Product Water Footprint Report of Computer

ThinkCentre X1

Powered by Instant LCA™ Electronics Tool

2015-12-15

Declaration

This is to declare that product water footprints of the following products have been calculated by Instant LCA™ Electronics Tool and input by user(s):

Product name: ThinkCentre X1
Machine type: 10HT, 10JW, 10KE, 10JX, 10JY, 10KF, 10K0, 10HU
Product water footprint*: 6.247 m^3/FU

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*The environmental impacts of the product to be assessed are displayed for the functional unit defined in chapter I.2.1 of the report

Using *Instant LCA™ Electronics*, Lenovo performs this study on basis of the Life Cycle Assessment (LCA) methodology which focuses on 6 environmental impact indicators, especially Water Footprint. LCA is a method for quantifying the total environmental footprint of providing a product or service through all stages of its life cycle. The general methodology for LCA used in this study is as described in the IS014040:2006 and ISO14044:2006 standards.

Either Intertek or RDC assumes no liability to any party other than to the Client. And then only in accordance with the agreed upon Agreement.

This automatic report is enabled by Instant LCA™ Electronics Tool

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I. Results summary

I.1 Product information

Product name	ThinkCentre X1
Machine type	10HT, 10JW, 10KE, 10JX, 10JY, 10KF, 10K0, 10HU
Model No.	

I.2 Product Water Footprint

I.2.1 FUNCTIONAL UNIT

The functional unit used for this report is: to use the computer during its whole lifetime

I.2.2 PRODUCT WATER FOOTPRINT

Lenovo takes a life cycle approach to manage the water consumption, from material extraction, component manufacturing, computer assembling, packaging & transportation, to use and end-of-life handling, water saving is one of our key environmental targets.

Water consumption	Unit	Results	Notes
	m^3/FU	6.247	The category "water consumption" comprises process water derived from lakes and rivers, wells and public networks. Water for cooling (open circuit) and hydroelectricity (usually referenced as turbine water) is excluded. In water accounting for manufacturing, the focus is on net water consumption which is the difference between water withdrawal (inlet water) and water discharge (outlet water).

The process contribution analysis helps us identify where we should focus our efforts to reduce water consumption via management, design and innovation.

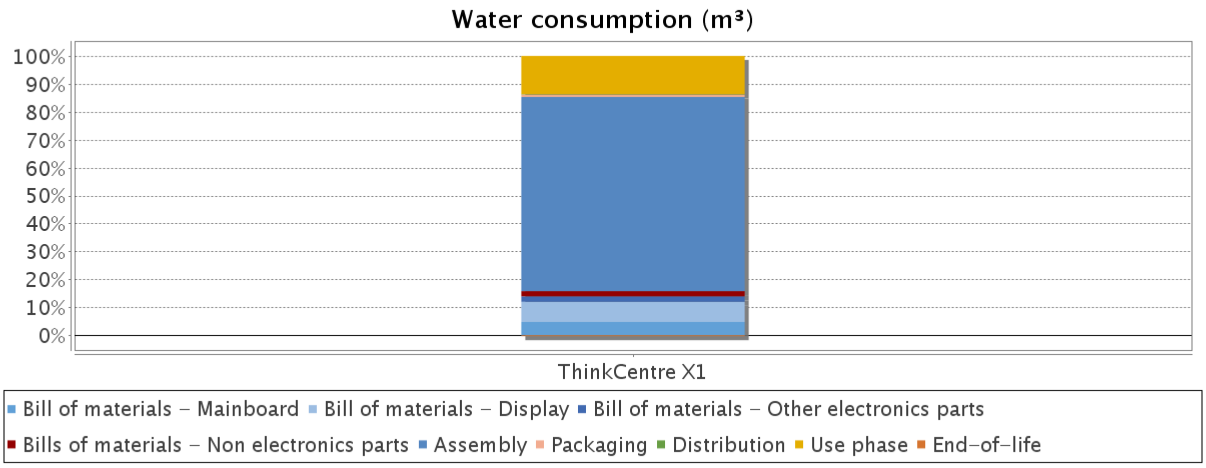


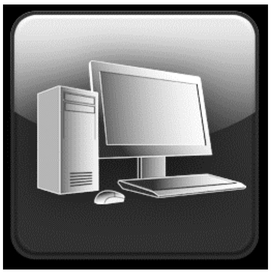
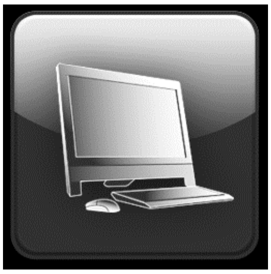
Figure I 1: Results of water consumption, by process

II. Presentation of the study

II.1 Goal of the study

The aim of the report is to assess the environmental footprint through a Life Cycle Assessment approach for computers.

This report is generated automatically by *Instant LCA™ Electronics*, developed by RDC Environment and Intertek.

		
Desktop	All-in-one	Laptop

II.2 Methodology and tool

Using *Instant LCA™ Electronics*, Lenovo performs this study on basis of the Life Cycle Assessment (LCA) methodology with focus on the following impact indicators: Water consumption; Resource depletion: mineral, fossil; Climate change; Photochemical ozone formation; Air Acidification; and Particulate matter/ Respiratory inorganics.

LCA is a method for quantifying the total environmental footprint of providing a product or service through all stages of its life cycle. The general methodology for LCA used in the study is as described in the IS014040:2006 and ISO14044:2006 standards.

II.3 Target audience

The target audience of the report is internal to Lenovo. This study should help include environmental criteria in the decision-making process for design and marketing of Lenovo's products, including desktop, all-in-one desktop and laptop computers.

III. LCA Methodology

The Instant LCA™ Electronics Tool is based on a full LCA model which encompasses all life cycle stages from the extraction of raw materials to the product's end-of-life (from cradle to grave). It includes the manufacturing of the components, assembling the components and transportation of the finished Electronics.

