

PP:D4M

6. g.design : assess

key learning objective : understand ecodesign tools

- checklists
- matrices
- Eco-indicators
- LCA (life cycle assessment) software

1.

rethink

investigate the internal and external drivers for product or service (re)design.

these drivers could include legislation, customers, new technology, competition.

2.

assess

assess the environmental impacts of the product.

map the product life cycle so you understand where these impacts occur. identify where materials and energy is used and where waste is produced.

3.

design

select ecodesign strategies that will allow designers to tackle the main environmental impacts.

explore the compromises and trade-offs. involve others from marketing, sales, production, purchasing.

4.

communicate

develop a clear brand and marketing strategy to reflect and communicate the environmental improvements.

consider the product packaging and how this will impact upon the brand.

	Analysis/Planning	Concept design	Detailed design	Prototype/ Testing	Market Launch	Product Review
Strategy tools						
Driver analysis						
Stakeholder assessments						
Research tools						
Usability testing						
Market analysis						
Creativity techniques						
Ecodesign checklists						
LiDS Wheel						
Rules of thumb						
Material matrices						
Material selection software						
Recycling checklist						
Guidelines						
Met Matrix						
Extended design matrix						
Eco-indicator						
Ecological footprint						
Life cycle costing						
Life cycle analysis						
Benchmarking						
Strategy wheel						
Standards						

assess

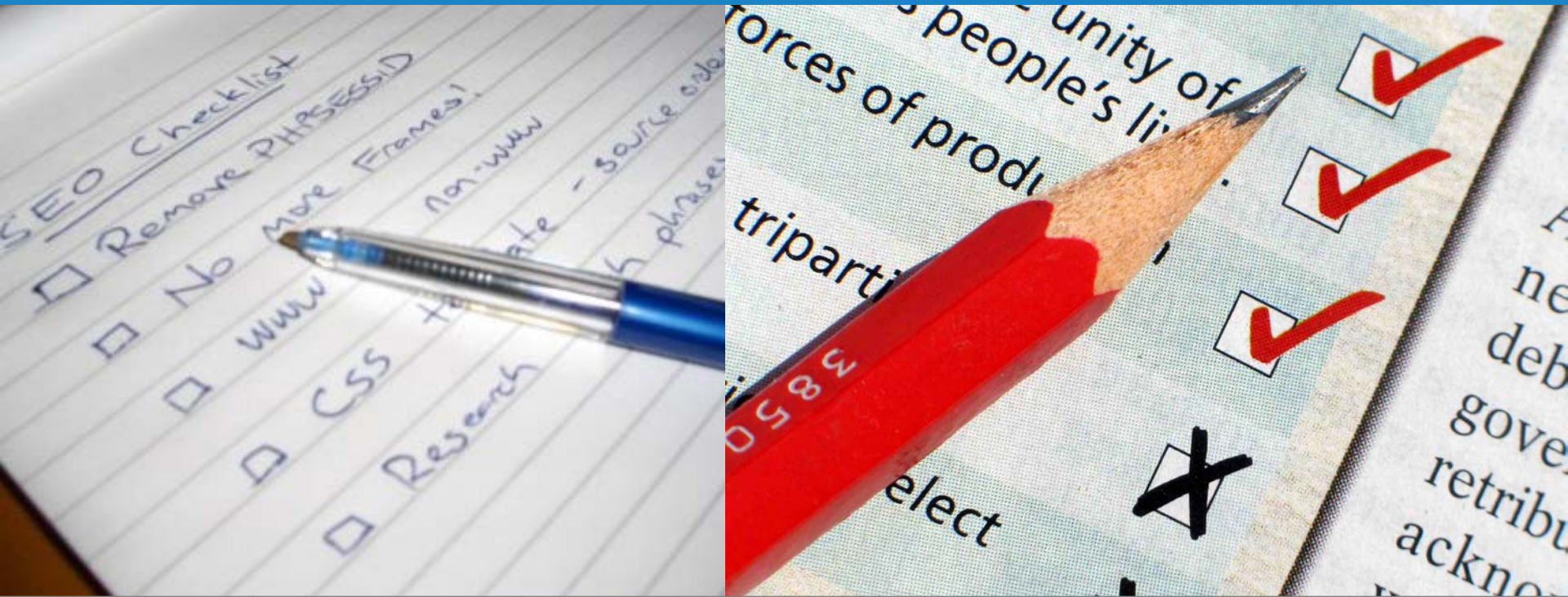
- assess the environmental impacts of the product.
- map the product life cycle so you understand where these impacts occur. identify where materials and energy is used and where waste is produced.

image source: orangebox



assess tools: checklists

- simple and commonly used qualitative env. analysis methods.
- list all the relevant questions that need to be asked when establishing environmental impacts during the product's life cycle
- indicating improvement options for areas where environmental problems are identified



Analysis/planning	Concept design	Detailed design	Prototype/testing	Market launch	Product review

II. Manufacture

Discussion questions

Can this product be manufactured with low-temperature or low-energy use processes? (For example, low-temperature lamination process.)

Can this product be manufactured without the use of hazardous chemicals or restricted metals?

1 POINT = YES, 0 POINTS = NO, UNLESS OTHERWISE NOTED

- ☐ 1. Is the number of types, composite mixtures, and amounts of materials used in this product minimized?
() Yes, describe briefly _____
() No
- ☐ 2. Are the number and types of manufacturing steps minimized (simplification to prevent errors and waste)?
() Yes, describe briefly _____
() No
- ☐ 3. Does the product contain materials that are considered to have the least environmental impact?
() Yes, describe briefly _____
() No
- ☐ 4. Is as much recycled and/or renewable material as possible used in this product?
() Yes, describe briefly _____
() No
- ☐ 5. Is the amount of material used in the product and during the manufacturing process (surplus coating, cut-aways, trimming, by-products) minimized?
() Yes, describe briefly _____
() No
- ☐ 6. If plastics are used, are they clearly marked by an identification system such as ISO 1043-1 or ASTM D1972-91?
() Yes, describe briefly _____
() No
- ☐ 7. Do the manufacturing processes for this product minimize the use of energy-intensive steps (for example multiple heating and cooling, use of inefficient motors)?
() Yes, describe briefly _____
() No
- ☐ 8. Is there minimal transport between manufacturing and assembly points?
() Yes, describe briefly _____
() No

Design Tip: Optimizing Fasteners

There are a number of ways to optimize use of fasteners to facilitate upgrade, repair, and assembly/disassembly (for recycling) of products.

- ▶ consider color coding connectors to their corresponding point of attachment
- ▶ use snap-fit fasteners where possible
- ▶ if screws are used, use the same head type
- ▶ avoid use of glues or welds
- ▶ use a simple component orientation with visible fastening points
- ▶ consider using fasteners of the same material type as the parts to be joined to facilitate recycling

- ☐ 9. Is the consumption of water and generation of water pollutants avoided or minimized during the manufacture of this product?
() Yes, describe briefly _____
() No
- ☐ 10. Is the generation of air pollutants avoided or minimized during the manufacture of this product?
() Yes, describe briefly _____
() No

III. Product Use

Discussion questions

Could this product be made to use a renewable or alternative (such as a fuel cell) source of energy?

Could this product be designed for repair or upgrade by the consumer (e.g., use of modules or readily available replacement parts)?

1 POINT = YES, 0 POINTS = NO, UNLESS OTHERWISE NOTED

- ☐ 1. Is the product easily disassembled for repair, upgrade or reuse?
() Yes, describe briefly _____
() No
- ☐ 2. Are parts readily available for repair of this product?
() Yes, describe briefly _____
() No
- ☐ 3. Have potential barriers to recycling been avoided, such as use of fillers, additives, embedded metal threads in plastics, paint applied to plastics, or use of materials of unknown composition?
() Yes, describe briefly _____
() No
- ☐ 4. Does the design avoid disposable components such as "one-time use" cartridges, containers, or batteries?
() Yes, describe briefly _____
() No
- ☐ 5. If the product uses electric power, has energy efficiency been optimized?
() Yes, describe briefly _____
() No
- ☐ 6. Are all batteries in the product easily identifiable by type and removable?
() Yes, describe briefly _____
() No

other checklists

Name	Description	Source/contact
Checklist for selecting new solutions	Short assessment if knowledge available More time consuming if investigation required	Tischner 2001
Ecodesign Matrix	Checklist with matrix Compares alternatives Can be processed quickly or in more detail	Stevens 1999
Ecodesign Portfolio	Portfolio diagram Compares alternatives Included matrix of technical and ecological feasibility/market potential (including 'quick wins') against ecological improvement potential Can be processed quickly	Centre for Design at RMIT Brezet/van Hemel 1997
Quality Profile	Determines quality profile of potential solutions User can add or modify criteria Worksheet provides positive or negative value diagram Can also be used for development phase 2.	e(c)oncept 1999 - based on Osgood's semantic differential
MBDC Protocol	Tool for applying the concept of 'cradle to cradle' design Consultant facilitated although software for off the shelf application being developed.	www.mbdc.org
Dominance Matrix	Ranking of competing criteria, for 8-10 aspects at a time Can also be used for development phase 2	e©oncept 1999 - based on Maser 1992
House of Environmental Quality	Modified version of House of Quality, a tool for quality management Facilitates coordination of environmental and other criteria during the co-design process Can be used for development phases 2,4,5 and 7.	Van Hemel 1994, Karlsson 1997
IDSA	Tool from the Industrial Designers Society of America.	www.idsa.org
ERD Guidelines for Packaging	EcoRedesign guidelines from RMIT	www.rmit.edu.au

assess tools: material selection

- using materials that are compatible can help recycling
- reducing the material mix is usually preferable

image source: chris jordan photography



Analysis/planning	Concept design	Detailed design	Prototype/testing	Market launch	Product review
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example material compatibility matrix

