About Nordic Ecolabelling of

Computers

Version 7.0

Background for comments

Date 2012-12-10

Nordic Ecolabelling

Nordic Ecolabelling – Background

048/Version 7.0

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1 Summary

In the revision carried out in 2012 -2013 Nordic Ecolabelling have focused on requirements regarding energy consumption, additives in plastics, the use of biocides on the computer surface, packaging material, electrical safety and finally on plastics based on recycled material and bio-based plastic The following has been concluded. The requirements will be strengthened regarding energy usage in accordance with Energy Star. The requirements for flame retardants in plastic parts will also be tightened. Requirements for softeners in external power cables will be introduced in order to focus on problems related to these substances. Requirement for packaging material has been reintroduced. Regarding new plastic requirements Nordic Ecolabelling concluded that it not yet is possible to introduce requirements for usage of recycled and bio-based plastics in the criteria mainly due to limited guaranteed availability of required plastic materials. Regarding the usage of biocides on computer surfaces the conclusion was to not allow biocides on the computer surface.

2 Basic facts about the criteria

Products that can be licensed

These criteria address computers available on the market for consumers and businesses. An ordinary computer consists of a central processing unit (see explanation below), a display (monitor) and input (keyboard and pointing device). These parts can be licensed all together, central processing unit and display can be licensed separately. There are different computer types available on the market such as desktop computers (also called stationary), notebook computers (also called portable) and tablet computers (either a notebook with a touch screen or a slate computer which is a notebook without a keyboard and with a touch screen). It is possible to license all of these. Small servers that basically are desktop computers can also be licensed. For more details see section F about Small-Scale Servers below.

It is not possible to license peripherals, such as mice, external storage devices or different types of cables for example.

Below you will find a detailed explanation of the different computer types that can be licensed. The categorization is identical to Energy Star[1]'s categorization. The reason for this is that almost all manufacturers of computers declare the energy consumption of their products according to the requirements/specifications from Energy Star. These specifications define standardized configuration and measurement procedures and ways to declare energy consumption for the different computer types. The intention is to make it easier for the customer to compare and choose. For a computer to become Energy

[1] Energy Star is a joint programme of the U.S. Environmental Protection Agency and the U.S. Department of Energy. http://www.energystar.gov/index.cfm?c=about.ab_index

Star compliant it has to meet given energy consumption requirements. In order to facilitate for the applicants the categorization of the computers is done equal to that of Energy Star.

The following computer equipment can be licensed.

A. Desktop Computer and/or display

B. Integrated Desktop Computer

C. Notebook computer (including slate)

D. Workstation

E. Thin Client

F. Small-scale Server

The use of slate PCs has increased significantly lately and a sales volume of 20 million units in year 2015 is predicted. Already in 2014 the slate PC is predicted to pass the traditional notebook according to the Forrester[2].

Nordic Ecolabelling has therefore made it possible also to license a slate computer. Some of the requirements in the criteria had to be adjusted to make this possible. The requirements for the number of I/O connectors and the expansion of memory, etc. needed to be changed. With the intended use of the tablet in mind it was deemed acceptable to make changes in these requirements.

A more detailed explanation of these categories follows below.

Definitions of a computer

A computer is a device which performs logical operations and processes data. For the purposes of this specification, computers include both stationary and portable units, including desktop computers, integrated desktop computers, notebook computers, small-scale servers, thin clients, and workstations. Although computers are capable of using input devices and displays, such devices are not required to be included with the computer upon shipment. Computers are composed of, at a minimum:

A central processing unit:

a) A central processing unit (CPU) to perform operations. If no CPU is present, then the device must function as a client gateway to a server which acts as a computational CPU,

b) User input devices such as a keyboard, mouse, or touchpad; and

c) An integrated display screen and/or the ability to support an external display screen to output information.

[2] http://www.forrester.com/ER/Press/Release/0,1769,1340,00.html

Display:

A display screen and associated electronics encased in a single housing, or within the computer housing (e.g. notebook or integrated desktop computer), that is capable of displaying visual information from a computer via one or more inputs (e.g. VGA, DVI, HDMI, Display Port, IEEE 1394). Examples of computer display technologies are the cathode-ray tube (CRT, i.e. the older type of monitor with a tube instead of a flat panel) and liquid crystal display (LCD).

External power supply

External Power Supply (EPS) also referred to as AC-Adapter. A component contained in a separate physical enclosure external to the computer casing, designed to convert line voltage AC input from the mains to lower dc voltage(s) in order to provide power to the computer. An external power supply shall connect to the computer via a removable or hard-wired male/female electrical connection, cable, cord or other wiring.

External power cable:

A removable cable that connects the computer, display or the external power supply, to the mains.

Computer Types

There are several different computer types. These are grouped into six categories, known as A-F. Computer types that comply with these definitions can be licensed.

A. Desktop Computer

A Desktop Computer is a computer whose main unit is designed to be located in a permanent location, often on a desk or on the floor. Desktop computers are not designed for portability but are designed for use with external display, keyboard, and mouse. Desktop computers are intended for a broad range of home and office applications.



Figure 1: Desktop computers of different sizes.

B. Integrated Desktop Computer

An Integrated Desktop Computer is a desktop computer in which the computing hardware and display are integrated into a single housing, and which is connected to AC mains power through a single cable. Integrated desktop computers come in one of two possible forms: (1) a system where the display and computer are physically combined into a single unit; or (2) a system packaged as a single system where the display is separate but is connected to the main chassis by a DC power cord and both the computer and display are powered from a single power supply.



Figure 2: Integrated desktop computer, also called All-in-One.