This model adheres to the principles and requirements of **ISO 14040:2006** and **ISO 14044:2006**, but it has not been subject to an external critical review.

A life cycle assessment (LCA) approach consists of considering all direct and indirect environmental effects for the realization of a function (called the functional unit). The main phases to be considered in a life cycle are:

- raw material extraction
- manufacturing
- distribution
- use
- disposal

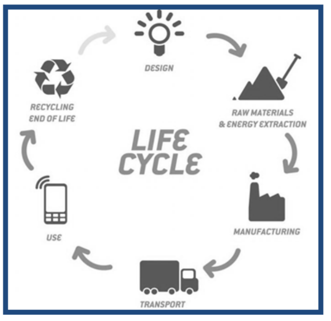
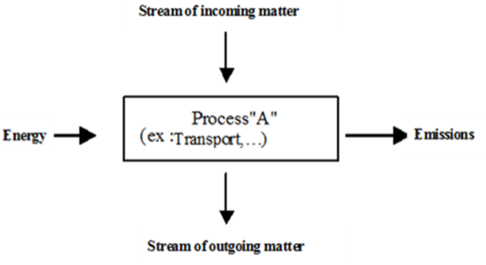


Figure III 1: Life cycle steps, e.g., for production, delivery, use and end of life of an electronic device.

In practice, each system is divided into different steps based on the identification of the different processes. Each step represents one specific transformation in the chain so that the sequence of all processes makes up the process tree. Then, each process is characterized by:

- one (or more) flow of matter incoming from another process
- one (or more) flow of matter outgoing to another process
- consumption of energy, water and mineral resources
- emissions of pollutants (in air, water, soil)



Once all processes are identified, their integration creates the whole system.

The environmental balance is calculated by aggregating the elementary flows of the different processes. As a result, all elementary flows, both direct and indirect, are automatically attributed to the functional unit.

In the assessment step, the different emissions are grouped into categories such as climate change, water eutrophication, etc. For each category, some specific characterization factors are assigned, to each emissions value in order to express this effect on the environment in a common unit (for example CO2 grams equivalent for climate change).

From this method, the impacts on the environment can be quantified and evaluated, and the most contributing phases (hotspots) identified. Subsequently, some measures can be implemented to prevent or limit the associated impacts.

The LCA approach also helps prevent taking decision about life cycle phases that only transfer the environmental damages from one phase to another.

IV. Scope of the study

IV.1 Functional unit and reference flow

The **functional unit** is defined as the function fulfilled by the system or systems under study. In order to make a fair and relevant study (or comparison between different systems), it is mandatory to define precisely and quantitatively the functional unit, i.e., the (various) function(s) fulfilled by the different systems.

This unit is defined with precision based on the goal of the study and utilization of the products.

- The functional unit used for this study is to use the computer during its whole lifetime.
- The life time of the product considered is 3.0 years.

All the results for the environmental footprint **are displayed** per functional unit.

IV.2 Geographical scope

The geographical scope is:

- Manufacturing of electronic components in: Brazil, China, Japan, Malaysia, South Korea, Taiwan and Thailand;
- Assembling in China, Japan and Asia (without China);
- Use phase and end of life in Africa, Asia (without China), China, Europe and USA

IV.3 Flow diagram

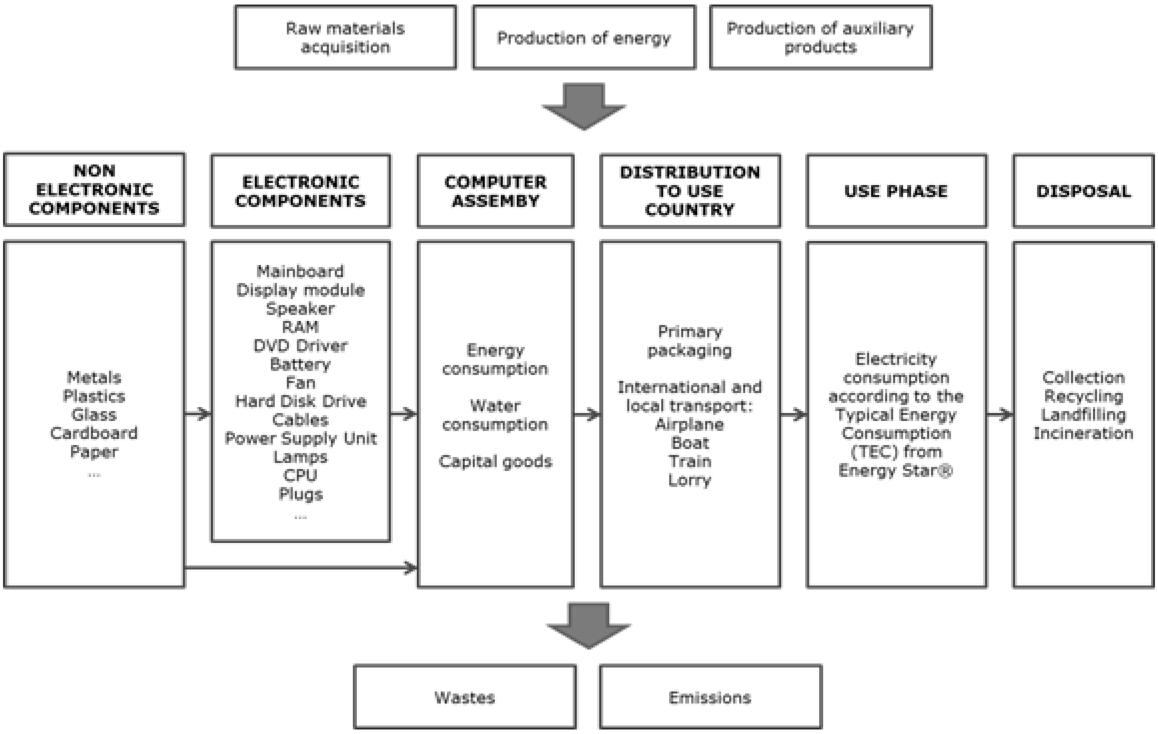


Figure IV 1: System boundaries

IV.4 Included and excluded Steps

The product life cycle is divided into elementary phases. Each elementary phase aggregates processes of a specific stage of the life cycle. The list of elementary phases can be found in *Table IV 1*. The life-cycle divisions are common to all types of computer.

