicator 98 explained" The International Journal of Life Cycle Assessment 3(6):352-360

Life Cycle Assessment (LCA)

Example of a completed form (in this case without figures) in which the product is subdivided.



Goedkoop and Hofstetter (1998). “The ECO-indicator 98 explained” The International Journal of Life Cycle Assessment 3(6):352-360

Life Cycle Assessment (LCA)

LCA involves the entire life cycle of a product, starting from raw material extraction and acquisition, including energy, material production and manufacturing, through to end of operational life and disposal.

Another analysis similar to LCA is the LCI (Life Cycle Inventory).

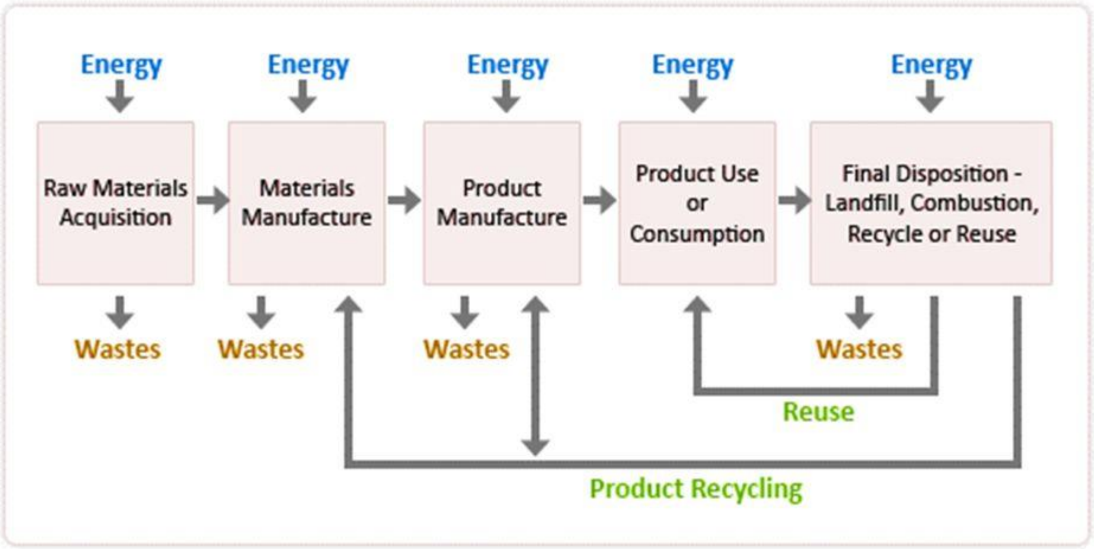
LCI is a phase of the LCA involving the compilation and quantification of inputs and outputs of a product during its life cycle (BSi 2006).

BSi (2006). BS EN ISO 14041:2006 Life cycle assessment — Goal and scope definition and inventory analysis. UK, BSi British Standards.

Life Cycle Inventory (LCI)

An environmental assessment of a product showing only the impact of materials and manufacturing process, avoiding the impact of the product’s operation and disposal, is considered a LCI study.