C. Notebook computer

A computer designed specifically for portability and to be operated for extended periods of time either with or without a direct connection to an AC power source. Notebook computers include an integrated display and are capable of being powered by an integrated battery or other portable power source. In addition, most notebooks use an external power supply and have an integrated keyboard and pointing device. Notebook computers are typically designed to provide similar functionality to desktops, including operation of software similar in functionality to that used in desktops.

a) Tablet Computer: A Notebook Computer with a reversible, touch-sensitive screen and a non-detachable physical keyboard. For the purposes of this specification, Tablet Computers are subject to all Notebook Computer requirements.

b) Slate Computing Device: A computer is a Slate Computing Device if it has all of the following characteristics:

(1) either lacking a physical keyboard or with a detachable physical keyboard;

(2) relying solely on touchscreen input;

(3) having solely a wireless network connection (e.g. Wi-Fi, 3G); and

(4) primarily powered from an internal battery (with connection to the mains for charging, not primary powering of the device).



Figure 3: Notebook computers



Figure 4a: Tablet PC with touch screen and keyboard



Figure 4b: Slate computing devices.

c) Mobile Thin Client: A computer meeting the definition of a Thin Client, designed specifically for portability, and also meeting the definition of a Notebook Computer. These products are considered to be Notebook Computers for the purposes of this specification.

D. Workstation

A high-performance, single-user computer, typically used for graphics, CAD, software development, financial and scientific applications among other compute intensive tasks. Workstations covered by this specification (a) are marketed as a workstation; (b) provide mean time between failures (MTBF) of at least 15,000 hours (based on either Bellcore TR-NWT-000332, issue 6, 12/97 or field collected data); and (c) support error-correcting

code (ECC) and/or buffered memory. In addition, a workstation meets three or more of the following criteria:

a) Provides supplemental power support for high-end graphics (e.g., PCI-E 6-pin 12V supplemental power feed)

b) Wired for greater than x4 PCI-E on the motherboard in addition to the graphics slot(s) and/or PCI-X support

c) Does not provide support for Uniform Memory Access (UMA) graphics

d) Provides 5 or more PCI, PCI-E, or PCI-X slots

e) Provides multi-processor support for 2 or more processors (shall support physically separate processor packages/sockets, i.e. requirement cannot be met with support for a single multi-core processor), and/or

f) Qualification by 2 or more Independent Software Vendor (ISV) product certifications; these certifications may be in process, but shall be completed within 3 months of qualification.



Figure 5: Workstations.

E. Thin Client

An independently-powered computer that relies on a connection to remote computing resources (e.g., computer server, remote workstation) to obtain primary functionality. Main computing functions (e.g. programme execution, data storage, interaction with other Internet resources) are provided by the remote computing resources. Thin Clients covered by this specification are (1) limited to devices with no rotational storage media integral to the computer and (2) designed for use in a permanent location (e.g. on a desk) and not for portability.

a) Integrated Thin Client: A Thin Client in which computing hardware and display are integrated into a single housing, and which is connected to AC mains power through a single cable. Integrated Thin Client computers come in one of two possible forms: (1) a system where the display and computer are physically combined into a single unit, or (2) a system packaged as a single system where the display is separate but is connected to the main chassis by a DC power cord and where both the computer and display are powered from a single power supply. As a subset of Thin Clients, Integrated Thin Clients are typically designed to provide similar functionality as Thin Client systems.

b) Ultra-thin Client: A computer with lesser local resources than a standard Thin Client that sends raw mouse and keyboard input to a remote computing resource and receives back raw video from the remote computing resource. Ultra-thin clients cannot interface with multiple devices simultaneously nor run windowed remote applications due to the lack of a user-discernible client-operating system on the device (i.e. beneath firmware, user inaccessible).



Figure 6: Thin client

F. Small-scale Server

A computer that typically uses desktop components in a desktop-form factor, but is designed primarily to be a storage host for other computers. Small-scale Servers are designed to perform functions such as providing network infrastructure services (e.g. archiving) and hosting data/media. These products are not designed to process information for other systems or run web servers as a primary function. A Small-scale Server has the following characteristics:

a) Designed in a pedestal, tower, or other form factor similar to those of desktop computers so that all data processing, storage, and network interfacing is contained within one box/product

b) Designed to operate 24 hours/day, 7 days/week, with minimal unscheduled downtime (on the order of hours/year)

c) Capable of operating in a simultaneous multi-user environment serving several users through networked client units, and

d) Designed for an industry-accepted operating system for home or low-end server applications (e.g. Windows Home Server, Mac OS X Server, Linux, UNIX, Solaris).



Figure 7: Small-scale Servers.

Products not covered by the product type definitions in this document:

- Computer Servers, as defined in Energy Star Computer Server-specification
- Small-scale Servers that are marketed and sold for use in a data centre
- Handheld Computers (including eReaders, Mobile Thin Clients not meeting the definition of Notebook Computer)
- Game Consoles
- Mobile phones and Smartphones
- Computer accessories such as modem, docking stations, external hard drive, USB memory stick (and mouse separately)
- Cathode-ray tube (CRT) displays
- Printers (see separate criteria for imaging equipment).

Motivation for Nordic Ecolabelling

A RPS analysis (relevance, potential, steerability) has been performed to determine which parameters Nordic Ecolabelling can influence in order to achieve the maximum possible environmental gains, i.e. the parameters on which requirements should be imposed.

Relevance is the first factor to be considered, i.e. what environmental problems (environmental impact) are associated with the product group and how great is the problem. *Is there an environmental threat, and, if so, how great is the threat?*

The second factor to be considered is the potential: What dynamic developments would allow environmental gains to be made within a particular product group. *Can we do anything about the environmental problem?*

Steerability is a measure of the extent to which ecolabelling can influence the activity, problem or requirement. *Can Nordic Ecolabelling do anything about the environmental problem?*

In this revision (2012) the RPS analysis is revised by examining available new life cycle assessments (LCA's) for computers. A summary of the studies, and the conclusion, is as follows:

For electronic equipment it has been the general assumption that the most important environmental impact is the electricity used in the use phase.