		Excess component																			
Mixture component		ABS	ASA	PA	PBT	PBT+PC	PC	PC+ABS	PC+PBT	PE	PET	PMMA	POM	PP	PPO	PPE+PS	PS	PVC	SAN	TPU	
	ABS	+	+	@	+	+	+	+	+	@	@	+	@	@	@	@	@	+	+	+	
	ASA	+	+	@	+	+	+	+	+	@	@	+	@	@	@	@	@	+	+	+	
	PA	@	@	+	@	@				@	@	@	@	@		@	@		@	+	
	PBT	+	+	@	+	+	+	+	+	@	@	@	@	@	@	@	@		+	@	
	PBT+PC	+	+	@	+	+	+	+	+	@	@	@		@	@	@	@		+	+	
	PC	+	+		+	+	+	+	+	@	+	+		@	@	@	@		+	@	
	PC+ABS	+	+	@	+	+	+	+	+	@	+	+	@	@	@	@	@		+	+	
	PC+PBT	+	+		+	+	+	+	+	@	+	+	@	@	@	@	@		+	+	
	PE			@			@			+				+		@		@		@	
	PET	+	+	@	+	+	+	+	+	@	+	@	@	@	@	@	@	@	@	@	
	PMMA	+	+	@			+	+	+	@	@	+	@	@	@	@	@	@	@	@	
	POM	@	@	@	@	@				@	@		+	@	@	@	@	@	@	@	
	PP			@						@				+		@		@		@	
	PPE	@	@	@	@	@	@	@	@	@	@	@	@	@	+	+	+		@	@	
	PPO+PS	@	@	+	@	@	@	@	@	@	@	@	@	@	+	+	+		@	@	
	PS	@	@	@	@	@	@	@	@	@	@	@	@	@	@	+	+	@	@	@	
	PVC	+	+							@		+	+	@		@	@	+	+	+	
	SAN	+	+	@	+	+	+	+	+	@	@	+	@	@	@	@	@	+	+	@	
TPU	+	+	+		+	+	+	+	@	+	+	+	@	@	@	@	+	+	+		

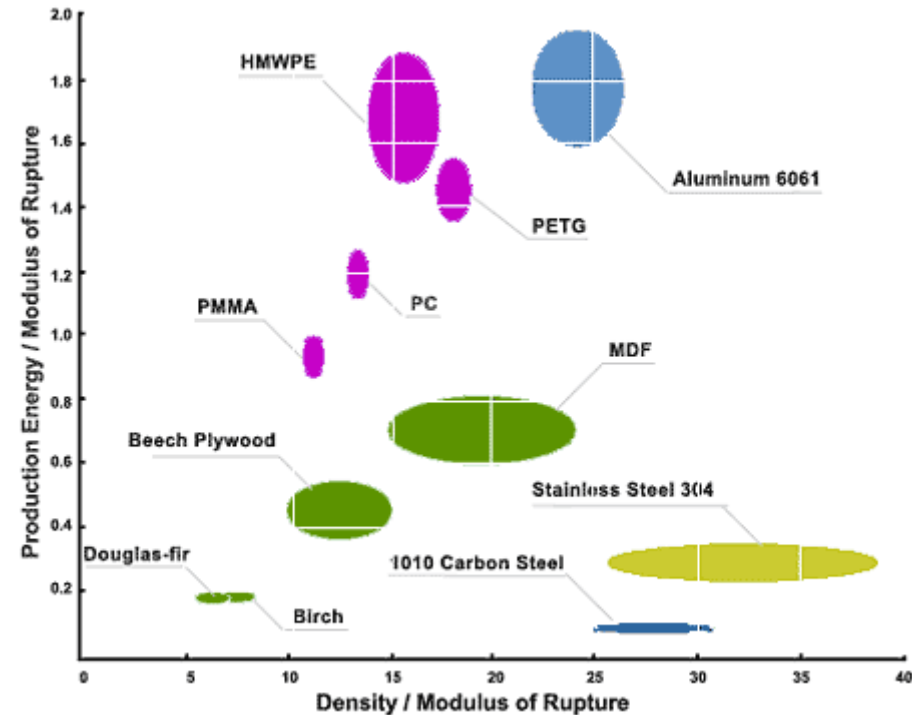
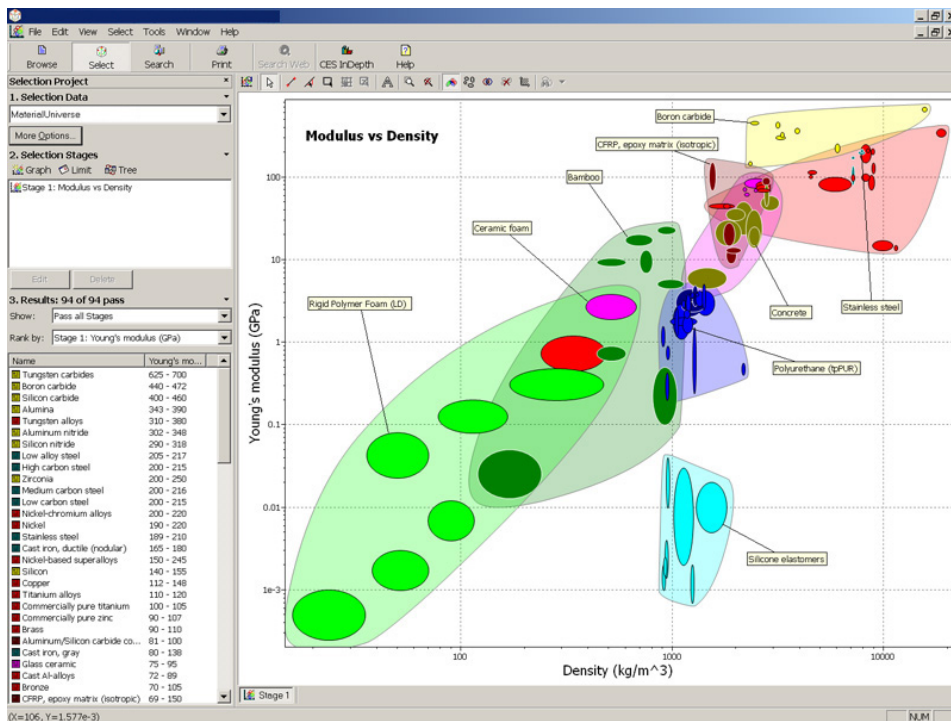
- + Good compatibility over a wide range of mixtures
- @ Limited compatibility for small excess component amounts
- Incompatible

assess tools: material selection

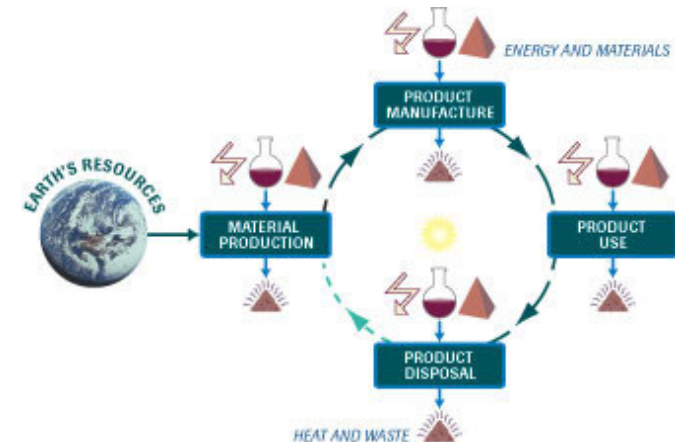
- The **embodied energy** of a material refers to the energy used to extract, process and refine it before use in product manufacture.

Materials	MJ/KG	Materials	MJ/KG
Particle Board	6	HDPE	75
PP (recycled)	8	PP	77
MDF	15	EPS	80
Steel (recycled)	16	LDPE	82
Aluminium (recycled)	17	PA	96
Glass	25	ABS	107
Lead	34	HIPS	117
Brass	39	Stainless Steel	128
Steel	58	PC	133
Copper	59	Aluminium	213
Zinc (diecast)	65	Nickel	383

example material selection software



GRANTA
MATERIAL INTELLIGENCE



assess tools: streamlined LCA

- qualitative or semi-qualitative **life cycle analysis (LCA)** method
- general view of the **inputs and outputs** in each phase of the product life-cycle
 - phases of product life cycle on one axis
 - various environmental and social impacts associated with each phase on other axis



Analysis/planning	Concept design	Detailed design	Prototype/testing	Market launch	Product review
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	use of Materials (input)	use of Energy (input)	Toxic emissions (output)
 raw materials			
 manufacture			
 distribution			
 use			
 end-of-life			

	use of Materials (input)	use of Energy (input)	Toxic emissions (output)
 raw materials	all the necessary materials, parts and components that are bought	necessary energy required to obtain raw materials necessary energy to obtain treated materials energy for material transport	toxic waste from obtainment and transformation of raw materials
 manufacture	auxiliary materials bought (screws, electrical items) auxiliary substances used in the production (welding, painting, glass, fibres etc.)	process energy consumption	toxic wastes produced in factory remainder materials e.g. off cuts, rejects etc.
 distribution	product packaging elements for re-packaging for transport, distribution and point of sale	energy consumption in packaging and packing transport from factory to retail/customer	waste from transport waste packaging
 use	consumables estimated spare parts	energy consumed in estimated life-span of product	waste from consumables waste from spare parts
 end-of-life	end-of-life treatment	energy used in end-of-life treatment (disassembly, recycling etc.) energy for transport to end-of-life treatment facility	landfill waste from combustion

assess tools: streamlined LCA

pros

- simple and cost effective method to identify areas of concern
- reserves focus on entire life cycle and all impact categories

cons

- scores can be viewed as arbitrary



source: <http://www.forumforthefuture.org.uk/>

	RAW MATERIALS	PRODUCTION	PACKAGING AND DISTRIBUTION	USE AND PERIPHERALS	END-OF-LFE
SC1: Scarce materials taken from the earth					
SC2: Man-made persistent materials					
SC3: Degradation of nature					
SC4: Meeting people's needs					

Key

Good	Quite Good	OK	Quite Bad	Bad	Don't Know
All answers positive. System condition met.	Mostly positive responses. System condition mostly met.	Some positive responses. System condition on the way to being met.	Mostly negative responses. System condition mostly not met.	All answers negative. System condition not met.	Insufficient knowledge to make reasonable judgment.