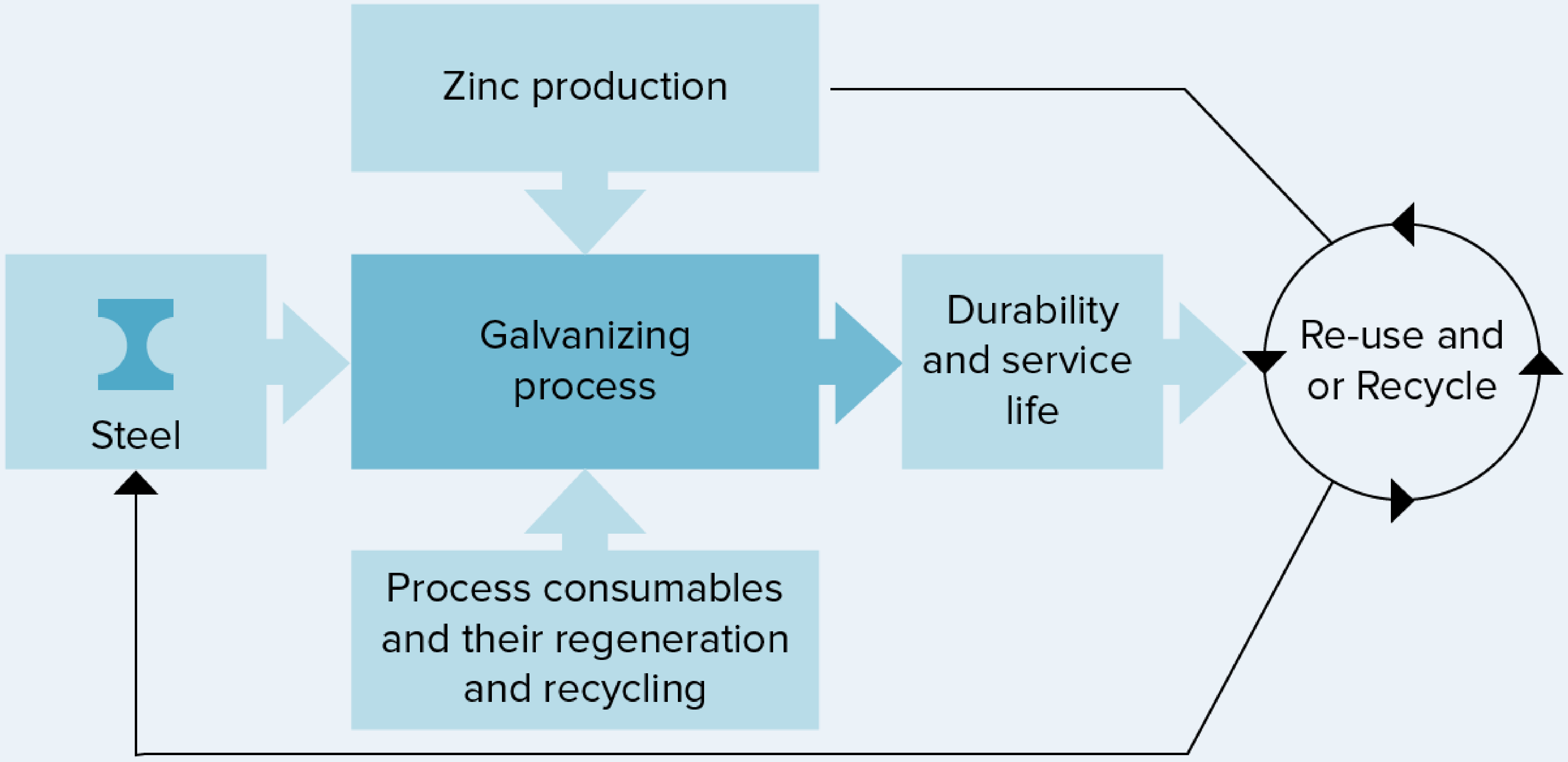
Life Cycle Inventory (LCI): collecting, validating and aggregating input and output data to quantify material use, energy use, environmental discharges, and waste associated with each life cycle stage.



The outcome of the LCI provides the starting point for the Life Cycle Impact assessment phase

BSi (2006). BS EN ISO 14041:2006 Life cycle assessment — Goal and scope definition and inventory analysis. UK, BSi British Standards.

Life Cycle Inventory (LCI)



The life cycle of hot dip galvanized steel

Life Cycle Assessment (LCA)

For a successful implementation of LCA to (PRe 2008):