For PC this assumption is supported by the SusteIT[3] (Sustainable Information Technology in Tertiary Education) report from 2011. The study is an update of a study from 2009[4]. In the 2009 report several LCA studies were analysed. 5 of the 7 studies

[3] http://www.goodcampus.org/files/files/57-LCA_of_computing_equipment_v7_final_June_2011.pdf

[4] Ibid

concluded that energy in the use phase is much greater than the energy used in the production phase. The SusteIT found that the most relevant study for European conditions, due to depth of information and transparency, was the IVF study for UK Universities and colleges. The IVF study was made by Swerea IVF[5], a Swedish industrial research group. For a 6.6 and 4 years' lifetime the life cycle energy for a desktop and a LCD monitor was as illustrated, see Figure 8 below:

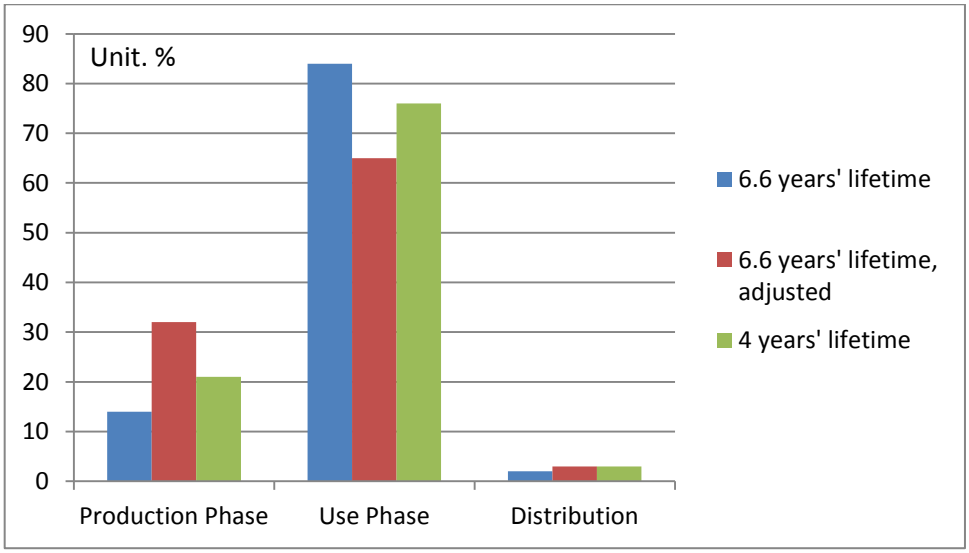

Figure 8: 6.6 and 4 years' lifetime life cycle relative energy consumption for desktops with LCD monitors

This indicates that the energy consumption in the use phase is still more important than the use of energy in the production phase. After reviewing the data from 2009 it is suggested that the estimation of the energy consumption in production is underestimated. After adjusting the data with information from another study by L. Hopkinson and P. James[6] , the impact from the production phase more than doubled. The energy mixes used have been the same. Although the overall conclusion remains the same.

A large manufacturer of computers has produced several Environmental product reports which provide total greenhouse gas emission broken down by production, use and transport and recycling. The detailed methodology is not provided but a comparison to the IVF products referred to in the above is given, see figure 9 below.

[5] http://www.swerea.se/sv/ivf/

[6] http://www.goodcampus.org/files/files/57-LCA_of_computing_equipment_v7_final_June_2011.pdf

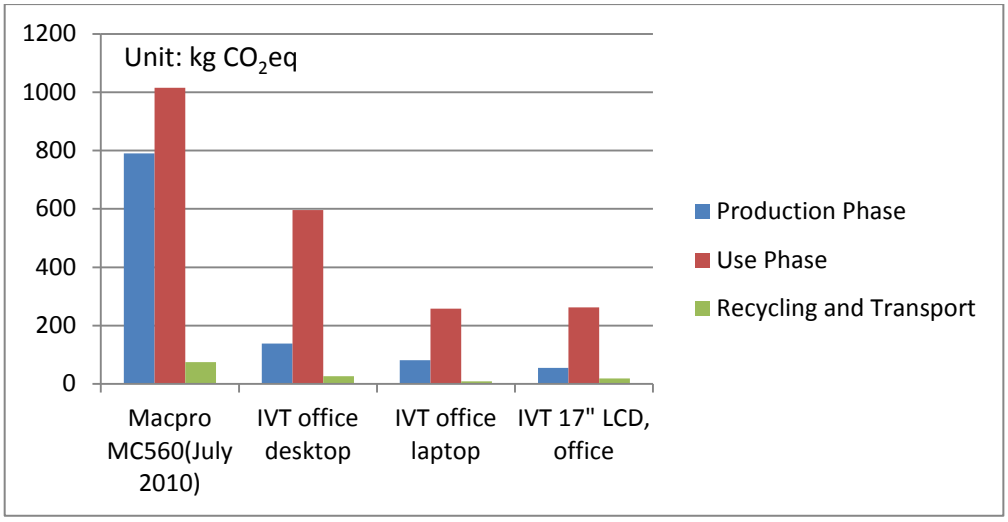

Figure 9: Comparison of carbon dioxide (CO_2) emission during the life cycle for products from a large manufacturer of computers to corresponding figures in the IVF report.

Again the conclusion for desktops, laptops and LCD screen is that the energy consumption in the use phase is the most important.

The SusteIT report also suggested that, although LCD manufacturing uses less energy than for CRTs[7], it may produce much higher levels of greenhouse gas emissions. The LCD module manufacturing emits sulphur hexafluoride (SF_6), a gas with a very high global warming potential (GWP) which partly explains the GWP_{100} difference between CRT and LCD manufacturing[8]. Figure 10 below shows the global emission of sulphur hexafluoride by major source categories[9]. The major part comes from the manufacturing of electrical equipment.