Table IV 1: Decomposition of the product life cycle into elementary phases.

Elementary phases of Electronics life cycle	
Bill of materials	Mainboard
	Display module
	Other electronic components
	Non-electronic components
Assembly	
Packaging	
Distribution	
Use phase	
End of life	

Several steps are excluded from the life cycle assessment developed with the Instant LCA™ Electronics tool. Depending on the goal of the study, there can be different approaches for justifying step exclusions with respect to the ISO 14044 standard.

- **First**, for an eco-design purpose, exclusion of the following steps is justified because they do not affect the conclusions for this kind of studies. However, these steps may be of concern for the Electronics producer with respect to other study goals.
    - Office emissions
    - Employee commuting
- **Secondly**, steps can be excluded because the available data are too confusing or lack the robustness to be used in an efficient LCA. However, these steps may be relevant to the Electronics producer for other specific study goals.
    - Storage at Electronics producer warehouse
    - Storage at retail distribution center and impacts of retail
    - Consumer transport between home and retail
- **Third**, the following steps are excluded because they are too specific in the framework of the Instant LCA™ Electronics tool. They should be modelled separately by the Electronics producer if required by the goal of the study.
    - Loss of products at manufacturing
    - Returns of unsold products
- **Finally**, some steps are excluded because they have a negligible effect on the results. They are expected to contribute to less than 1% of overall results
    - Secondary and Tertiary packaging
    - Transport of intermediate materials up to the assembly site
    - Business travel

IV.4.1. CUT-OFF CRITERIA

Lenovo could report separately the cut-off criteria, especially based on the bill of material of the product assessed.

IV.5 Impact category

The Instant LCA™ Electronics tool is a multi-criteria assessment tool covering six LCA environmental impacts (resource consumption or environmental pollution):

Table IV 2: Categories for impacts on the resource consumption, units and characterization methods

Category	Flow property	Unit	Characterization method	Quality Level
Resource depletion, water	Scarcity adjusted mass of water used	Unit of volume (m^3)	RDC	-
Resource depletion, mineral, fossil	Mass Sb-equivalents	Unit of mass (g)	CML 2002 (Van Oers – Reserve base)	Level II

Table IV 3: Categories for impacts on the environmental pollution, units and characterization methods.

Category	Flow property	Unit	Characterization method	Quality Level
Climate change	Mass CO_2 equivalents	Unit of mass (g)	IPCC 2007 – GWP 100 with biogenic carbon	Level I
Photochemical ozone formation	Mass of C_2H_4 equivalents	Unit of mass (g)	LOTOS-EUROS (van Zelm et al, 2008) as used in ReCiPe	Level II
Air Acidification	Mole H+ equivalents	Unit of mole (kmole)	Accumulated Exceedance (Seppala et al, 2006, Posch et al, 2008)	Level II
Particulate matter/ Respiratory inorganics	Mass $PM_{2.5}$ equivalents	Units of mass (kg)	RiskPoll model (Rabl and Spadaro, 2004) and Greco et al 2007	Level I

Those impact categories come from the following document: "Recommendations for Life Cycle Impact Assessment in the European context"[1] , except for water consumption.

[1]*They are classified into three levels according to their quality: level I (recommended and satisfactory), level II (recommended but in need of improvements), level III (recommended, but to be applied with caution)*

http://lct.jrc.ec.europa.eu/pdf-directory/ILCD Handbook Recommendations for Life Cycle Impact Assessment in the European context.pdf

V. Data sources and description

V.1 Characterization of the data

There are two types of data used in LCA studies:

- **Activity factors**: Modeling parameters expressing the relationships between processes (e.g., raw material has to be transported over a distance of 100 km to the manufacturing site);
- **Emission factors or inventories**: Data corresponding to the resource use and emissions profile associated with each process, i.e., elementary flows gathered in the LCI (Life Cycle Inventory).

Activity factors can be:

- **Primary**, i.e., have significant influence on environmental impacts and are collected specifically for the product.
- **Semi-Primary**, i.e., have somewhat significant influence on the environmental impacts, and are sometimes known by the producer and could vary according to the product
- **Secondary**, i.e., have no significant influence on environmental impacts, and/or cannot be directly controlled by the producer. This is typically the case for end-of-life parameters (e.g., incineration rate). These data are the same for all the possible products considered in the tool

Emission factors are always secondary data.

Informative note

Primary	Definition of primary data from ISO 14067: quantified value originating from direct measurement or calculation based on direct measurements of a unit process of the product system at its original source
Secondary	Definition of secondary data from ISO 14067: quantified value of an activity or life cycle process obtained from sources other than direct measurement or calculation from direct measurements.

V.2 Data sources of emission factors

The general emissions factors data source for this study is the ecoinvent database, v2.2. The **ecoinvent** Centre offers science-based, industrial, international life cycle assessment (LCA).

The other sources of LCI are used for the study are: PlasticsEurope, Worldsteel, and GaBi.