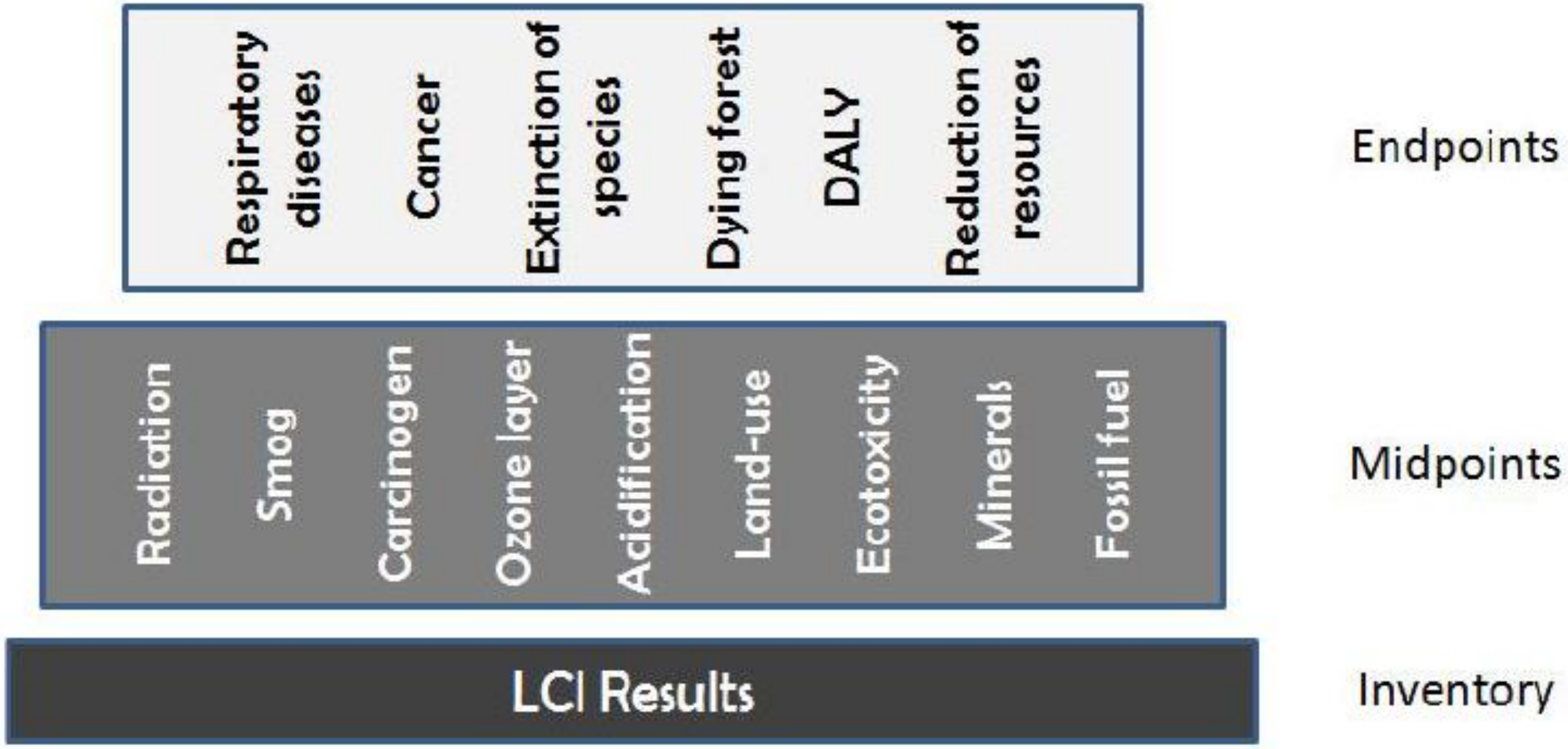
- Clearly define the reason for using LCA.
- Clearly define how to communicate LCA results.
- Allocate an adequate budget.

Large and complex LCA requires a large amount of information that in most cases is difficult and laborious to obtain. The system boundaries and specifications are of major importance for the outcome of the LCA. The system boundaries can include three main orders or levels (PRe 2008):

- First order: only the production of materials and transport.
- Second order: all processes during the life cycle are included.
- Third order: All processes and capital goods are included.

PRe (2008). Introduction to LCA with SimaPro7, Pre Consultants: 88.

Life Cycle Assessment (LCA)



PRe (2008). Introduction to LCA with SimaPro7, Pre Consultants: 88.

Life Cycle Assessment (LCA)

LCA analysis can be divided in four main types according to their level of complexity (PRe 2008):