[7] CRT, Cathode Ray Tube.

[8] Life Cycle Energy and Environmental Impacts of Computing Equipment - A June 2011 Update to a 2009 SusteIT Report by Lisa Hopkinson and Peter James.

[9] EDGAR 4.0, JRC/PBL, 2009 http://edgar.jrc.ec.europa.eu/part_SF6.php

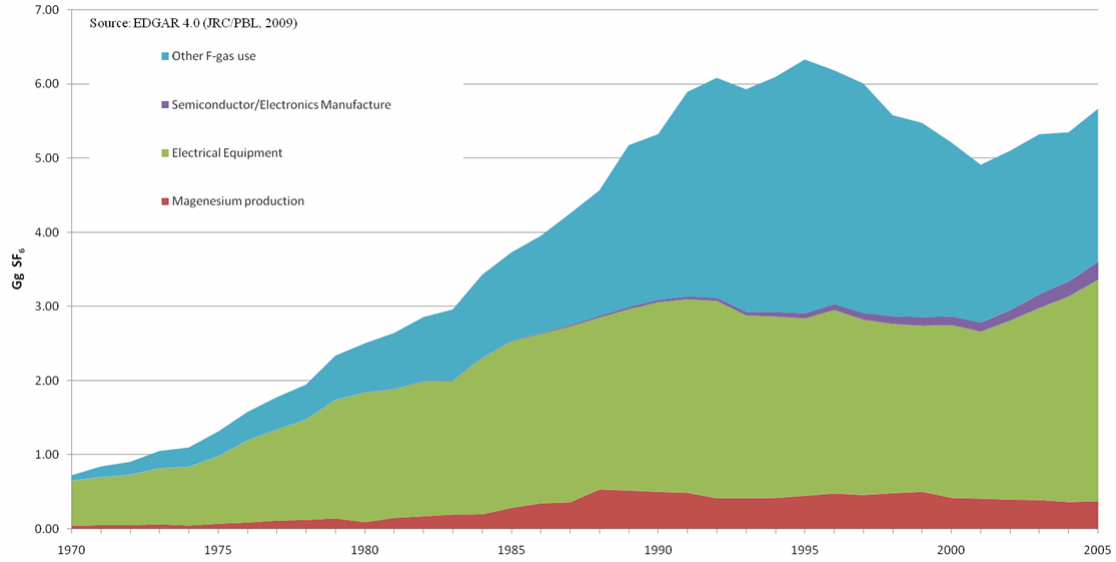

Figure 10: Trends in global emissions of sulphur hexafluoride by major source category (1970-2005) in Gigagram (Gg) SF_6.[10]

According to the Intergovernmental Panel on Climate Change (IPCC), sulphur hexafluoride is the most potent greenhouse gas that it has evaluated, with a global warming potential of 23,900 times that of carbon dioxide when compared over a 100- year period. It is also inert in the troposphere and stratosphere and therefore has an estimated atmospheric lifetime of 800–3200 years[11].

A 10-year-old US-EPA study on desktop computer monitors found that the greatest global warming impact for LCDs is from sulphur hexafluoride in the LCD monitor/ module manufacturing process, although carbon dioxide from the use stage and the materials processing stage also contributed significantly to global warming impacts.

LCD manufacturing also uses nitrogen trifluoride (NF_3) which has a similar GWP to sulphur hexafluoride but which is not covered by international climate-change agreements. The GWP_{100} for desktops using LCD screens becomes 140% higher than for desktops using CRT screens[12].

According to Hopkinsons and James a 2008 report by DEFRA (Department for Environment, Food and Rural Affairs, UK) on television acknowledged that the environmental impacts of manufacturing LCDs cannot be readily quantified, but that the use of sulphur hexafluoride, along with nitrogen trifluoride, in LCDs and monitors could be significant in terms of global-warming potential[13].

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[10] http://edgar.jrc.ec.europa.eu/part_SF6.php#2difference

[11] [L. Hopkinson and P.James]: Life Cycle Energy and Environmental Impacts of Computing Equipment - A June 2011 Update to a 2009 SusteIT Report. Lisa Hopkinson and Peter James

[12] Ibid

[13] http://www.goodcampus.org/files/files/57-LCA_of_computing_equipment_v7_final_June_2011.pdf

Some manufacturers are aware about the need to reduce the use of these gases. One large manufacturer of LCDs has obtained the world's first CDM (Clean development mechanism - limiting emissions under the Kyoto protocol) project approval from the UN designed to destroy and decompose the sulphur hexafluoride gas emitted from the LCD manufacturing process[14].

It should be noticed when looking at all impacts (not just energy) that the material and manufacturing stage probably has the greatest ecosystem and resource impact overall (specific to China, but other phases are considered to be valid at a global level). Three damage categories are used in the study and they are: Human health, Ecosystem Quality and Resources[15].

Looking at the overall impacts, the manufacturing phase has a greater impact than the previous studies indicated. The impact from the manufacturing phase and the use phase is approximately the same[16], see figure 11.

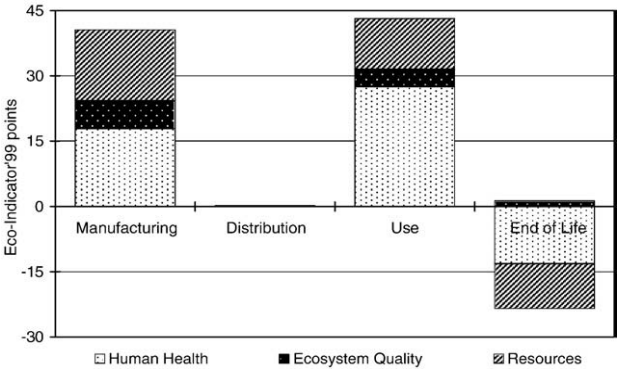


Figure 11. Environmental impacts of a PC system expressed in the Eco-Indicator'99 method.