MET Matrix case study – Coffee Maker

MET Matrix Case Study



image source: IHOBE

	Use of MATERIALS (Inputs) M	Use of ENERGY (Inputs) E	TOXIC EMISSIONS (Outputs: emissions, effluent, waste) T
Obtainment & consumption of materials and components 	- Copper (exhaustible material) (0,05 kg). - Steel (0,3 kg) - Aluminium (0,3 kg) - Polystyrene (PS) (1 kg) - PVC (0,1 kg) - Glass (0,4 kg) - Printed circuits (0,1 kg)	- High energy content in materials (Al, Cu) - Transport of ready assembled printed circuits from Asia (0.03 kWh)	- Fire retardants in printed circuit boards (↓) - Liquefiers for injection moulding (↓) - PS: Benzene emissions (↓) - PUR: Isocyanate (↓) - Emissions due to painting and gluing (↓)
Factory production 	- Auxiliary materials (welding materials, degreasers and lubricants for the machines of the production system of the company, etc.) (↓)	- Energy in miscellaneous processes (Polystyrene moulding, aluminium extrusion, welding etc.) (↓)	- Metallic and plastic waste (offcuts and rejects) (↓) - Remainder of lubricants and degreasers for machines. (↓)
Distribution 	- Product packaging. (polyethylene bag: 0.3 kg and cardboard: 0.1 kg) - Cardboard for repacking (↓) - Instruction manual (0,04 kg).	- Diesel fuel for transport (lorries) (0.3 kWh)	- Emissions from diesel fuel combustion (↓). - Remainder of packing: - Polyethylene bag (recyclable) (0.3 kg) - Cardboard (recyclable) (0.1 kg)
Use or utilisation 	- OPERATION - Paper filters (7,3 kg) - Coffee used (65 kg)* - Cleaning materials (↓) - Water for cleaning (10.950 l)	- Energy consumption (375 kwh) - a.- Heating: 281,25 kwh - b.- Maintenance: 93,75 kwh **	- Waste from consumables (filter with coffee dregs, etc.) (72,3 kg) - Waste water from cleaning (10.950 l). - Emissions deriving from energy consumption (2305 kg CO₂).
	MAINTENANCE - Parts which are easily breakable (↓).	- Transport of maintenance providers (↓)	- Remainder of replaced parts (↓).
End of life system. Final disposal 			RECYCLING - Glass (0,4 kg) - Plastics (1,1kg) - Instruction manual (0,04 kg) DISPOSAL - Printed circuit board (0,1 kg) - Copper (0,05 kg) - Aluminium (0,3 kg) - Steel (0,3 kg)

 Priority impacts (detected with the aid of environmental consultant expert in Ecodesign).

* Consumption of coffee is allowed for at one 250 g packet per week throughout the 5 years of estimated lifetime. Despite the fact that the coffee is quantitatively one of the highest figures, it is the only one which cannot be minimised, so it has not been considered to be a priority.

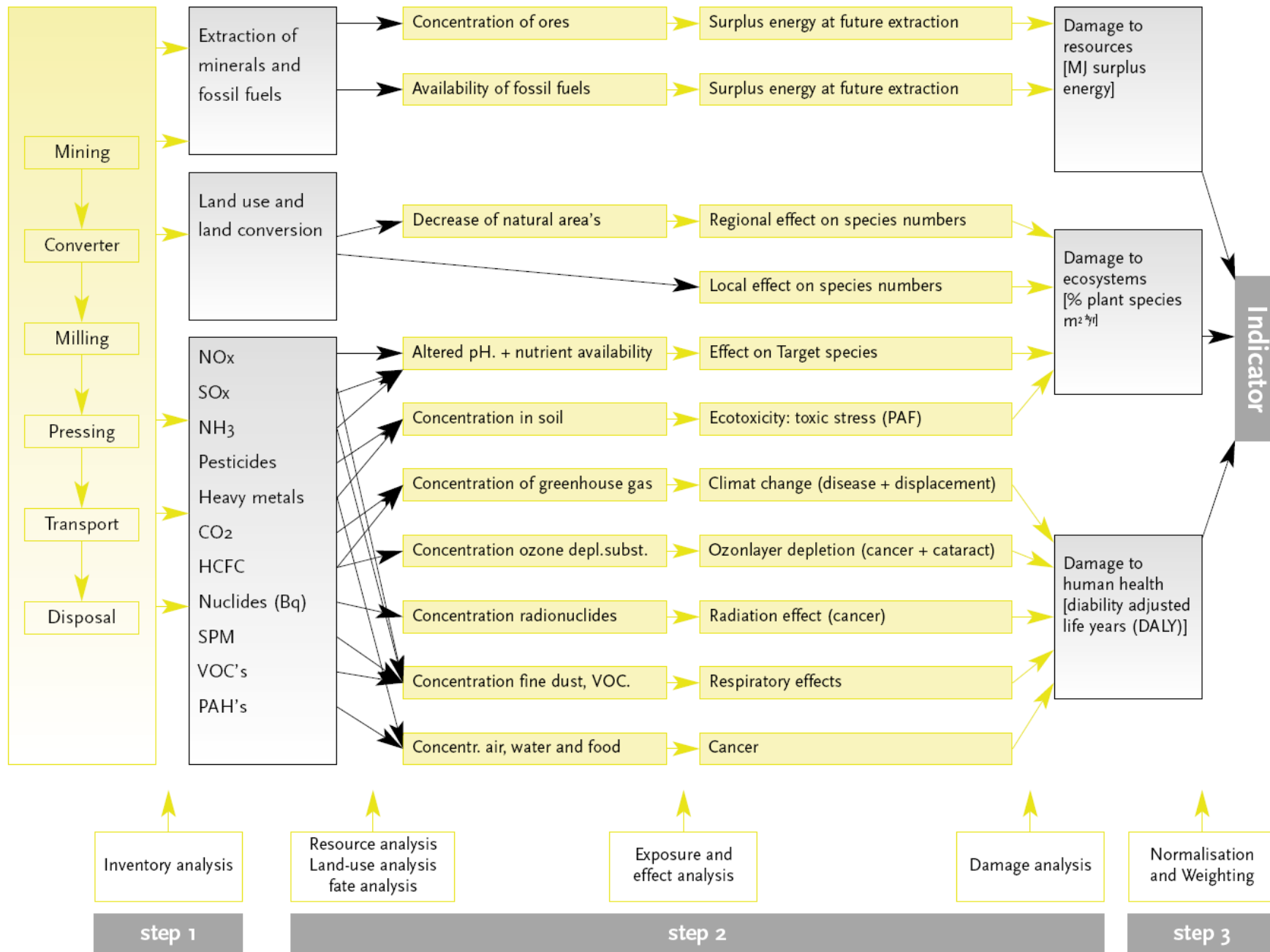
** This breakdown may facilitate the generation of ideas for improvement on this environmental aspect.

assess tools: eco-indicator

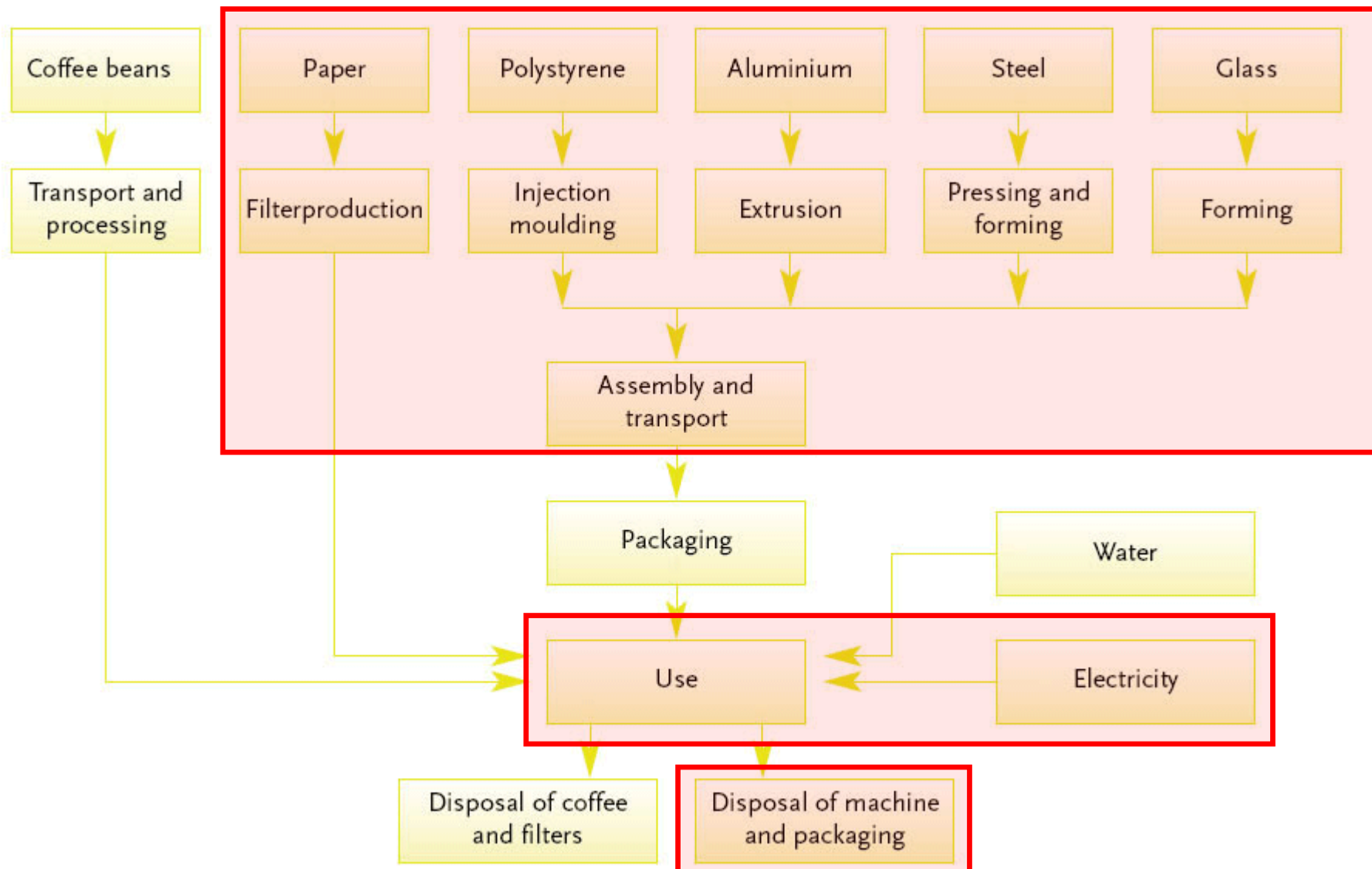
- simplified LCA Tool
- identifies the **stage, material and process** of the life-cycle causing the largest environmental impact enabling designers design them out
- split into three sections:
 1. **production**
 2. **use**
 3. **disposal**