- Screenings
- Short studies
- Extensive studies
- Continuous LCA operations

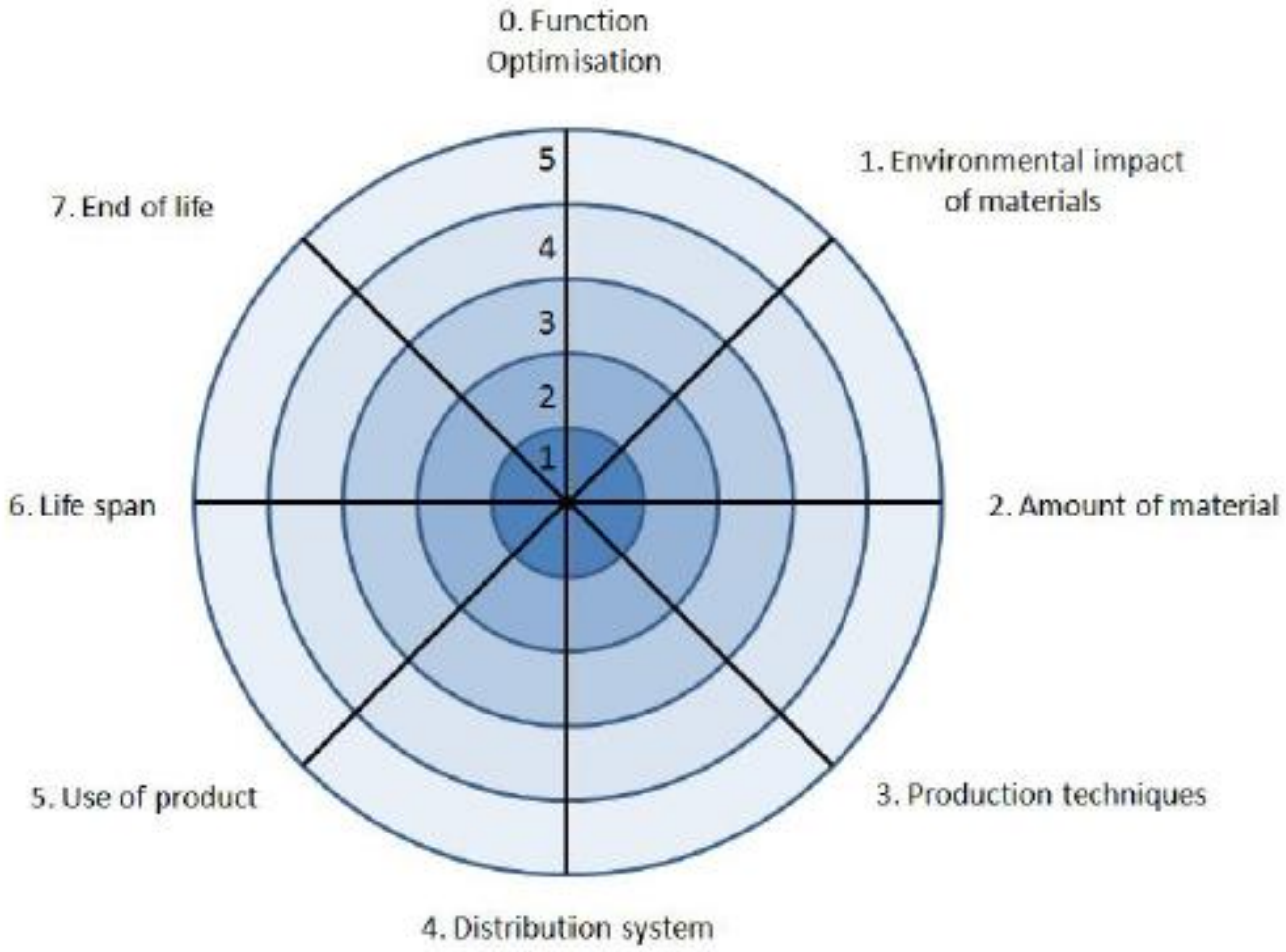
PRe (2008). Introduction to LCA with SimaPro7, Pre Consultants: 88.

LiDS wheel

LiDS stands for Life-cycle Design Strategy (Brezet and Hemel, 1997). Is a cluster of strategies for eco-design represented in a graphical manner, with every strategy containing a number of simple rules (Mulder 2006).

Basically the LiDS wheel is a selection of seven life cycle design strategies to consider during the product design process.