The list of inventories used for this study is in Annexes

V.3 Description and documentation of all unit processes and activity factors

See annex to identify the LCI associated with each component or process

V.3.1. BILL OF MATERIALS

Part	Materials	Weight (g)
		ThinkCentre X1
Mainboard	Mainboard	115.1
	CPU	10.0
	RAM	9.5
	Resistors	1.7265
	Capacitors	14.963
Display Module	Display Module	1280.0
	Printed wiring board	4.5
Other Electronic Components	Speaker	66.5
	RAM	9.5
	DVD driver	0.0
	Battery	0.0
	Fan	38.0
	Hard drive disk	89.0
	Cables	23.8
	Power supply unit	200.0
	Lamp (LED)	0.7
	Plugs	0.0
	Other electronic cards	0.0
	Unspecified electronics	37.5
Non-electronic Components	Metals	3200.0
	Plastics	457.3
	Glass	976.1
Total		6.5 kg

V.3.2. ASSEMBLY AND PACKAGING

		ThinkCentre X1
Resources consumption	Water consumption (m3/computer)	3.8
	Electricity consumption (kWh/computer)	1.08
Primary packaging	Paper/carton system box (g/computer)	1385.9
	Paper/carton accessory box (g/computer)	200.0
	Paper/carton misc corrugated insert (g/computer)	0.0
	Plastics system cushions (g/computer)	840.0
	Plastics system bag (g/computer)	16.0

V.3.3. DISTRIBUTION

		ThinkCentre X1
Market share	Africa	15.4 %
	Asia (without China)	10.3 %
	China	19.2 %
	Europe	12.8 %
	USA	42.3 %
Africa	Truck 1 – one-way distance	1000.0 km
	Truck 1 – ERR	28.0 %
	Truck 2 – one way distance	2000.0 km
	Truck 2 – ERR	28.0 %
	Train – one way distance	0.0 km
	Boat – one way distance	8000.0 km
	Plane – one way distance	0.0 km
Asia (without China)	Truck 1 – one-way distance	1000.0 km
	Truck 1 – ERR	28.0 %
	Truck 2 – one way distance	2000.0 km
	Truck 2 – ERR	28.0 %
	Train – one way distance	0.0 km
	Boat – one way distance	4000.0 km
	Plane – one way distance	0.0 km
China	Truck 1 – one-way distance	4000.0 km
	Truck 1 – ERR	28.0 %
	Truck 2 – one way distance	0.0 km
	Truck 2 – ERR	28.0 %
	Train – one way distance	0.0 km
	Boat – one way distance	0.0 km
	Plane – one way distance	0.0 km
Europe	Truck 1 – one-way distance	1000.0 km
	Truck 1 – ERR	28.0 %
	Truck 2 – one way distance	2000.0 km
	Truck 2 – ERR	28.0 %
	Train – one way distance	0.0 km
	Boat – one way distance	16000.0 km
	Plane – one way distance	0.0 km
USA	Truck 1 – one-way distance	1000.0 km
	Truck 1 – ERR	28.0 %
	Truck 2 – one way distance	5000.0 km
	Truck 2 – ERR	28.0 %
	Train – one way distance	0.0 km
	Boat – one way distance	12000.0 km
	Plane – one way distance	0.0 km

V.3.4. USE PHASE

		ThinkCentre X1 (kWh/year)
Use	Typical Electricity Consumption (TEC) from Energy Star®	90.72

V.3.5. END OF LIFE

Treatment of household Electronics waste includes:

- Collection transport
- Recycling for a fraction specific to each region
- Incineration for a fraction specific to each region
- Landfilling for the complementary fraction

Table V 1: End of life streams

	Recycling rate	Incineration rate	Landfill rate
Africa	13%	0%	87%
Asia (without China)	75%	14%	11%
China	75%	5%	20%
Europe	56%	16%	28%
USA	38%	11%	51%

VI. Water Footprint and other environmental footprints

VI.1 Result of Water Footprint

Environmental Impact category	Value	Unit
Product Water Footprint	6.247	m³/FU

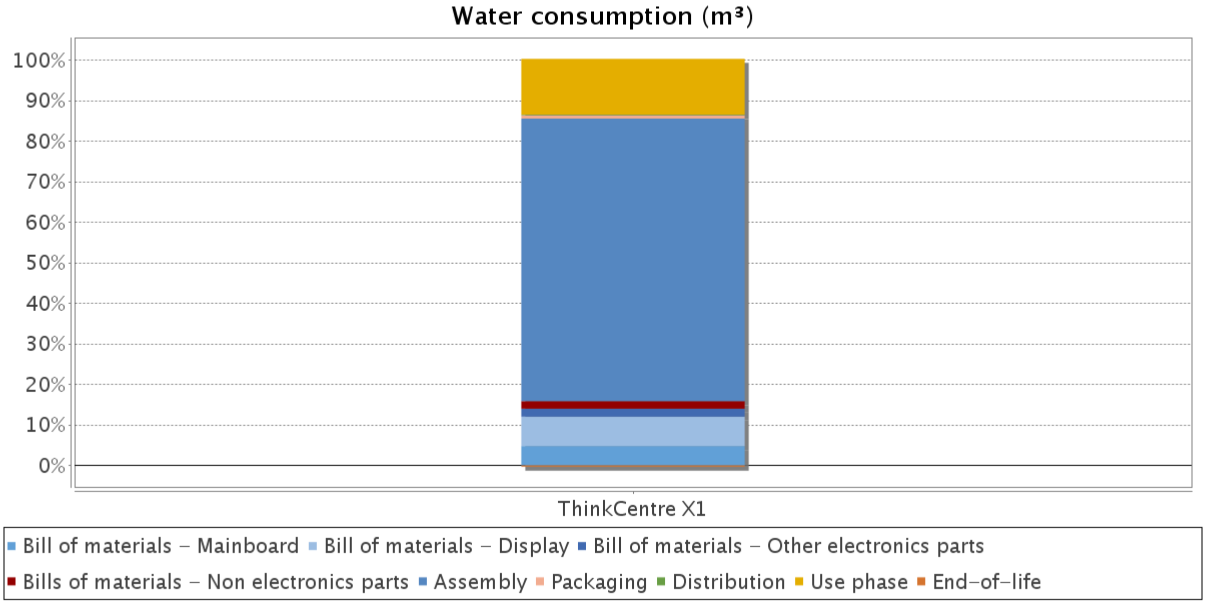


Figure VI 1: Results of water consumption, by process

VI.2 Result of Other Environmental Footprints

The following environmental impact categories were also assessed. The results are as follows:

Environmental impacts category	Value	Unit
Resource depletion : mineral, fossil	4.472	kg eq Sb / FU
Climate change	381.861	kg eq CO_2 / FU
Photochemical ozone formation	1.240	kg eq NMVOC / FU
Air Acidification	3.356	kmol H+ eq / FU
Particulate matter and respiratory inorganics	0.241	kg $PM_{2.5}$ eq[2] / FU

[2]*Due to insufficient data from the supply chain, the result is for reference only*

Leading the sustainable development has been the commitment of Lenovo. We have pledged continuous green innovation. The measurement of our products' environmental footprint enables us to communicate with customers and other stakeholders on our efforts in sustainable development.

The environmental impacts of the product to be assessed are displayed for the functional unit defined in chapter I.2.1 page 4:

Table VI 1: Environmental footprint (absolute results)

	Resource depletion: water (m^3)	Resource depletion: mineral, fossil (kg Sb eq)	Climate change (kg CO2 eq)	Photochemical ozone formation (kg NMVOC)	Air Acidification (kmol H+ eq)	Particulate matter/ Respiratory inorganics
Materials - Mainboard	0.299	0.048	24.145	0.096	0.200	0.013
Materials - Display module	0.452	4.417	36.526	0.132	0.352	0.029
Materials - Other electronics	0.123	0.010	12.838	0.047	0.092	0.006
Materials - Non electronics	0.117	0.000	14.610	0.035	0.064	0.004
Assembly	4.354	0.000	3.718	0.011	0.025	0.002
Packaging	0.052	0.000	4.824	0.026	0.022	0.002
Distribution	0.009	0.000	2.932	0.017	0.033	0.001
Use phase	0.859	0.001	283.399	0.881	2.575	0.185
End of life	-0.019	-0.005	-1.132	-0.005	-0.008	-0.000
Total	6.247	4.472	381.861	1.240	3.356	0.241

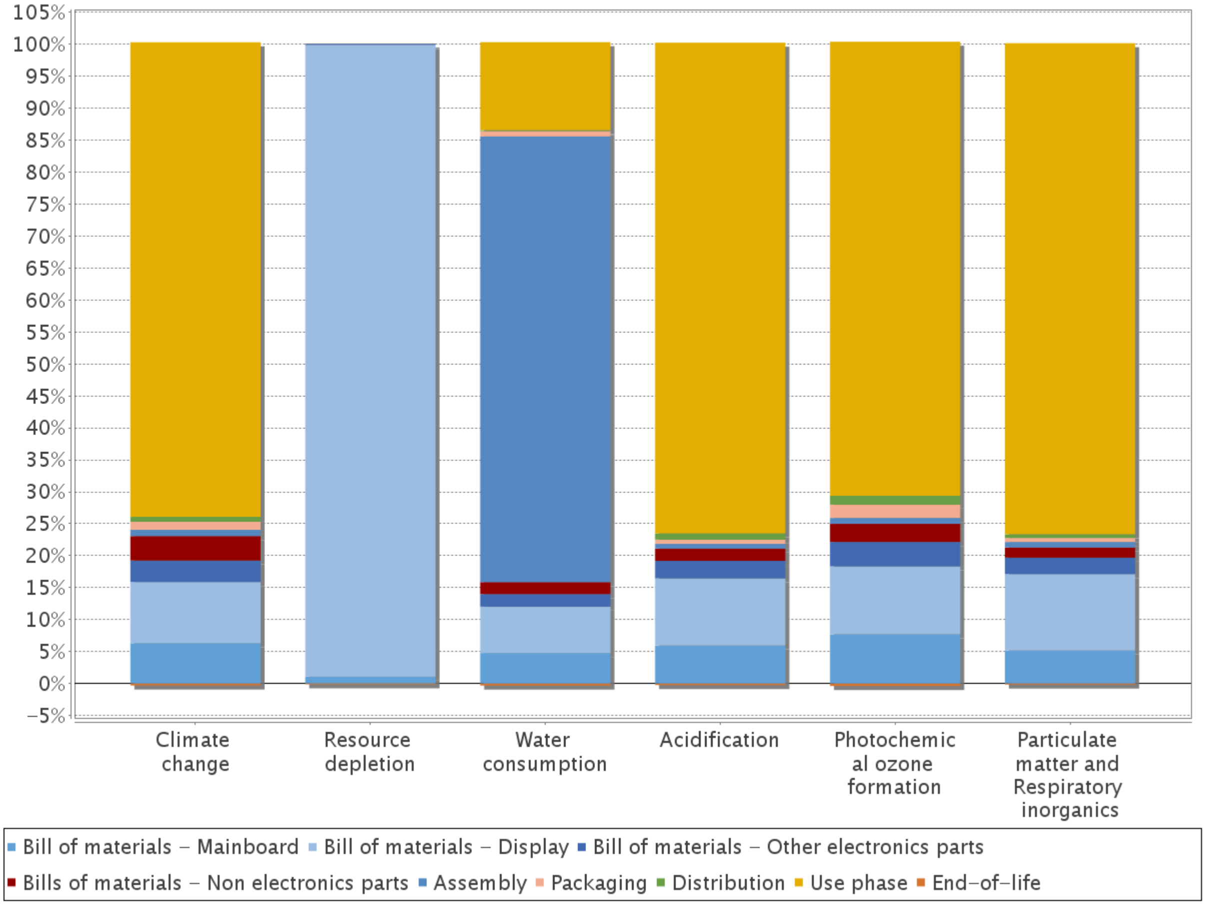


Figure VI 2 : Environmental footprint (relative results)

VII. Limits

Limits of LCIA

The impact assessment phase of the LCA is aimed at evaluating the significance of potential environmental impacts using the results of the life cycle inventory analysis. As for all LCAs, results are only valid if the data used and the models represent reality.