The study also investigated the impact from the different components of a PC system.

[14] Life Cycle Energy and Environmental Impacts of Computing Equipment - A June 2011 Update to a 2009 SusteIT Report. Lisa Hopkinson and Peter James

[15] Ibid

[16] Life cycle assessment study of a Chinese desktop personal computer: Huabo Duana, Martin Eugsterb, Roland Hischierb, Martin Streicher-Porteb, Jinhui Lia. 2009

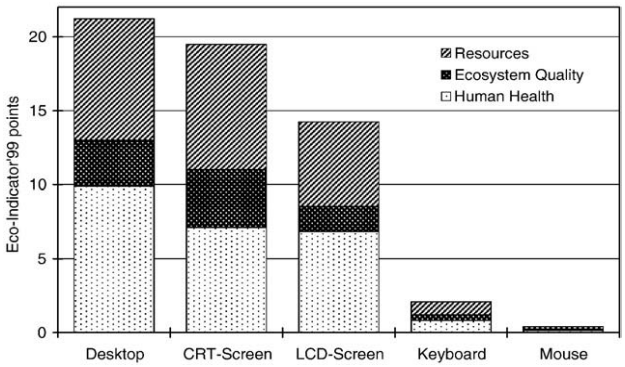
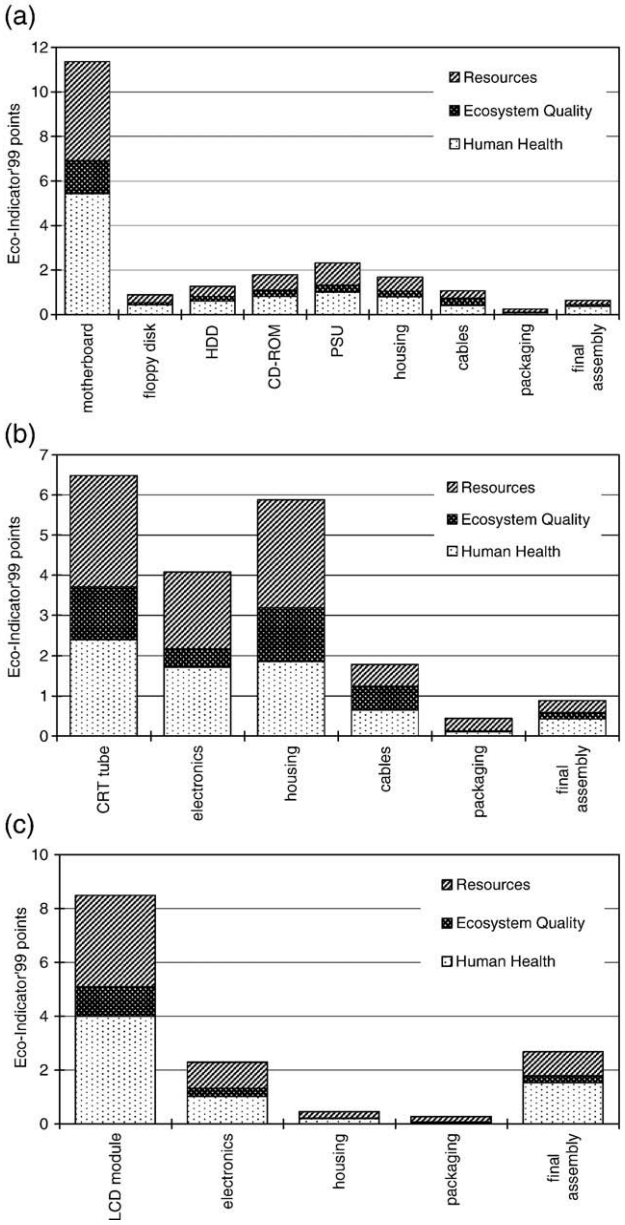


Figure 12. Environmental impacts caused by the production of the various parts of the PC system examined here, expressed in the method of Eco-Indicator'99.

From this, see Figure 12, it can be shown that the impact from the keyboard and the mouse is very small compared to the desktop and the monitor.

Looking at three different products; a desktop computer, a CRT screen and a LCD screen, it can be shown (see Figure 13) that the major contributor from the desktop computer is the motherboard, contributing with 54% of the impact of the desktop computer. CRT screens are not relevant in this revision. For a LCD screen it can be shown that the major impact is related to the LCD module (60% of the total LCD monitor)[17].

[17] Life cycle assessment study of a Chinese desktop personal computer: Huabo Duana, Martin Eugsterb, Roland Hischierb, Martin Streicher-Porteb, Jinhui Lia. 2009



(Eco-indicator99 a damage-oriented method for Life Cycle Impact Assessment)

Figure 13. Environmental impacts from the production of the various devices making up the PC system (from (a) to (c)): desktop PC itself, the CRT and the LCD screen - all expressed in the method of Eco-Indicator'99.

Conclusion

Based on the above the following conclusion can be drawn:

- The largest contributors to the environmental impacts from a PC system are the desktop and the monitor. Impact from keyboard and mouse is negligible in comparison since their energy consumption is very low during the use phase.
- Energy consumption in the use phase has the highest impact.
- When also considering other parameters such as resources, the production phase is probably as important as the use phase.
- Looking at the production phase the most important impact from a desktop is from the production of the motherboard, for an LCD display it is from the production of the LCD module.