LiDS wheel



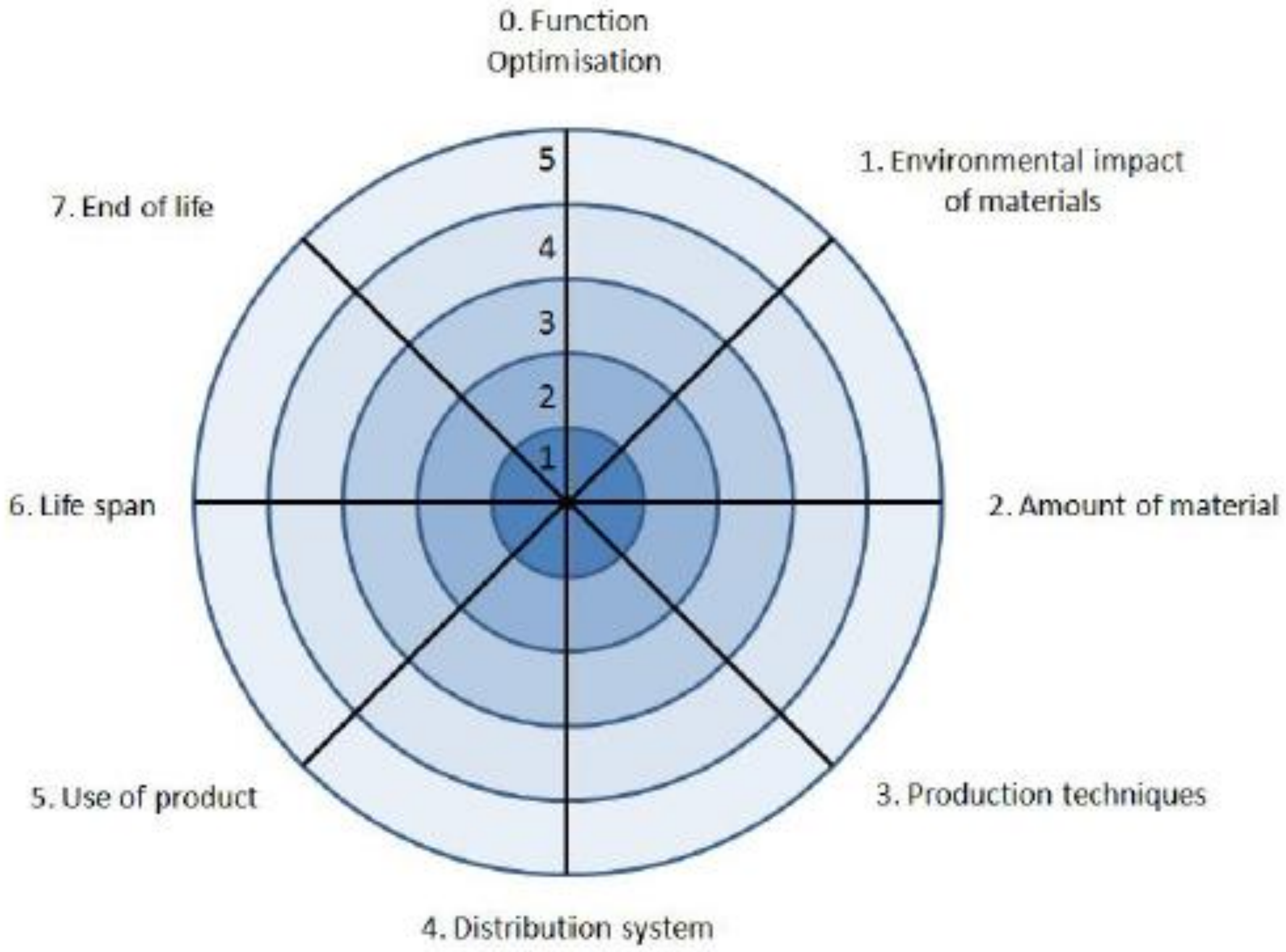
0. Function Optimisation
1. Environmental impact of materials
2. Amount of material
3. Production techniques
4. Distribution system
5. Use of product
6. Life span
7. End of life
5
4
3
2
1