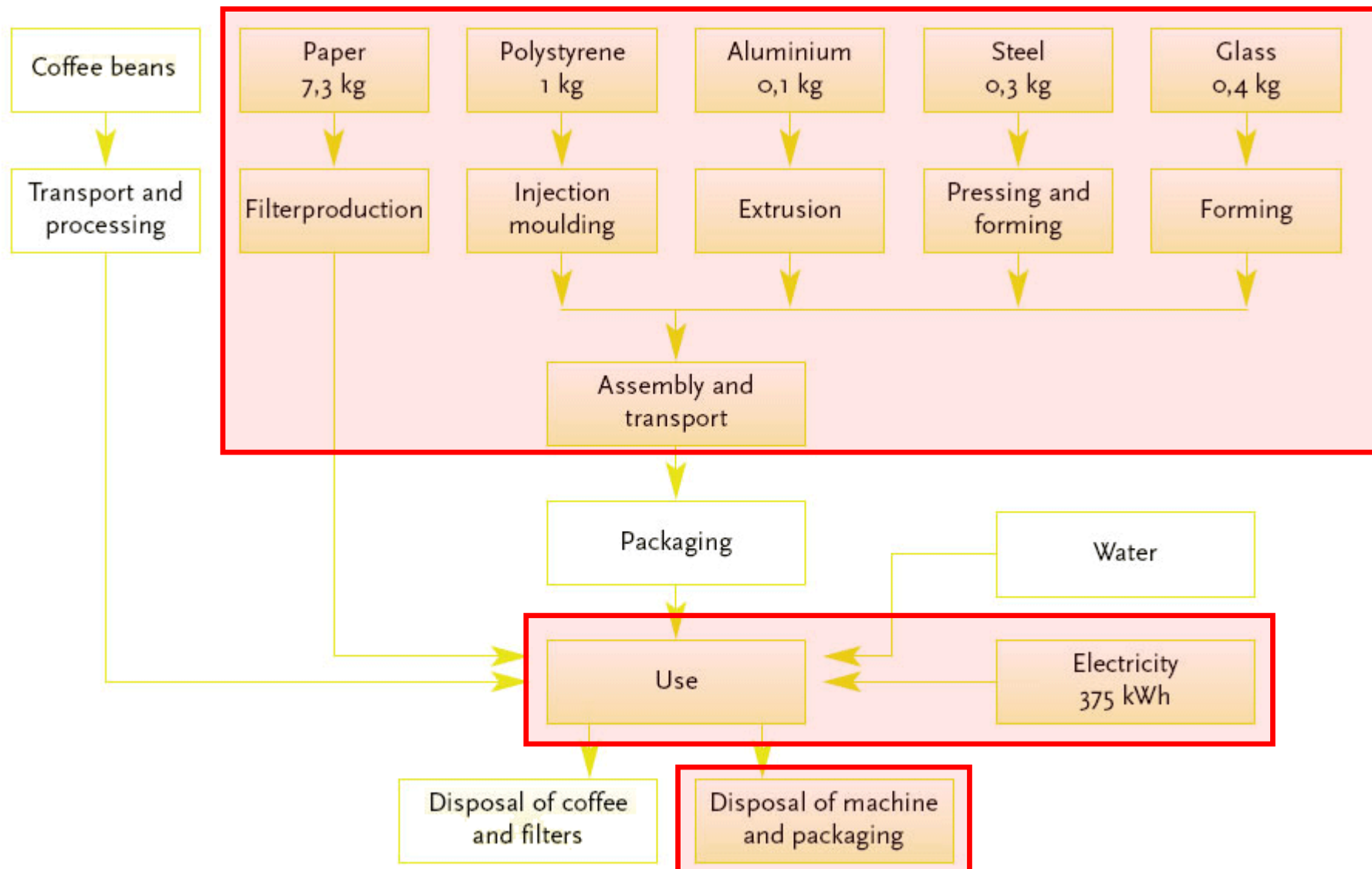
Analysis/planning	Concept design	Detailed design	Prototype/testing	Market launch	Product review



Step 1: draw process tree and establish boundaries of assessment



Step 2: identify materials & processes and weight (in kgs) for each part



Step 3: add each component to the correct section in the table

Product or component

coffee machine

Project

example

Notes and conclusions

Analysis of a coffee machine, assumption: 5 years' use, 2 x per day, half capacity, keep hot for 30 minutes

Production (Materials, treatments, transport and extra energy)

material or process	amount	indicator	result
polystyrene	1 kg	360	360
injection moulding PS	1 kg	21	21
aluminium	0,1 kg	780	78
extrusion Al	0,1 kg	72	7
steel	0,3 kg	86	26
glass	0,4 kg	58	23
gas-fired heat (forming)	4 MJ	5,3	21
Total [mPt]			536

Step 3: add each component to the correct section in the table

Use (Transport, energy and possible auxiliary materials)

process	amount	indicator	result
electricity low-voltage	375 kWh	37	13.875
paper	7,3 kg	96	701
Total [mPt]			14.576

Disposal (Disposal processes for each material type)

material and type of processing	amount	indicator	result
municipal waste, PS	1 kg	2	2
municipal waste, ferrous	0,4 kg	-5,9	-2,4
household waste, glass	0,4 kg	-6,9	-2,8
municipal waste, paper	7,3 kg	0,71	5,2
Total [mPt]			2
Total [mPt] (all phases)			15.114

Step 4: multiply the weight of each of the components by its Eco-indicator value to give its eco-points

Use (Transport, energy and possible auxiliary materials)			
process	amount	indicator	result
electricity low-voltage	375 kWh	37	13.875
paper	7,3 kg	96	701
Total [mPt]			14.576
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municipal waste, paper	7,3 kg	0,71	5,2
Total [mPt]			2
Total [mPt] (all phases)			15.114

Step 5: the total number of eco-points can be calculated for each life-cycle stage

Use (Transport, energy and possible auxiliary materials)

process	amount	indicator	result
electricity low-voltage	375 kWh	37	13.875
paper	7,3 kg	96	701
Total [mPt]			14.576

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municipal waste, paper	7,3 kg	0,71	5,2
Total [mPt]			2
Total [mPt] (all phases)			15.114

assess tools: eco-indicator

pros

- does not need environmental expert
- allows for learning of more detailed LCA processes

cons

- lists of Indicators under development and not all geographically exact

Product or component

coffee machine

Project

example

Notes and conclusions

Analysis of a coffee machine, assumption: 5 years' use, 2 x per day, half capacity, keep hot for 30 minutes

Production (Materials, treatments, transport and extra energy)

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municipal waste, paper	7,3 kg	0,71	5,2
Total [mPt]			2
Total [mPt] (all phases)			15.114

eco-indicator case study – Ofita Furniture

Ofita, S.A.M.M. is a company that manufactures office furniture from its premises in Basque Region of Spain.

It has a workforce of 94 and holds ISO 9001 and ISO 14001 certification.



Eco-indicator Case Study

Product or component <i>Lisis Desk</i>	Project <i>Ofita S.A.M.M.</i>
Date <i>15-04-00</i>	Author
Notes and conclusions	

Production (Materials, processes and transport).

Material or process	Quantity	Indicator	Result
100% recycled aluminium	13,22 kg.	60	793,2
Sheet (Steel)	12,5 kg.	86	1075
Chipboard (wooden board)	26,4 kg.	39	1029,6
High pressure laminate ⁽¹⁾	1,6 kg	510	816
Flexible PVC	0,2 kg.	240	48
Extrusion-aluminium (Al)	8,536 kg	72	614,59
Cutting wood ⁽²⁾	2,088 dm ³	6.4	13,36
Injection – aluminium (Al) ⁽³⁾	4,684 kg	72	337,25
Extrusion PVC ⁽⁴⁾	0,2 kg.	44	8,8
Powder painting ⁽⁶⁾	1 m ²	-	-
Cutting steel	-	0,00006	-
Gluing (high pressure laminate) ⁽⁶⁾	2,56 m ²	-	-
Gluing (PVC edge) ⁽⁶⁾	0,0832 m ²	-	-
Cardboard (reception)	0,3 kg.	69	20,7
Total			4756,5

Hardwood (solid wood)	28,35 kg	6,6	187,11
Wood veneer ⁽⁵⁾	0,9 kg	39	35,1

Use (Transport, energy and auxiliary materials).

Material or process	Quality	Indicator	Result
Cardboard	2,5	69	172,5
LDPE	1	360	360
28 t. Lorry	23,67	22	520,74
Total			1053,24

Ocean going cargo ship	180,47	1,1	198,51
Continental air transport	58,72	120	7046,4
Intercontinental air transport	704,952	80	56396,16

Waste (For each type of material).

