Recommended list of Environmental Impact categories and Inventory results

The environmental performance indicators are based on the results of an Impact assessment (LCIA) according to ISO 14044 and on taking several flows of the life cycle inventory into account. The LCIA assesses the life cycle model of the product from an environmental point of view by modeling selected environmental issues, so-called impact categories. Results from an LCIA represent the environmental impacts of the products.

The method is flexible in the choice of the impact categories, in order to reflect product specific environmental issues and user preferences.

In order to meet the requirements on the selection of impact categories as stated in ISO 14044, it was decided, that for the EPIC-ICT case study on personal computers, selected impact categories are based on the CML methodology framework are chosen. A thorough contribution analysis was carried out to examine, whether the results from the LCIA differ when other methodologies are chosen. The results show that the contribution of the results to the life cycle phases and main assemblies does not differ significantly. For the purpose of EPIC-ICT, identifying life cycle performance indicators for eco-design, the contribution to the main aspects of the product's life cycle is more important than the total amount of the respective impact categories and LCI results.

In addition to the LCIA impact categories, some life cycle inventory flows were taken into account. In particular, a method for identifying the most relevant toxic flows has been applied, which indicates all environmentally relevant toxic substances contributing to a specific percentage (here 70 %) of chosen human toxicity and ecotoxicity LCIA methods (flows relating to 13 impact categories of Impact 2002+, EcoIndicator99 and CML 2001 methodologies).. Water consumption and non-renewable materials with both energy and non-energy contents have been included. Finally, electricity consumption is here considered only as an additional indicator, in order to avoid double counting.

Table 1: Recommended list of impact categories and inventory results

Life cycle Indicators for environmental aspects	**Unit**	**Method (where applicable)**
Environmental Impact categories		
AP	[kg SO_2 Equiv.]	CML 2001
EP	[kg PO_4^{---} Equiv.]	CML 2001
GWP	[kg CO_2 Equiv.]	CML 2001
ODP	[kg R11 Equiv.]	CML 2001
POCP	[kgC_2H_2 Equiv.]	CML 2001
Primary energy	MJ	
LCI results		
Emissions contributing to human health and eco-toxicity (see list reported in Table 2)	kg	
Water consumption (renewable resources)	l or m3	
Additional indicators		
Electricity consumption during use phase	kWh	

Based on the scientific acceptance and by considering the calculated inventory results of the baseline PC study, we recommend the given list of environmental indicators. It also widely covers the environmental aspects as requested by the Commission. The environmental aspect of resource consumption is not explicitly covered as no scientifically agreed upon characterization method is available at time, but somehow reflected by considering the Primary Energy consumption.

Nonetheless the EPIC-ICT method of calculating the product specific environmental performance indicators which is applied subsequently based on these environmental indicators is flexible enough to cope with all kinds of environmental indicators (e.g. single point indicators and / or other impact categories). Thus, the list is currently a recommendation from the EPIC-ICT consortium, and can be enlarged with further development in LCIA or adapted to own choices and selection of categories.

Human toxicity and eco-toxicity issues

As discussed, there is no international consensus on LCIA toxicity characterization methods in science. Therefore, the EPIC-ICT partners decided not to take solely the results of currently provided toxicity impact categories (e.g. CML 2001 Human toxicity potential, Impact 2002+ Aquatic Eco-toxicity or EcoIndicator 99 Carcinogenic effects) but to take LCI information - namely elementary flows - into account, which are representative for toxicity issues. Against this background, the consideration of potentially toxic flows which occur over the life cycle of a PC was elaborated in detail. A method was applied, which identifies and defines product group specific relevant toxic flows, taking into account the variety of existing LCIA methods and therefore different underlying models. It allows practitioners to integrate toxicity issues into the decision making process without selecting and relying on only one method.

This method was applied to 13 different human health and ecotoxicity impact categories of the following LCIA methodologies: CML 2001, EcoIndicator 99 and Impact 2002+. Coverage (%) of the total specific result of each of these categories was applied. This was done in order to reduce the number of selected flows to a number which still represents the results to a certain degree. It was found that for the product group personal computer and these 13 categories in total 20 flows are responsible for 70 % of the total result of each of the categories. These flows are chosen to represent human health and ecotoxicity aspects for ecodesign purposes of a personal computer.

Table 2: List of elementary flows which contribute to 70 % of human health and ecotoxicity categories of CML 2001, EI99 and Impact 2002+

Methods covered (tox-categories): CML 2001, EI 99 and Impact 2002+	
Percentage of indicator results covered with flows: 70%	
Acrylonitrile	Organic emissions to fresh water
Aluminum	Inorganic emissions to fresh water
Arsenic	Heavy metals to air
Cadmium	Heavy metals to air
Chromium (unspecified)	Heavy metals to air
Copper	Heavy metals to fresh water
Copper	Heavy metals to industrial soil
Hydrogen fluoride	Inorganic emissions to air
Mercury	Heavy metals to air
Nickel	Heavy metals to air
Nickel	Heavy metals to fresh water
Nitrogen oxides	Inorganic emissions to air
NMVOC (unspecified)	Organic emissions to air (group VOC)
Polychlorinated dibenzo-p-dioxins (2,3,7,8 - TCDD)	Organic emissions to air (group VOC)
Polycyclic aromatic hydrocarbons (PAH, unspec.)	Organic emissions to fresh water
Sulphur dioxide	Inorganic emissions to air
Vanadium	Heavy metals to air
Vanadium	Heavy metals to fresh water
Zinc	Heavy metals to air
Zinc	Heavy metals to industrial soil