LiDS wheel

Table 25. Criteria defined for LiDS wheel assessment

	Strategy	Level 1	Level 2	Level 3	Level 4	Level 5
0	Function optimisation	50%> Reduction on performance and/or Increased number of components	50< Reduction on performance and/or Increased number of components	Current product	20%> improved performance and/or 20 % >Reduction of total number of components	20%< Improved performance and/or 20%< Reduction of total number of components
1	Environmental impact of materials	Toxic and non recyclable material is presented on high levels High energy content and non recyclable material is used.	Medium levels of toxic material is used 50%> non recyclable material is used and High energy content.	Low levels of toxic material is used 50%> non recyclable material and Low energy content material used.	Non toxic material is used. (or reduction of toxic material) 50%<Low energy content material and recyclable is used.	Non toxic material used. (or reduction of toxic material) 90%< recyclable material/low energy content.
2	Amount of material	More than 50% heavier	Less than 50% heavier	Initial weight	Less than 50% lighter	More than 50% lighter
3	Production techniques	More than 50% more components and manufacturing process. Manufactured in a different continent	Up to 50% more components and manufacturing process. Manufactured in a different country	Initial number of components. Initial number of manufacturing processes Manufactured in the same country	Up to 50% less components and manufacturing processes Manufactured up to 300 km from the selling point	More than 50% less components and manufacturing processes. Manufactured up to 100 km from the selling point.
4	Logistics	Use of plastics, cardboard, glue and/or metal for packaging. Shipped by air	Use of metal for packaging. Shipped by land or water. Shipping by air.	Use of plastics, cardboard and glue for packaging. Shipped only by land or water	Small packaging, use of plastic and or cardboard. Shipped only by land and or water.	None or minimum packaging. Transported by fuel efficient vehicles or fossil fuel free system.
5	Use of product	Heavy use of electricity and consumables (every week)	Use of electricity and consumables (every month)	Moderate use of electricity or consumables (every 6 – 9 months)	Reduction on electricity consumption. Consumables used every 9 – 13 months.	No electricity consumption. No consumables are used
6	Life span	0 – 2 years Difficult to access maintenance Special tools and personnel needed	3 – 5 years Special tools and personnel required for maintenance	6 - 14 years Special tools required for maintenance	15 years Easy maintenance	30 years plus No tools needed for maintenance
7	End of life	Recycle of less than 50% of product	Recycle of more than 50% of the product	Re-use and or – Re-manufacture available for up to 50% of the product Recycle option available	Re-use and or Re-manufacture available for up to 90% of product 100% recyclable	Re-use of entire product