Material & type of process	Quantity	Indicator	Result
Aluminium (Landfill)	13,22 kg.	1,4	18,51
Steel (Landfill)	12,5 kg.	1,4	17,5
Chipboard ⁽⁶⁾	26,4 kg.	-	-
High pressure laminate ⁽⁶⁾	1,6 kg.	-	-
PVC (Landfill)	0,2 kg.	2,8	0,56
Cardboard (recycle)	2,8 kg.	-8,3	-23,24
LDPE (Landfill)	1 kg.	3,9	3,9
Total			17,23

TOTAL(all phases) **5826,97**



Priority environmental aspects

BEFORE (Lisis Desk)**Production (Materials, processes and transport)**

Material or process	Quantity	Indicator	Result
100% recycled aluminium	13,22 kg.	60	793,2
Sheet (steel)	12,5 kg.	86	1075
Chipboard (wooden board)	26,4 kg.	39	1029,6
High pressure laminate ⁽¹⁾	1,6 kg.	510	816
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Extrusion PVC ⁽⁴⁾	0,2 kg.	44	8,8
Powder painting ⁽⁶⁾	1 m ²	-	-
Cutting steel	-	0,00006	-
Gluing (high pressure laminate) ⁽⁶⁾	2,56 m ²	-	-
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Total			1053,24

Ocean going cargo ship	180,47	1,1	198,51
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WASTE (For each type of material)

Material & type of process	Quantity	Indicator	Result
Aluminium (tip)	13,22 kg.	1,4	18,51
Steel (tip)	12,5 kg.	1,4	17,5
Chipboard ⁽⁶⁾	26,4 kg.	-	-
High pressure laminate ⁽⁶⁾	1,6 kg.	-	-
PVC (tip)	0,2 kg.	2,8	0,56
Cardboard (recycle)	2,8 kg.	-8,3	-23,24
LDPE (tip)	1 kg.	3,9	3,9
Total			17,23

TOTAL(all phases) **5826,97**

NOTE 1.- The Eco-indicators of hardwood and wood laminate are included to see the priorities when the desk has those materials. The same occurs with transport by air and sea, which is included although it is only used in urgent cases.

NOTE 2.- See notes overleaf.

AFTER (Genius Desk)**Production (Materials, processes and transport)**

Material or process	Quantity	Indicator	Result
100% recycled aluminium	5,464 kg.	60	327,84
Sheet (steel)	7,934 kg.	86	682,32
Chipboard (wooden board)	21,3 kg.	39	830,7
High pressure laminate ⁽¹⁾	1,6 kg.	510	816
PP	0,340 kg.	330	112,2
LDPE	0,004 kg.	360	1,44
Rigid PVC	0,736 kg.	270	198,72
Flexible PVC	0,2 kg.	240	48
Injection aluminium (Al) ⁽³⁾	2,264 kg.	72	163
Extrusion-aluminium (Al)	3,2 kg.	72	230,4
Cutting wood ⁽²⁾	2,088 dm ³	6,4	13,36
Injection/Extrusion PP ⁽⁷⁾	0,340 kg.	21	7,14
Injection LDPE ⁽⁷⁾	0,004 kg.	21	0,08
Extrusion PVC ⁽⁸⁾	0,936 kg.	44	41,18
Powder painting ⁽⁶⁾	1 m ²	-	-
Cutting steel	-	0,00006	-
Gluing (high pressure laminate) ⁽⁶⁾	2,56 m ²	-	-
Gluing (PVC edge) ⁽⁶⁾	0,0832 m ²	-	-
Cardboard (reception)	0,3 kg.	69	20,7
Total			3493,08

Hardwood (solid wood)	22,8 kg.	6,6	150,48
Wood veneer ⁽⁵⁾	0,9 kg	39	35,1

Use (Transport, energy and auxiliary materials).

Material or process	Quantity	Indicator	Result
Cardboard	1,6	69	110,4
LDPE	0,4	360	144
28 t Lorry	15,99	22	351,78
Total			606,18

Ocean going cargo ship	121,89	1,1	134,08
Continental air transport	39,678	120	4761,36
Intercontinental air transport	476,14	80	38091,2

WASTE (For each type of material)

Material & type of process	Quantity	Indicator	Result
Aluminium (tip)	5,464 kg.	1,4	7,65
Steel (tip)	7,934 kg.	1,4	11,1
Chipboard ⁽⁶⁾	21,3 kg.	-	-
High pressure laminate ⁽⁶⁾	1,6 kg.	-	-
PP (tip)	0,340 kg.	3,5	1,19
PVC (tip)	0,936 kg.	2,8	2,62
Cardboard (recycled)	1,9 kg.	-8,3	-15,77
LDPE (tip)	0,404 kg.	3,9	1,57
Total			8,36

TOTAL(all phases) **4107,62**

other streamlined LCA tools

Name	Description	Source/contact
Eco-Indicator 99	Not strictly a software tool but underlying data available as a computer version. Provides background information to support life cycle thinking	Pré Consultants BV www.pre.nl
Eco-It	Simplified LCA software for practical application of the Eco-Indicator Method. Simple screening tool.	Pré Consultants BV www.pre.nl
Ecoscan	For analysing the environmental impact and costs of a design. Points are awarded for three life cycle phases to generate an ECO score. Based on Eco-Indicator method. (above)	Turtle Bay, Netherlands
MERGE	LCA – based tool which evaluates a product on 7 metrics, including recyclability, and assigns a score.	Developed by Richard Dennison
PIQET	Quick evaluation tool for packaging (under development) Proposed to be an on-line tool considering all levels of packaging and different product categories; allows for assessments of incoming raw materials packaging systems and outgoing product packaging systems; intended to fill data gaps in selection, design and use of packaging materials and systems.	RMIT, Melbourne. Australia www.rmit.ed.au

assess tools: full LCA

- detailed assessment of products environmental impact
- LCAs help a manufacturer to quantify how much energy and raw materials are used, and how much solid, liquid and gaseous waste is generated, at each stage of the product's life

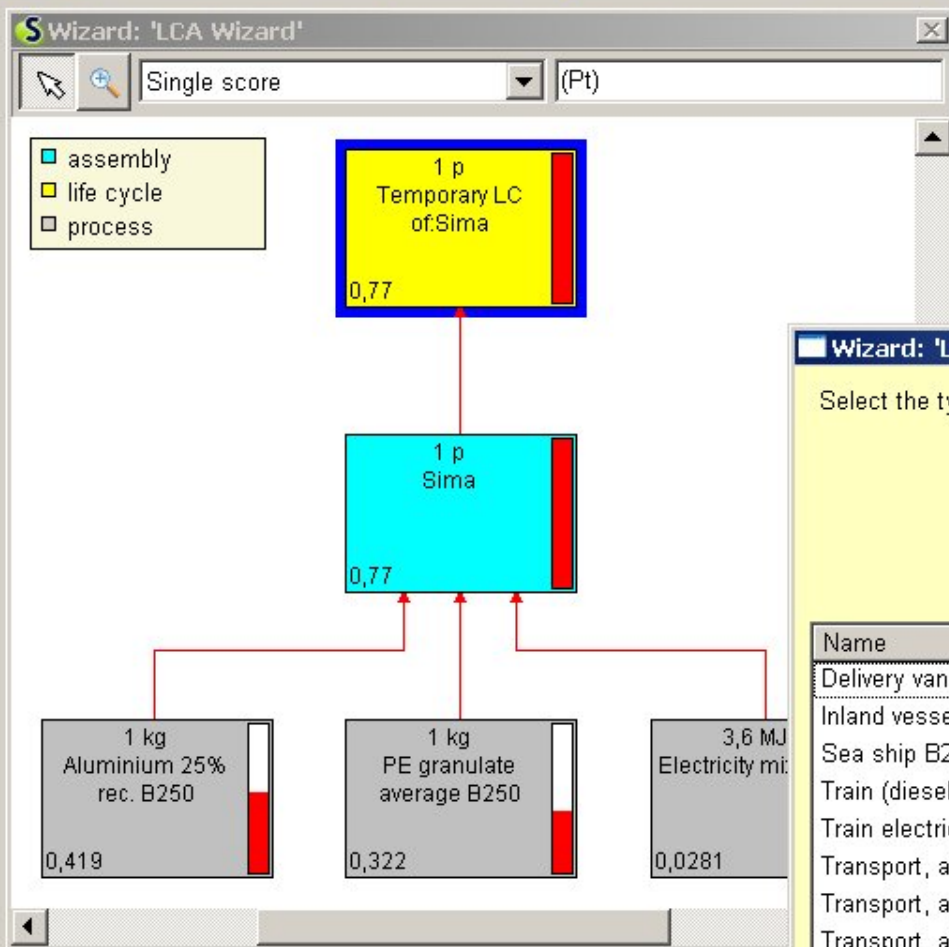
image source: Pre International



Analysis/planning	Concept design	Detailed design	Prototype/testing	Market launch	Product review

Lifecycle Assessment process





Wizard: 'LCA Wizard'; Step: 19

Select the type of transport you would like to add.