Environmental impact	**Relevance**	**Potential**	**Steerability**	**Assessment of RPS**
Power consumption	Very high	High[1)]	High	+++
Plastics (housing and packaging material)	Low	High[2)]	Good	+
Flame retardants in plastics	Very high	High[2)]	Good	+++
Other additives in plastics	High	High[2)]	Good	++
Mercury in flat screens and in portable computers	Very high	Very High[3)]	Very High	+++
Lead	Very high[4)]	Low	High	+
Other heavy metals	Indifferent	Indifferent	Indifferent[5)]	0
Environmental impact of production (use of raw materials and energy, transport, GWP gases (SF_6 and others))	High	High	Poor[7)]	0
Waste, recycling	Very high	Very high	Good	+++
Service life	Very high[6)]	High	Indifferent/poor[7)]	0
Design (upgradeability)	High	High	Good	++

1) Power consumption decreases with new technology with smaller dimensions.
2) Alternatives available:
3) LED technology is now available.
4) RoHS restricts the use of lead in solder tin Alternatives are available.
5) Controlling the chain of suppliers is difficult.
6) The shorter the service life of a computer, the more computers are sold and the greater the waste problem.
7) It is difficult to influence the behaviour of consumers.

Table 1: RPS analysis of individual environmental parameters

According to the RPS factors in Table 1 the following parameters are the most relevant from an environmental perspective:

- energy consumption
- flame retardants in plastics
- waste and recycling of discarded products
- mercury in flat screens
- nano particles

Other relevant parameters are:

- Additives in plastics (phthalates)
- design (ease of upgrading and disassembly)
- plastics
- nickel in metal parts in contact with user

Since the European directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment, RoHS, was introduced in 2006 the use of lead in electronic equipment in Europe has been banned in soldering tin. Alternatives to lead in soldering tin are now used.

Service life is an important factor in terms of the environment because electrical and electronic products contain lots of different material and the shorter the service life of a computer, the more computers will be sold and the greater the waste problem and the need of recycling . It is still difficult to influence this issue through ecolabelling. It is not easy for manufacturers to exercise control over their suppliers. Similarly, it is difficult to influence the behaviour of consumers.

Other parameters for which requirements are imposed in this criteria document include:

- electrical and magnetic fields
- performance properties such as noise level, ergonomic instructions for use

We are today surrounded by an increasing number of equipment that emit electromagnetic radiation in our homes and offices. To which extent this emission is hazardous is difficult to say. There are studies and reports with different conclusions which amongst others are shown on the European Commission online magazine[18]. Due to this and the fact that there is a concern for this emission this criteria has had a requirement for electromagnetic field emission. The requirement has, however, not been evaluated this time so it will continue to be part of the criteria. The requirements for emitted electromagnetic fields (EMF) rely on the standard SS 436 14 90 (equivalent to prEN 502879) which is equal to the MPR III which was released in the middle of the1990s. This standard addressed the radiation from a CRT-based display. CRTs have now been

[18] http://ec.europa.eu/enterprise/magazine/articles/single-market/article_9101_en.htm

replaced by flat-screen monitors. So this requirement needs to be evaluated in a future evaluation of the criteria.

Low noise emission is important from an ergonomic and health point of view. A high noise level can lead to stress which in turn can lead to health problems. A high noise level can be disturbing and lead to less effective usage of the computer and in the long run to a replacement of it with a new computer. The noise emission levels were adjusted to the criteria version 6.x. The requirement refers to a standard used by the governmental purchasing organization "The Swedish Agency for Public Management". The requirement levels are still considered relevant. An evaluation of them is suggested for the following revision.

Criteria versions and validity

Criteria version 1.0 was valid from 1995-10-12 to 1998-10-11. The first licence is dated 1997-06-27. The criteria have been revised 5 times.

1998: to version 2.0.

2002: to version 3.0. The main focus was on adjusting the criteria for easy use. The mercury requirement for monitors in the notepad was removed. The packaging requirement was removed.

2004: to version 4.0. The main focus was on harmonizing with EU Ecolabel.

2007: to version 5.0.

2009: to version 6.0. The main focus was on energy consumption.

The Nordic market

Computer sales fluctuate with the economic growth in a country, but the sale of computers will most probably increase over time due to the increasing need of IT equipment. New product types, such as tablets and slate computers, have found new customers and thereby enlarged the market. According to analysts[19] from International Data Corporation (IDC, a market research and analysis firm specializing in information technology, telecommunications and consumer technology) the market share of slate computers will rise to 25 % within 5 years. Many large resellers today see a trend toward an increasing sale of slate computers at the expense of the traditional PC. The sale of traditional desktop computers is decreasing in favour of notebooks and other portable computers.

Nordic Ecolabelling licences

This product group has two licence holders, Fujitsu and Lenovo. Total number of licensed products is 110.

[19] IDC Anders Elbak (article in Computer Sweden) http://www.idg.se/2.1085/1.455046

Other ecolabelling schemes

Ecolabels:

Blue Angel is well known but not so established in the Nordic countries regarding computers. Blue Angel today has (2012-09-07) no licences published for any type of computer according to the latest version of the criteria.

EU Ecolabel is well known in some product groups on the Nordic market but not so well known on others, for example computers. EU Ecolabel today has (2012-09-09) no licences published for any type of computer according to the latest criteria version.

TCO Development develop criteria for IT products. TCO Development is well known in the Nordic countries and around the world and has many licensed products mainly for monitors but also for laptops and desktop computers.

Self-declarations:

Energy Star is a self-declaration but lately accredited test reports are required.

Electronic Product Environmental Assessment Tool **(EPEAT**)[20] and the **IT Eco Declaration** are self-declarations that are well known. The IT Eco Declaration has mainly been developed by the Swedish IT & Telecom Industries[21] association. Both are very popular. The IT Eco Declaration is widely used by purchasers on the Nordic markets and so is EPEAT.