LiDS wheel


0. Function
Optimisation
1. Environmental impact
of materials
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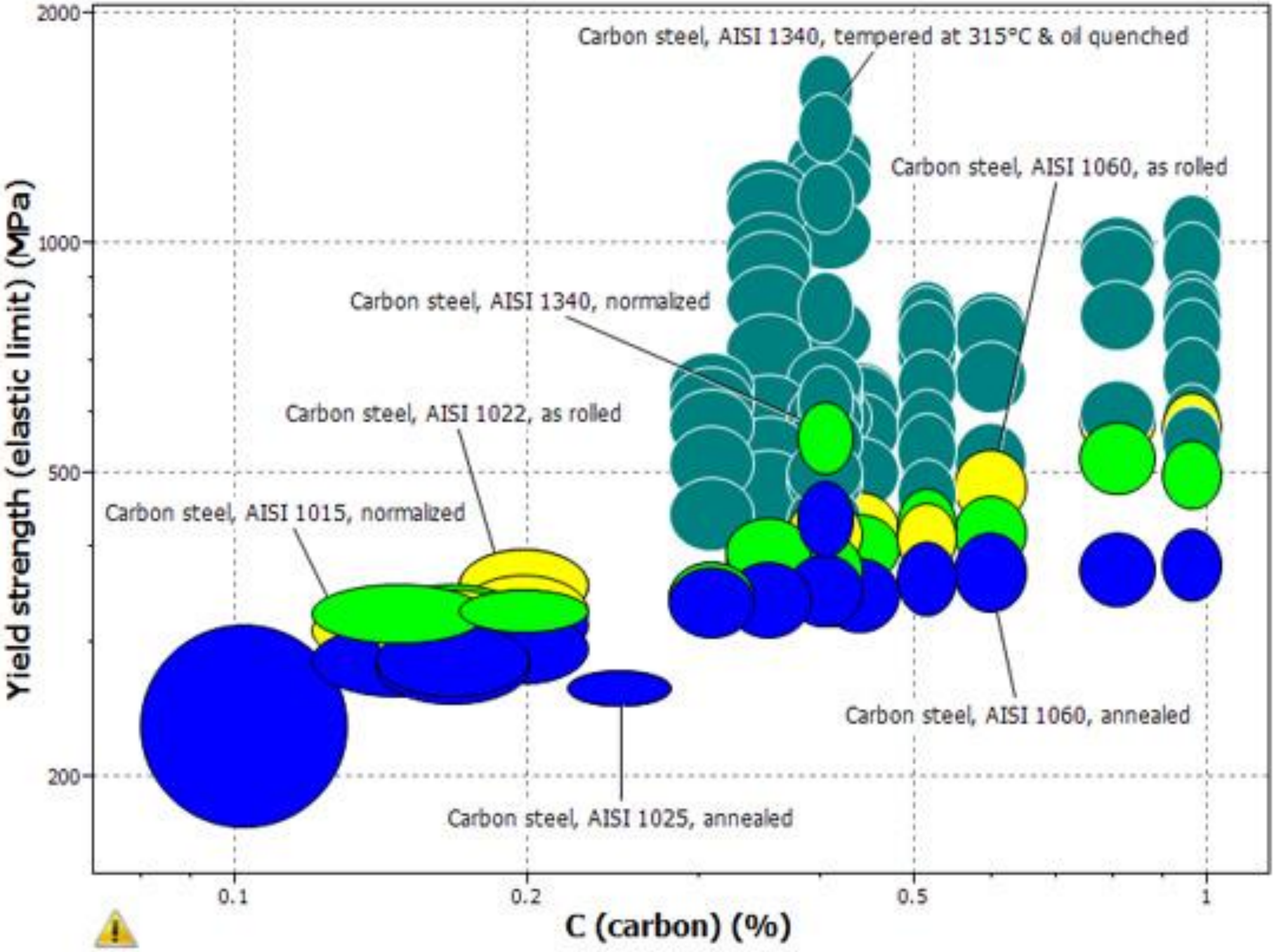
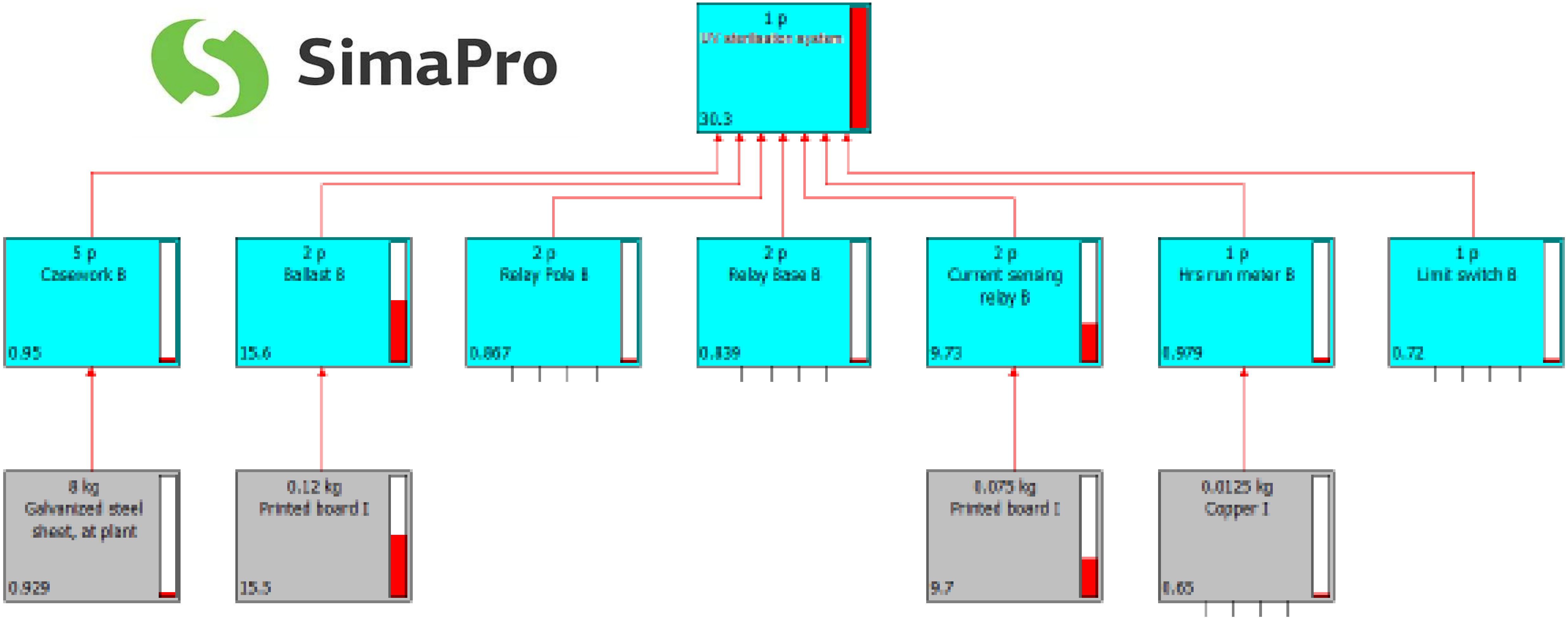
6. Life span
7. End of life
5
4
3
2
1