Name
Delivery van (<3.5t) B250
Inland vessel B250
Sea ship B250
Train (diesel & electric) B250
Train electric B250
Transport, aircraft, freight, Europe/RER S
Transport, aircraft, freight, Europe/RER U
Transport, aircraft, freight, intercontinental/RER S
Transport, aircraft, freight, intercontinental/RER U

Previous Next Cancel



Impact assessment Inventory Process contribution Setup Checks (317)

Compartment

All compartments

☐ Per sub-compartment

☒ Skip unused ☐ Default units

Indicator

Weighting

Category

Human Health

Cut-off

0,3%

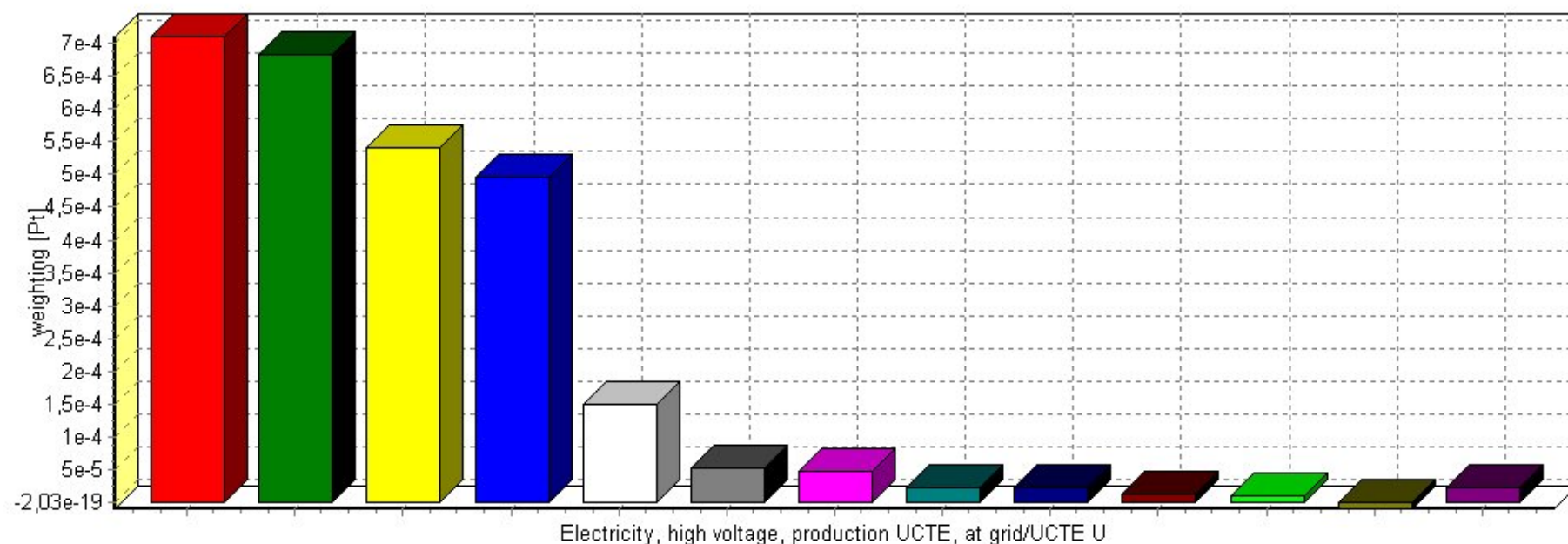
Increment cut-off

☐ Per impact category



Chart of process / product stage

Electricity, high voltage, production UC



Sulfur dioxide

Nitrogen oxides

Radon-222

Cadmium, ion

Remaining substances

Carbon dioxide, fossil

Arsenic, ion

Carbon-14

Carbon dioxide, biogenic

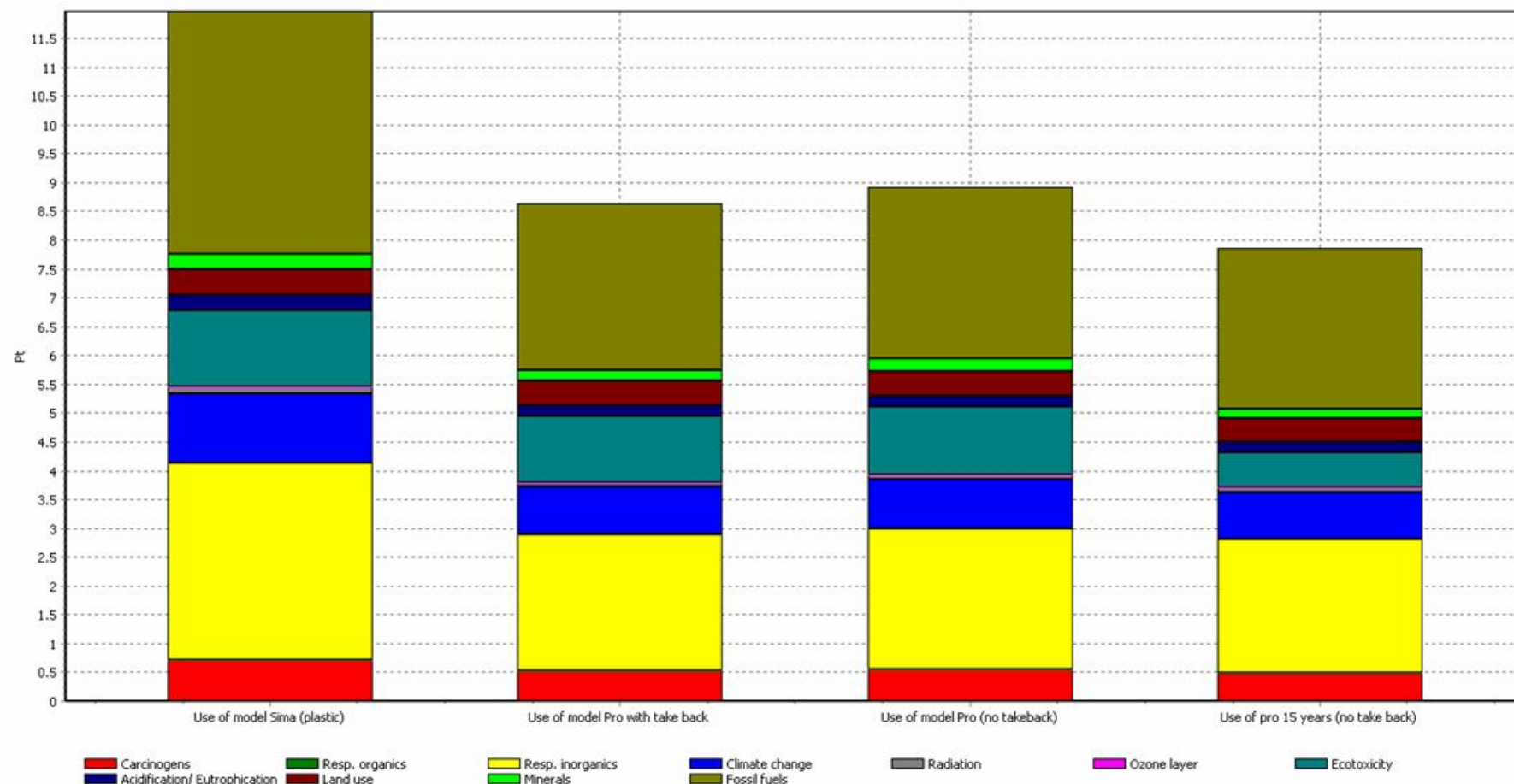
Particulates, < 2.5 um

Particulates, > 2.5 um, and < 10um

Methane, fossil

Carbon dioxide, in air

Comparing 1 MJ energy 'Electricity, high voltage, production UCTE, at grid/UCTE U'; Method: Eco-indicator 99 (H) V2.03 / Europe EI 99 H/A / weighting



Comparing 1 p 'Use of model Sima (plastic)', 1 p 'Use of model Pro with take back', 1 p 'Use of model Pro (no takeback)' and 1 p 'Use of pro 15 years (no take back)'; Method: Eco-indicator 99 (H) V2.05 / Europe EI 99 H/A / single score

Previous

Next

Cancel

Analyst

assess tools: full LCA

pros

- allows for more detailed calculation over wider impact categories
- can be adapted for different companies and regions

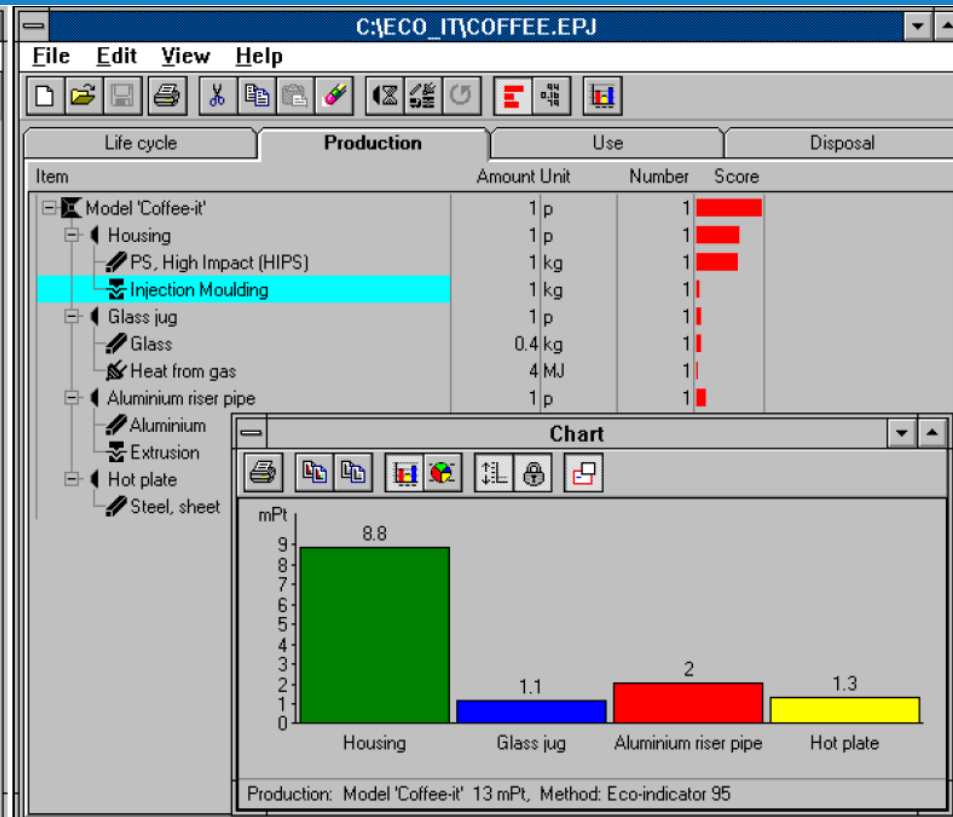
cons

- can be expensive can be time consuming
- does not answer design questions

image source: Pre International

The screenshot shows the 'Database processes' dialog box in the Pre International LCA software. The dialog box is titled 'Database processes' and contains a table with the following columns: Category, Sub-category, Name, Unit, and mPt. The 'Materials' category is selected, and the 'Plastics' sub-category is highlighted. The 'PS, High Impact (HIPS)' material is selected in the list. The 'Comment' field contains 'high-impact polystyrene source: P'. The 'Database' field shows 'Pre, EI-95 update'. The 'OK' and 'Cancel' buttons are at the bottom.