Even if using the list of LCIA methods, LCAs do not represent a complete picture of the environmental impact of a system. As key categories, such as biodiversity, are left out, results should be considered carefully, taking into account qualitative elements for those categories.

Any judgments that are based on the interpretation of LCI data must bear in mind this limitation and, if necessary, obtain additional environmental information from other sources (hygienic aspects, risk assessment, etc.). The LCIA results are relative expressions and do not predict impacts on endpoint categories, nor exceedance of thresholds, safety margins or risks.

When comparing results obtained for the subject products for the various impact categories, the user should bear in mind that various levels of uncertainties are associated with the different categories.

Limits of the tool

The quantitative reliability analysis is based on a qualitative judgment of the user and LCA experts. It is possible that two different users modelling the same computer would end up with different results.

VIII. Annexes

VIII.1 Annex 1: LCI used

LCI	Source
ABS, average, PlasticsEurope2005, W/o waste treatment	PlasticsEurope 2005
ABS, average, PlasticsEurope2005, W/o waste treatment	PlasticsEurope 2005
alkylbenzene, linear, at plant, RER [#369] Rigid	Ecoinvent v2.2.
Alu, primary	EAA 2005
ammonia, liquid, at regional storehouse, CH [#247]	Ecoinvent v2.2.
assembly, LCD module, GLO [#7105]	Ecoinvent v2.2.
backlight, LCD screen, at plant, GLO [#7096]	Ecoinvent v2.2.
battery, LiIo, rechargeable, prismatic, at plant, GLO [#7003]	Ecoinvent v2.2.
battery, NiMH, rechargeable, prismatic, at plant, GLO [#7001]	Ecoinvent v2.2.
cable, connector for computer, without plugs, at plant, GLO [#7017]	Ecoinvent v2.2.
capacitor, electrolyte type, < 2cm height, at plant, GLO [#7011]	Ecoinvent v2.2.
capacitor, SMD type, surface-mounting, at plant, GLO [#7010]	Ecoinvent v2.2.
capacitor, Tantalum-, through-hole mounting, at plant, GLO [#7013]	Ecoinvent v2.2.
CD-ROM/DVD-ROM drive, desktop computer, at plant, GLO [#10160]	Ecoinvent v2.2.
CD-ROM/DVD-ROM drive, laptop computer, at plant, GLO [#10161]	Ecoinvent v2.2.
cement, unspecified, at plant, CH [#484]	Ecoinvent v2.2.
chemicals inorganic, at plant, GLO [#264]	Ecoinvent v2.2.
chemicals organic, at plant, GLO [#382]	Ecoinvent v2.2.
chromium oxide, flakes, at plant, RER [#270]	Ecoinvent v2.2.
chromium steel 18/8, at plant, RER [#1072]	Ecoinvent v2.2.
connector, computer, peripherical type, at plant, GLO [#10162]	Ecoinvent v2.2.
connector, PCI bus, at plant, GLO [#7081]	Ecoinvent v2.2.
copper, at regional storage, RER [#1074]	Ecoinvent v2.2.
copper, secondary, from electronic and electric scrap recycling, at refinery, SE [#8140]	Ecoinvent v2.2.
diesel, low-sulphur, at regional storage, RER [#1548]	Ecoinvent v2.2.
diode, glass-, SMD type, surface mounting, at plant, GLO [#7075]	Ecoinvent v2.2.
dipropylene glycol monomethyl ether, at plant, RER [#7211]	Ecoinvent v2.2.
disposal, Battery lythium LI-Ion, to municipal incineration	RDC based on Ecoinvent v2.2.
disposal, capacitors, 0% water, to hazardous waste incineration, CH [#10919]	Ecoinvent v2.2.
disposal, cement, hydrated, 0% water, to residual material landfill, CH [#2164]	Ecoinvent v2.2.
disposal, copper, 0% water, to municipal incineration, CH [#2096]	Ecoinvent v2.2.
disposal, desktop computer, to WEEE treatment, CH [#7049]	Ecoinvent v2.2.
disposal, EEE, to municipal incineration	RDC based on Ecoinvent v2.2.
disposal, emulsion paint, 0% water, to municipal incineration, CH [#2097]	Ecoinvent v2.2.
disposal, glass, 0% water, to inert material landfill, CH [#2071]	Ecoinvent v2.2.
disposal, glass, 0% water, to municipal incineration, CH [#2099]	Ecoinvent v2.2.
disposal, hazardous waste, 25% water, to hazardous waste incineration, CH [#2059]	Ecoinvent v2.2.
disposal, inert material, 0% water, to sanitary landfill, CH [#2221]	Ecoinvent v2.2.
disposal, laptop computer, to WEEE treatment, CH [#7052]	Ecoinvent v2.2.
disposal, LCD , to sanitary landfill, CH, [ ]	RDC based on Ecoinvent v2.2.
disposal, LCD module, to municipal waste incineration, CH [#10975]	Ecoinvent v2.2.
disposal, lorry 40t, CH [#1903]	Ecoinvent v2.2.
disposal, municipal solid waste, 22.9% water, to municipal incineration, CH [#2103]	Ecoinvent v2.2.