CES Edupack



2000
1000
500
200
0.1
0.2
0.5
1
Yield strength (elastic limit) (MPa)
C (carbon) (%)
Carbon steel, AISI 1340, tempered at 315°C & oil quenched
Carbon steel, AISI 1060, as rolled
Carbon steel, AISI 1340, normalized
Carbon steel, AISI 1022, as rolled
Carbon steel, AISI 1015, normalized
Carbon steel, AISI 1060, annealed
Carbon steel, AISI 1025, annealed

SimaPro


1 p
30.3
5 p
Casework B
0.95
2 p
Ballast B
15.6
2 p
Relay Pole B
0.867
2 p
Relay Base B
0.839
2 p
Current sensing relay B
9.73
1 p
Hrs run meter B
0.979
1 p
Limit switch B
0.72
8 kg
Galvanized steel sheet, at plant
0.929
0.12 kg
Printed board I
15.5
0.075 kg
Printed board I
9.7
0.0125 kg
Copper I
0.65

Debate

ORGANICS

vs

GMOs

Debate vs Discussion vs Argument

Debate vs Discussion vs Argument

Testing ideas with debate

GMO
Genetically modified organisms

Is the sustainable answer

ORGANIC
Organically produced foods

Is the sustainable answer

There are no right or wrong answers – only strong or weak arguments

ORGANIC
Organically produced foods

Is the sustainable answer

Arguments for	Arguments against
Evidence	Evidence

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GMO
Genetically modified organisms

Is the sustainable answer

Arguments for	Arguments against
Evidence	Evidence

Strengths

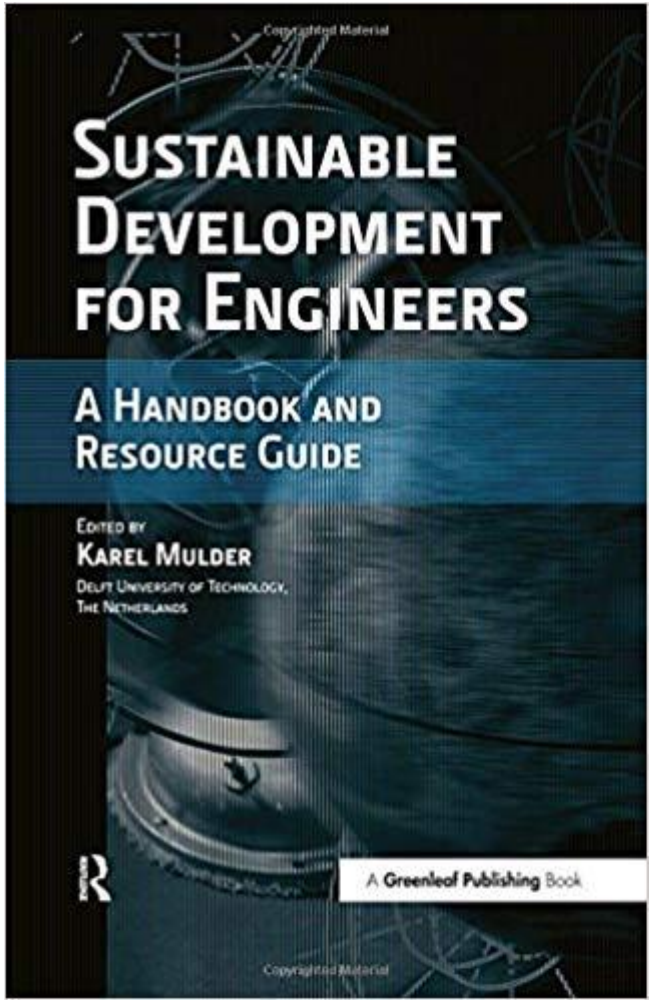
Arguments for	Arguments against
Evidence	Evidence

Weakness

- Why is it sustainable?
- Why is it not sustainable?
- What is the major problem?
- What is the major benefit?

20 mins to carry your research

Recommended lectures



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