3 About the revision

The goal of the revision

The goal with this revision was to address/update a number of requirements that were identified in the last evaluation of the criteria. These are the RPS analysis, usage of nano silver on surfaces, energy consumption, flame retardants, additives, recycled and bio-based plastic, packaging material and electrical safety.

[20] EPEAT is a registry where manufacturers can declare their products environmental performance and where purchasers can look for this information. See http://www.epeat.net/

[21] Swedish IT and Telecom Industries is a member organization for companies of all sizes within the entire IT and telecom sector. See http://www.itotelekomforetagen.se/om_oss/about_us

About this revision

The project has been carried out with members from Denmark, Norway and Sweden. The planning is based on the results from the evaluation of criteria version 6.x. External contacts have been made with computer manufacturers and public, cabling manufacturers, institutions such as the Swedish Chemical Agency and others in order to gather up- to- date information relevant for the revision of the criteria document.

Project leader:	Björn Simons
Denmark:	Jakob Wegener Waidtløw
Finland:	-
Norway:	Marianne Eskeland
Sweden:	Ove Jansson

4 Motivation of the requirements

Here follows a listing of the requirements and a motivation of them.

Environmental requirements

General description

The intention with this requirement is to see if it is possible to license this product, i.e. it is included in the product definition.

Suggested requirement:

R1 Description of the computer

Describe the computer and how it fulfils the definition of what can carry the Nordic Ecolabel.

✉ Description as specified above.

Energy and power consumption

Energy consumption during the usage phase of a computer, display or small-scale servers is still the most important environmental load when considering the whole life cycle of the product according to new LCA's mentioned above in this document.

In addition to the requirement for energy consumption there is a requirement for the On/Off switch that has to be easily reachable for the user so that the power can be switched of when the computer is not being used.

Nordic Ecolabelling has harmonized the requirement for energy consumption in accordance with that of Energy Star (Environmental Protection Agency). The Energy Star

programme is used by the whole IT sector to classify and qualify their products. The current version (5.1) of the Energy Star criteria is expected to be replaced soon by version 6.0. The proposed new requirement levels represent roughly the current top 25% of Energy Star- approved products, which EPA believes is reasonably reflective of the current computing market. These levels are also in accordance with the ambition of Nordic Ecolabelling.

The Energy Star requirements (proposal version 6.0) use the TEC (Typical Energy Consumption) measure for desktops and notebooks. For workstations the weighted power consumption value P_{TEC} (the off-mode, idle-mode and sleep-mode power consumptions are weighted) is suggested for use and for Small-Scale Servers the measured Off-Mode power, P_{OFF}. For Thin Clients P_{OFF} and P_{SLEEP} will be used to qualify the product.

Below you will find the suggested values for the different categories of the Energy Star version 6.0 requirements.

In the EU Ecolabel criteria for computers the energy requirements are related to the requirements in Energy Star version 5.x. by weighting the requirement levels for the different products by specific % rates in relation to the requirement levels in the Energy Star requirements.

It is not clear when Energy Star version 6.0 will be released. If version 6.0 is released after these criteria are published/adopted our suggestion is that these criteria will use the old version (version 5.x) until version 6.0 is released. When Energy Star 6.0 is released the previously licensed products (according to requirements in Energy Star 5.0) can hold their Nordic Ecolabelling licence for 6 months and will then lose their licences if not relicensed. It is only when Energy Star releases a new "major" version, for example version 6.0 or version 7.0, the Nordic Ecolabelled products will have to be relicensed. A "revision" of the Energy Star specification from for example 6.0 to 6.1 is not regarded as a "new version". Consequently relicensing is not required when a new "revision" is released.

The same applies for displays as for computers when a new major version of the specification for displays is released by Energy Star. The Energy Star specification for displays version 5.0, tier 2, took effect in October 2011. This means that the criteria are now in the second half of their lifetime. So their specifications are still "up- to- date".

The Blue Angel requirements for energy consumption are set to absolute values which correspond to those of the EU Ecolabel requirements.

In the Energy Star requirements (proposal version 6.0) the following requirement levels for the different product categories are presented. These values are still preliminary but probably give quite a good idea of the final levels:

Desktop (Base TEC Allowances for Desktop and Integrated Desktop Computers, where TEC_{BASE} is the basic power consumption value without adders such as those for larger memory etc.):

Product Category	**TEC_{BASE} (kWh): Proposal Version 6.0**
DT 0	100.0
DT 1	103.0
DT 2	135.0
DT 3	190.0

Notebook (Base TEC Allowances for Notebook Computers):

Product Category	TEC_{BASE} (kWh): Proposal Version 6.0
NB 0	25.0
NB 1	25.0
NB 2	25.0
NB 3	27.0
NB 4	30.5

Workstation (P_{TEC}_MAX Calculation for Workstations):

P_{TEC}_MAX ≤ 0.28 * {PMAX + (NHDD * 5)}

Small-scale Server: (Classification & Power Consumption Requirements for Small-scale Servers)

Operational Mode Requirements

P_{OFF_BASE} (watts)	P_{OFF_WOL} (watts)	P_{IDLE_BASE} (watts)	P_{IDLE_HDD} (watts)
1.0	0.4	24.0	8.0

External power supply:

Energy Star no longer has requirements for external power supplies. They refer to the requirements in the International Efficiency Marking Protocol. Nordic Ecolabelling has also chosen to refer to it.

Additional information on the Marking Protocol is available at http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/International_Efficiency_Marking_Protocol.pdf

and

http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/computer/ES_Computers_Draft_1_Version_6.0_Specification.pdf

Regarding displays, the LCAs studied show that parameters other than energy consumption affect the environment, such as gases used in production with high GWP values. Since the steerability of these factors is low Nordic Ecolabelling chooses not to add requirements for them.