disposal, plastic, consumer electronics, 15.3% water, to municipal incineration, CH [#2110]	Ecoinvent v2.2.
disposal, polyethylene terephtalate, 0.2% water, to sanitary landfill, CH [#2231]	Ecoinvent v2.2.
disposal, polyethylene, 0.4% water, to sanitary landfill, CH [#2232]	Ecoinvent v2.2.
disposal, polystyrene, 0.2% water, to sanitary landfill, CH [#2234]	Ecoinvent v2.2.
disposal, polyvinylchloride, 0.2% water, to sanitary landfill, CH [#2236]	Ecoinvent v2.2.
disposal, road, RER [#1905]	Ecoinvent v2.2.
disposal, sludge, pig iron production, 8.6% water, to residual material landfill, CH [#2209]	Ecoinvent v2.2.
disposal, steel, 0% water, to inert material landfill, CH [#2082]	Ecoinvent v2.2.
disposal, steel, 0% water, to municipal incineration, CH [#2123]	Ecoinvent v2.2.
disposal, treatment of printed wiring boards, GLO [#7095]	Ecoinvent v2.2.
distribution network, electricity, low voltage, CH [#568]	Ecoinvent v2.2.
electricity, at cogen ORC 1400kWth, wood, allocation exergy, CH [#2326]	Ecoinvent v2.2.
electricity, at wind power plant 600kW, CH [#2296]	Ecoinvent v2.2.
electricity, at wind power plant, RER [#2293] Rigid	Ecoinvent v2.2.
electricity, hard coal, at power plant, CN [#11087]	Ecoinvent v2.2.
electricity, hard coal, at power plant, UCTE [#861] Rigid	Ecoinvent v2.2.
electricity, high voltage, production UCTE, at grid, UCTE [#606]	Ecoinvent v2.2.
electricity, hydropower, at power plant, DE [#939] Rigid	Ecoinvent v2.2.
electricity, hydropower, at reservoir power plant, non alpine regions, RER [#983]	Ecoinvent v2.2.
electricity, low voltage, at grid, CN [#6680]	Ecoinvent v2.2.
electricity, low voltage, at grid, US [#6683]	Ecoinvent v2.2.
electricity, low voltage, production RER, at grid, RER [#7207]	Ecoinvent v2.2.
electricity, medium voltage, at grid, BR [#6678]	Ecoinvent v2.2.
electricity, medium voltage, at grid, CN [#6681]	Ecoinvent v2.2.
electricity, medium voltage, at grid, JP [#6687]	Ecoinvent v2.2.
electricity, medium voltage, production RER, at grid, RER [#7208]	Ecoinvent v2.2.
electricity, medium voltage, production UCTE, at grid, UCTE [#664]	Ecoinvent v2.2.
electricity, natural gas, at power plant, CENTREL [#1385]	Ecoinvent v2.2.
electricity, natural gas, at power plant, UCTE [#1376] Rigid	Ecoinvent v2.2.
electricity, nuclear, at power plant pressure water reactor, CN [#11099]	Ecoinvent v2.2.
electricity, nuclear, at power plant, UCTE [#1456] Rigid	Ecoinvent v2.2.
electricity, oil, at power plant, CZ [#1626]	Ecoinvent v2.2.
electricity, oil, at power plant, UCTE [#6047] Rigid	Ecoinvent v2.2.
electronic component production plant, GLO [#7083]	Ecoinvent v2.2.
extrusion, plastic film, RER [#1850]	Ecoinvent v2.2.
fan, at plant, GLO [#10806]	Ecoinvent v2.2.
ferrite, at plant, GLO [#7090]	Ecoinvent v2.2.
foaming, expanding, RER [#1852]	Ecoinvent v2.2.
glass fibre reinforced plastic, polyester resin, hand lay-up, at plant, RER [#1816]	Ecoinvent v2.2.
gold, at regional storage, RER [#10121]	Ecoinvent v2.2.
gold, primary, at refinery, GLO [#10120]	Ecoinvent v2.2.
gold, secondary, at precious metal refinery, SE [#8142]	Ecoinvent v2.2.
HDD, desktop computer, at plant, GLO [#10158]	Ecoinvent v2.2.
HDD, laptop computer, at plant, GLO [#10159]	Ecoinvent v2.2.
heat, natural gas, at industrial furnace >100kW, RER [#1351]	Ecoinvent v2.2.
heat, natural gas, at industrial furnace low-NOx >100kW, RER [#1352]	Ecoinvent v2.2.
hot rolling, steel, RER [#1165]	Ecoinvent v2.2.
hydrochloric acid, 30% in H2O, at plant, RER [#282]	Ecoinvent v2.2.
hydrogen peroxide, 50% in H2O, at plant, RER [#284]	Ecoinvent v2.2.
inductor, ring core choke type, at plant, GLO [#7067]	Ecoinvent v2.2.