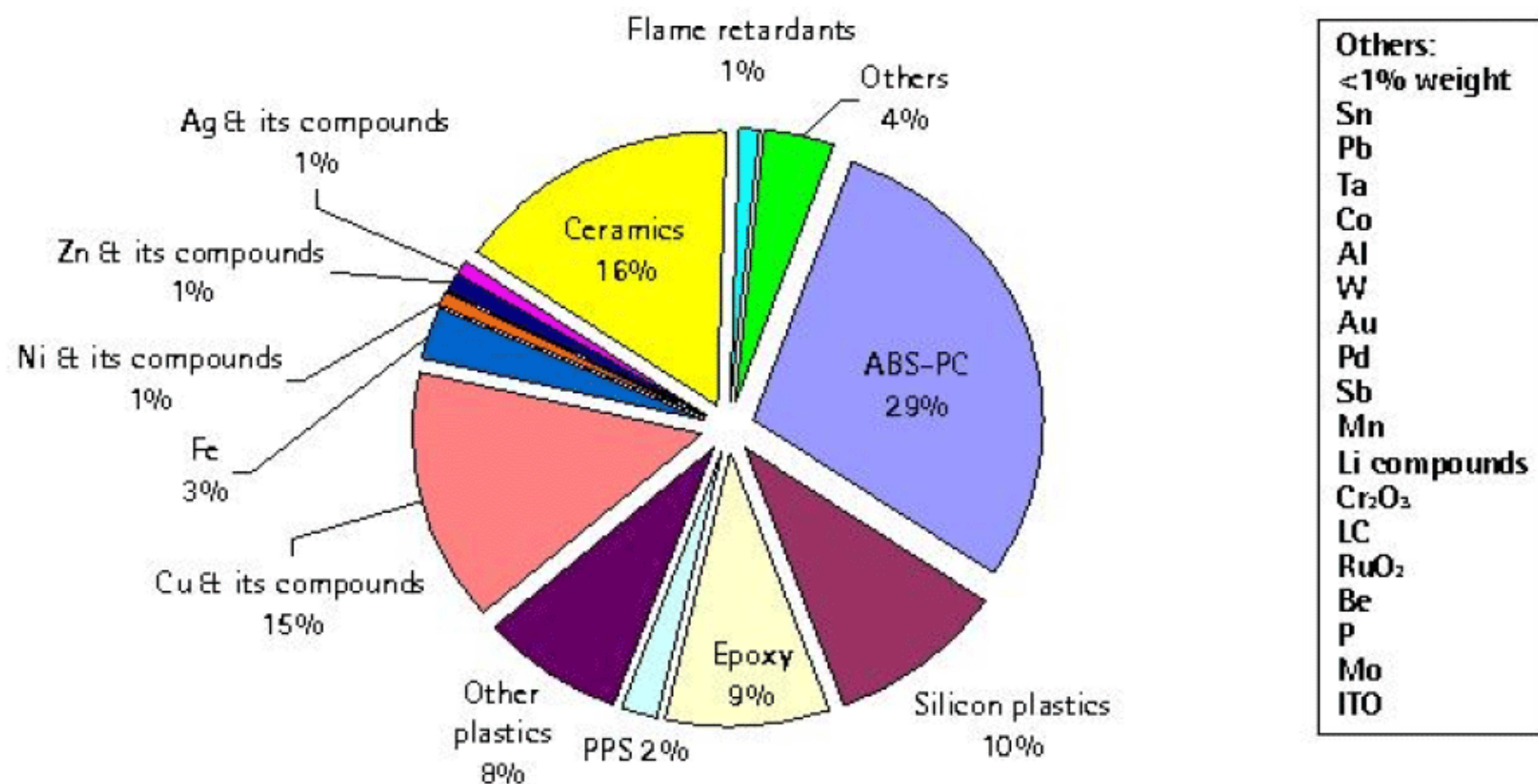
Category	Sub-category	Name	Unit	mPt
Materials	Metals	ABS	kg	9.3
	Others	PA	kg	13
	Plastics	PC	kg	13
	Rubbers & elastome	PE High Density (HDPE)	kg	2.9
		PE Low Density (LDPE)	kg	3.8
		PET, amorphous	kg	7.1
		PET, bottle grade	kg	7.4
		PP	kg	3.3
		PPE/PS	kg	5.8
		PS, High Impact (HIPS)	kg	8.3
		PS, rigid foam	kg	13