injection moulding, RER [#1853]	Ecoinvent v2.2.
integrated circuit, IC, logic type, at plant, GLO [#7016]	Ecoinvent v2.2.
integrated circuit, IC, memory type, at plant, GLO [#7015]	Ecoinvent v2.2.
iron (III) chloride, 40% in H2O, at plant, CH [#292]	Ecoinvent v2.2.
LCD glass, at plant, GLO [#10167]	Ecoinvent v2.2.
lead, primary, at plant, GLO [#10777]	Ecoinvent v2.2.
light emitting diode, LED, at plant, GLO [#7077]	Ecoinvent v2.2.
lithium, at plant, GLO [#7224]	Ecoinvent v2.2.
lorry 40t, RER [#1908]	Ecoinvent v2.2.
Low density polyethylene (LDPE), PlasticsEurope 2005, w/o waste treatment Rigid	PlasticsEurope 2005
maintenance, lorry 40t, CH [#1912]	Ecoinvent v2.2.
mounting, surface mount technology, Pb-free solder, GLO [#10788]	Ecoinvent v2.2.
mounting, through-hole technology, Pb-free solder, GLO [#10789]	Ecoinvent v2.2.
municipal waste incineration plant, CH [#2134]	Ecoinvent v2.2.
natural gas, burned in industrial furnace low-NOx >100kW, RER [#1364]	Ecoinvent v2.2.
nickel, 99.5%, at plant, GLO [#1121]	Ecoinvent v2.2.
Nylon 6, PlasticsEurope 2005, w/o waste treatment	PlasticsEurope 2005
operation, maintenance, road, CH [#1932]	Ecoinvent v2.2.
packaging film, LDPE, at plant, RER [#1854]	Ecoinvent v2.2.
packaging, corrugated board, mixed fibre, single wall, at plant, RER [#1698]	Ecoinvent v2.2.
paper, newsprint, at plant, CH [#1709]	Ecoinvent v2.2.
phenolic resin, at plant, RER [#1673]	Ecoinvent v2.2.
photovoltaic cell factory, DE [#1783]	Ecoinvent v2.2.
plugs, inlet and outlet, for computer cable, at plant, GLO [#7018]	Ecoinvent v2.2.
PMMA, PlasticsEurope 2005, w/o waste treatment	PlasticsEurope 2005
Polycarbonate (PC), PlasticsEurope 2005, w/o waste treatment	PlasticsEurope 2005
Polycarbonate (PC), PlasticsEurope 2005, w/o waste treatment	PlasticsEurope 2005
polycarbonate, at plant, RER [#1826]	Ecoinvent v2.2.
Polyethylene terephtalate (PET) amorphous, at plant, RER	PlasticsEurope 2005
Polypropylene (PP), PlasticsEurope 2005, with waste treatment	PlasticsEurope 2005
Polystyrene, expandable, PlasticsEurope 2005, w/o waste treatment	PlasticsEurope 2005
power supply unit, at plant, CN [#10805]	Ecoinvent v2.2.
printed wiring board, mixed mounted, unspec., solder mix, at plant, GLO [#7101]	Ecoinvent v2.2.
printed wiring board, mounted, Desktop PC mainboard, Pb free, at plant, GLO [#10796]	Ecoinvent v2.2.
printed wiring board, mounted, Laptop PC mainboard, Pb free, at plant, GLO [#10797]	Ecoinvent v2.2.
printed wiring board, surface mount, lead-free surface, at plant, GLO [#10995]	Ecoinvent v2.2.
process-specific burdens, municipal waste incineration, CH [#2135]	Ecoinvent v2.2.
process-specific burdens, residual material landfill, CH [#2213]	Ecoinvent v2.2.
process-specific burdens, slag compartment, CH [#2136]	Ecoinvent v2.2.
quicklime, milled, packed, at plant, CH [#476]	Ecoinvent v2.2.
residual material landfill facility, CH [#2214]	Ecoinvent v2.2.
resistor, SMD type, surface mounting, at plant, GLO [#7068]	Ecoinvent v2.2.
road, CH [#1937]	Ecoinvent v2.2.
section bar extrusion, aluminium, RER [#1169]	Ecoinvent v2.2.
section bar rolling, steel, RER [#1170]	Ecoinvent v2.2.
sheet rolling, aluminium, RER [#1171]	Ecoinvent v2.2.
sheet rolling, copper, RER [#1173]	Ecoinvent v2.2.
silver, at regional storage, RER [#10153]	Ecoinvent v2.2.
silver, secondary, at precious metal refinery, SE [#8144]	Ecoinvent v2.2.
slag compartment, CH [#2137]	Ecoinvent v2.2.

sodium chloride, powder, at plant, RER [#329]	Ecoinvent v2.2.
sodium hydroxide, 50% in H2O, production mix, at plant, RER [#336]	Ecoinvent v2.2.
sputtering, ITO, for LCD, RER [#10962]	Ecoinvent v2.2.
Steel scrap benefits	Worldsteel 2005-2008
Steel, FCRC	Worldsteel 2005-2008
steel, low-alloyed, at plant, RER [#1154]	Ecoinvent v2.2.
sulphur hexafluoride, liquid, at plant, RER [#348]	Ecoinvent v2.2.
sulphuric acid, liquid, at plant, RER [#350]	Ecoinvent v2.2.
synthetic rubber, at plant, RER [#1847]	Ecoinvent v2.2.
tap water, at user, RER [#2288]	Ecoinvent v2.2.
tin, at regional storage, RER [#1155]	Ecoinvent v2.2.
titanium dioxide, production mix, at plant, RER [#355]	Ecoinvent v2.2.
transistor, SMD type, surface mounting, at plant, GLO [#7078]	Ecoinvent v2.2.
transistor, wired, small size, through-hole mounting, at plant, GLO [#7079]	Ecoinvent v2.2.
transmission network, electricity, high voltage, CH [#570]	Ecoinvent v2.2.
transmission network, electricity, medium voltage, CH [#573]	Ecoinvent v2.2.
transmission network, long-distance, UCTE [#574]	Ecoinvent v2.2.
transport, aircraft, freight, RER [#1892]	Ecoinvent v2.2.
transport, freight, rail, RER [#1983]	Ecoinvent v2.2.
transport, lorry >16t, fleet average, RER [#1943]	Ecoinvent v2.2.
transport, lorry 20-28t, fleet average, CH [#1942]	Ecoinvent v2.2.
transport, transoceanic freight ship, OCE [#1968]	Ecoinvent v2.2.
treatment, sewage, unpolluted, to wastewater treatment, class 3, CH [#2281]	Ecoinvent v2.2.
Truck, Articulated 34 - 40 t, 100% Euro III	COPERT IV
Truck, Articulated 34 - 40 t, 100% Euro IV	COPERT IV
Truck, Articulated 34 - 40 t, 100% Euro V	COPERT IV
Truck, Articulated 34 - 40 t, 100% Euro VI	COPERT IV
water, ultrapure, at plant, GLO [#7237]	Ecoinvent v2.2.
whitelined chipboard, WLC, at plant, RER [#1705]	Ecoinvent v2.2.
wire drawing, copper, RER [#1178]	Ecoinvent v2.2.