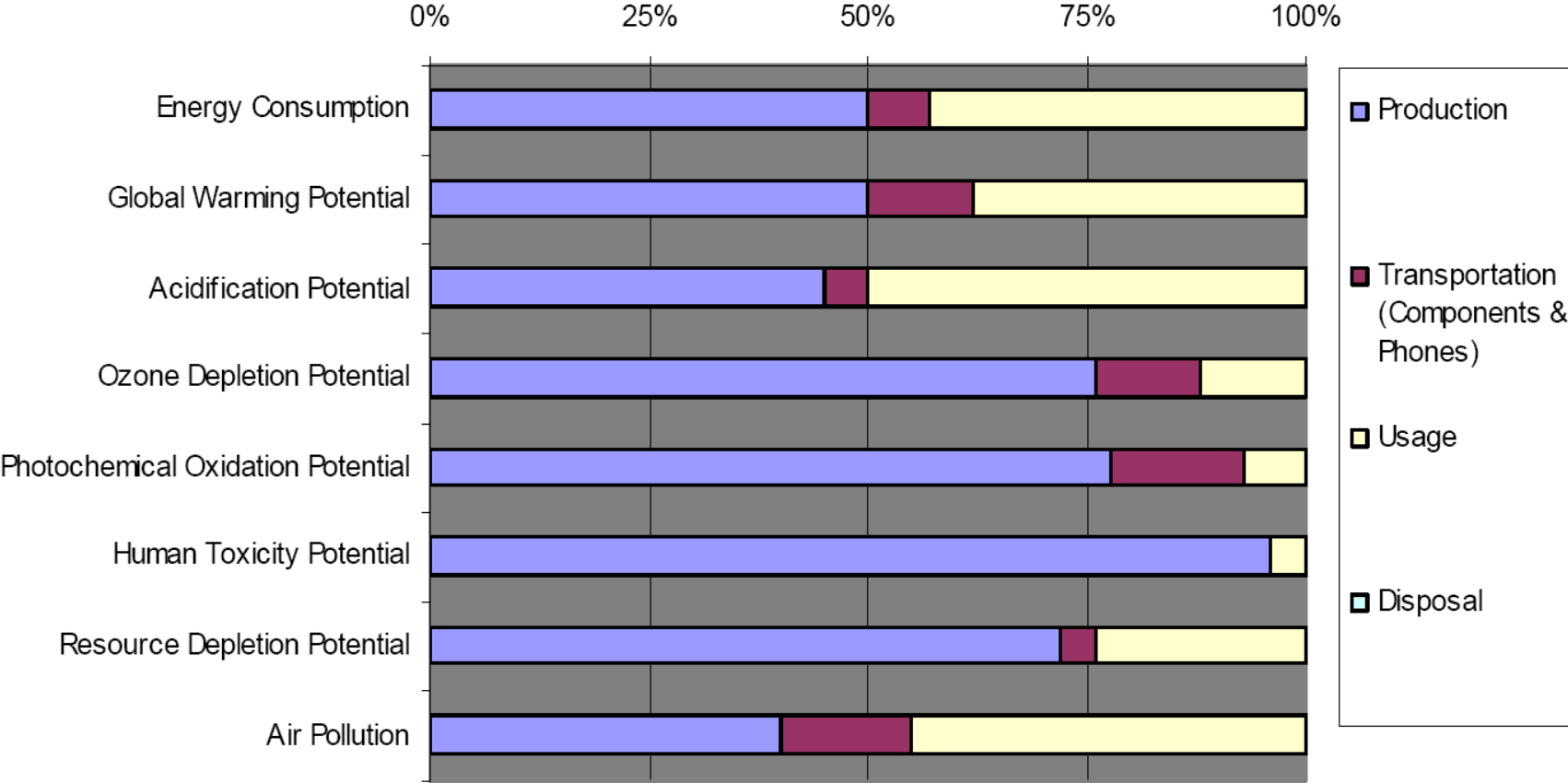
LCA case study - Nokia

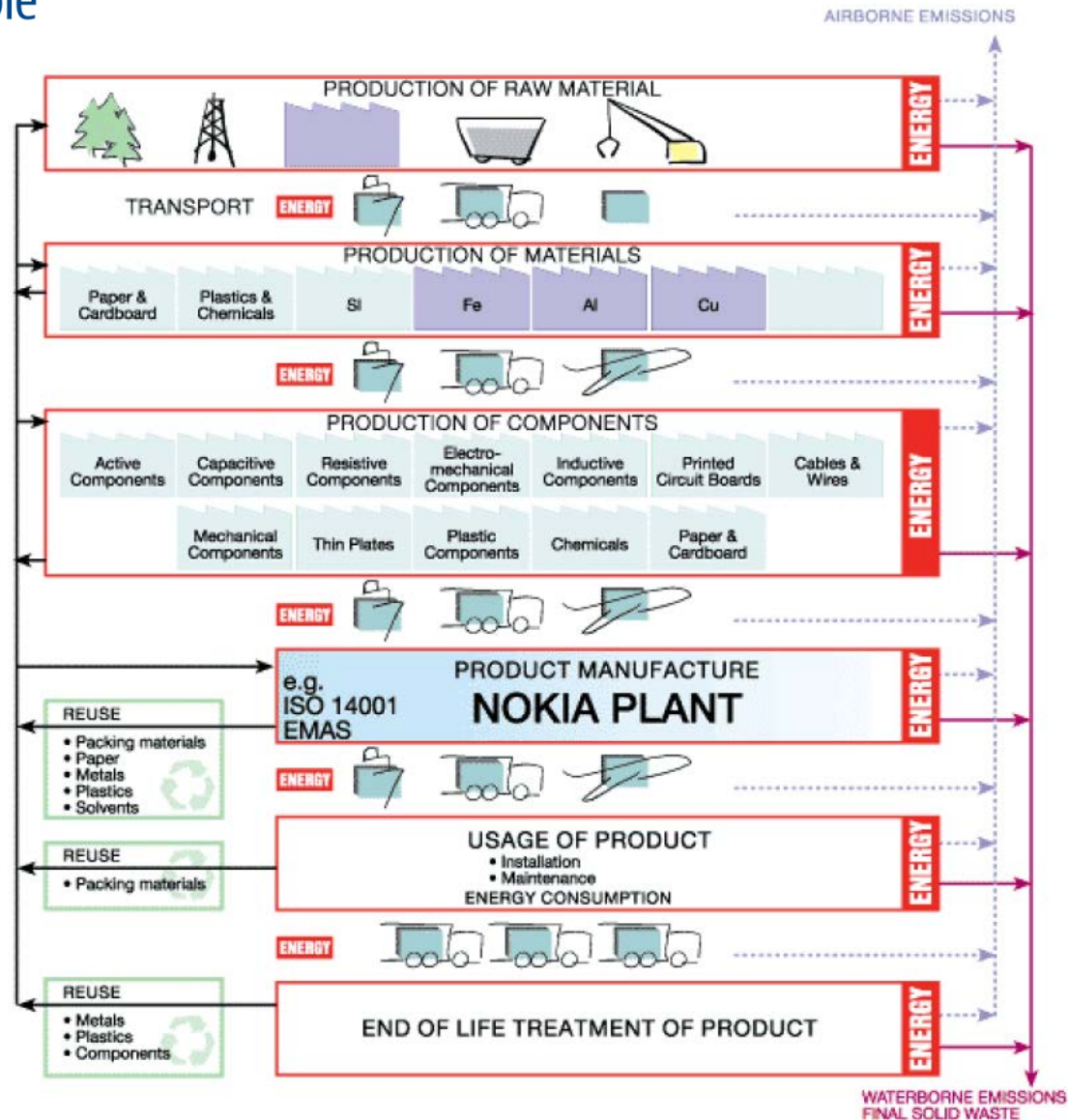


material composition from a typical mobile phone

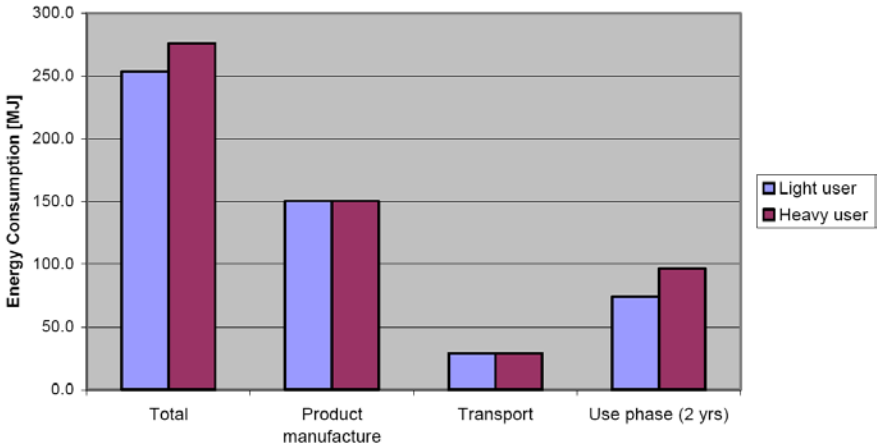


environmental impact distribution for mobile phones - 2 year lifetime

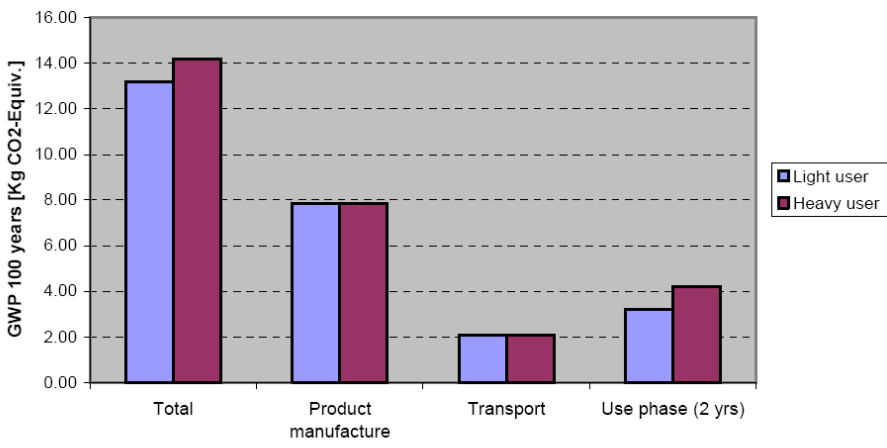




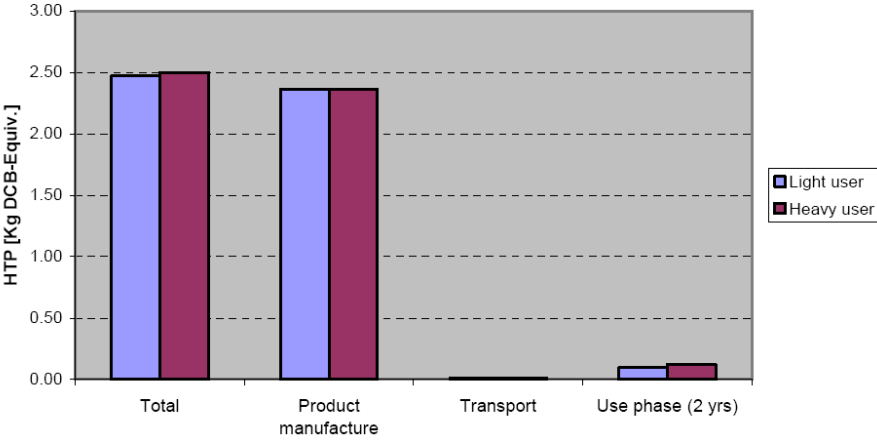
Primary Energy Consumption



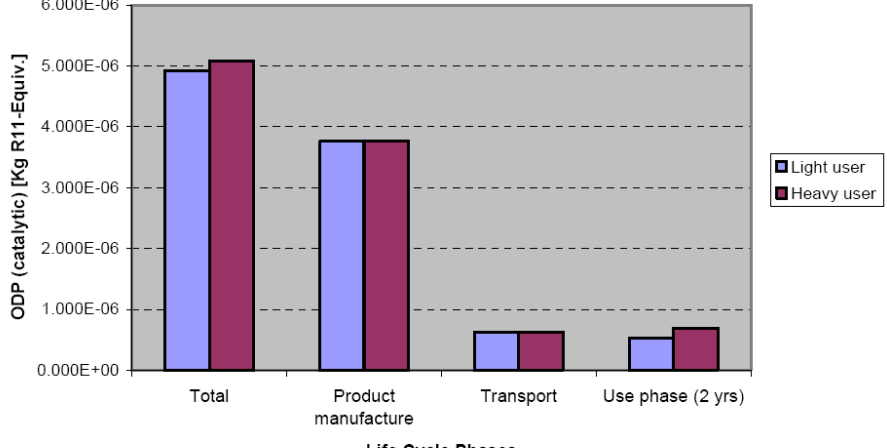
Global Warming Potential



Human Toxicity Potential



Ozone Depletion Potential



other LCA tools

Name	Description	Source/contact
SimaPro	SimaPro LCA software is used throughout the world. It has many advanced features, yet is still very easy to use. The results you get are always transparent, and SimaPro is famous for its flexibility in handling different impact assessment methods. You can always click through a result screen and find out what is behind the results; what are the most important emissions or processes etc. For beginners an LCA wizard is available to help you define the lifecycle, and add the most important data.	www.pre.nl/simapro/default.htm
Boustead	The Boustead Model database and software are aimed primarily at educational users (both in teaching and research), large companies or companies who manufacture a large number of different products, technical trade associations, government agencies and consultancy firms requiring an LCA capability.	www.boustead-consulting.co.uk
Umberto	Umberto is a flexible and powerful software tool for modelling, calculation, visualization, and evaluation of material and energy flows. It has been developed and improved for about 15 years.. Industries with material- and cost-intensive production, such as the chemical, semiconductor, waste management, and printing industries, use Umberto extensively. Umberto is also embraced by consulting businesses and research facilities in the completion of many successful projects.	www.pre.nl/umberto/default.htm
Gabi	GaBi 4.2 is already available in its fourth generation and is one of the world-wide leading software for Life Cycle Assessment (LCA), Life Cycle Engineering (LCE), Green House Gas Accounting, Benchmarking and Energy Efficiency of products and companies. GaBi 4.2 is widely used for LCA studies and decision support in industry - thanks to its performance, reliability, and flexibility while being easy to learn and efficient to use.	www.io.tudelft.nl/research/dfs/idemat/Onl_db/od_frame.htm