Based on the fact that Energy Star is the most commonly used method/programme to determine energy consumption and that Nordic Ecolabelling finds that their requirement levels are relevant from an environmental point of view, Nordic Ecolabelling choose to set the requirements as follows in the Energy/power consumption section:

Suggested requirement:

R2 On/Off switch

Products in categories A-E must have a visible On/Off switch.

✉ Description of the On/Off switch (Appendix 2, power consumption, can be used).

R3 Energy / power consumption of computer

The computer (A-F) must fulfill the requirements of the most up-to-date version of the Energy Star specification for computers. When a new version of an Energy Star specification is released products that have been licensed according to the previous version of the specification have to be relicensed within 6 month in order to continue being licensed. .A link to the current version can be found on the following link www.svanen.se/en/computers.

The following requirements apply to Slate computers:

The AC-adapter must fulfil at least the requirements of "International Efficiency Marking Protocol for External Power supplies" level V.

It must be possible to swap the battery. A replacement battery must be available as an option or spare part. The battery replacement may be done at a repair shop.

✉ The computer must be tested by a laboratory fulfilling requirement R32.

✉ A test report showing the fulfilment of the requirement (Appendix 2, power consumption, can be used).

The following applies to Slate computers:

✉ A test report showing the fulfilment of the requirement for the external power supply.

✉ Declaration from the computer manufacturer that the battery requirement is fulfilled.

R4 Energy / power consumption of display

The display must fulfil the requirements of the most current version of the Energy Star specification for monitors/displays at the date of application. A link to the current version can be found on the following link www.svanen.se/en/computers

✉ The display must be tested by a laboratory fulfilling requirement R32.

✉ Test report showing the fulfilment of the requirement. (Appendix 2, power consumption, can be used).

R5 Energy efficiency of external power supply

External power supply that is sold / delivered with Nordic Ecolabelled products shall meet the performance requirements under the International Efficiency Marking Protocol for External Power Supplies and include the level V marking.

Additional information on the Marking Protocol is available at www.energystar.gov/powersupplies.

Single-output EPS shall meet level V requirements when tested using the *Test Method for Calculating the Energy Efficiency of Single-Voltage External AC-DC and AC-AC Power Supplies, Aug. 11, 2004*.

Multi-output EPS shall meet the level V requirements when tested using the *EPRI* 306 *Generalized Internal Power Supply Efficiency Test Protocol, Rev. 6.4.2*.

A link to version 2.0 (August 2009) of the Energy Star specification for external power supplies can be found at www.svanen.se/en/computers.

✉ The external power supply must be tested by a laboratory fulfilling requirement R32.

✉ Test report showing the fulfilment of the requirement.

Design and material

Disassembly

Computers have a relatively short life cycle and are produced in large volumes. They represent a large amount of material that is of interest to recycle as efficiently as possible. The total amount of products for recycling covered by WEEE (the European Waste Electrical and Electronic Equipment Directive) collected in 2011 in Sweden was 154 000 tons, in Norway about the same and in Denmark 80 000 tons according to information from Elkretsen (the business sector's service company for the collection and recycling of electrical and electronic products implementing the producer responsibility solution). Historical products are heavier than new products. The historical flow is still significant even if the WEEE was established already 2001 according to Elkretsen.

A computer consists of a number of different raw materials of which many are classified as being particularly significant and critical by the European Union (EC 2010)[22]. Many of the critical metals, especially the rare earth metals, show a total end-of-life recycling rate of less than 1 % according to a study carried out by the German institute Oeko-Institut e.V[23]. The recycling situation for precious metals (platinum, palladium, gold and silver) and cobalt is significantly better with rates above 50% according to the study. Unfortunately it is not possible for Nordic Ecolabelling to influence this phase of the recycling process.

With these figures in mind Nordic Ecolabelling find the requirement on disassembly to facilitate recycling important. Not much has changed regarding this issue so the disassembly requirement stays unchanged.

Suggested requirement:

R6 Disassembly

Computers and displays must be designed in such a way that disassembly is possible. The requirement consists of the following individual requirements:

- A qualified person, working alone, must be able to disassemble the product.
- The manufacturer must ensure that disassembly of the unit is possible and compile disassembly instructions demonstrating that:
  - connections are easy to locate and access and easily separable with generally available tools.
  - connections are, where possible, standardized.
- It must be possible to separate the substances, preparations and components listed in ANNEX VII of the WEEE Directive (2012/19/EU).
- If labels are required they shall be easily removable or integrated. This does not apply to safety labels according to CENELEC safety standard EN 60850 §1.7.2.

[22] WEEE directive: http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2012:197:SOM:EN:HTML

[23] http://www.oeko.de/oekodoc/1375/2012-010-en.pdf

- Plastic parts heavier than 25 g must be composed of one polymer or compatible polymers, except for the enclosure, which shall consist of no more than two types of polymers that are separable.
- Plastic parts (>25 g) may contain metallic inlays provided that these can easily be separated without the use of special tools.
- 90% by weight of plastics and metals in the enclosure and chassis must be technically suitable for material recovery.

✉ Disassembly instructions and a declaration from the manufacturer of the product showing that the requirements are met (Appendix 3, Design, can be used).

The ecolabelling organization may request a demonstration of disassembly, if this is considered necessary. The demonstration may take the form of a video film or an inspection visit by the ecolabelling organization. The licence applicant may also choose to arrange for a third party to verify that the product fulfils the requirements. The products that are checked must be selected randomly. The licence applicant will bear the cost of verification.

Upgradeability

The shorter the service life of a computer, the more computers there will be sold and more computers will become waste and the greater the environmental impact. It is therefore important that the service lifetime for a computer can be extended.

A computer must be upgradeable. Configurations that are available to the end customer are often built to meet certain price points in the retail. When buying a computer it is recommended to check that it is upgradeable. When using the computer with standard programmes delivered with it the computer's memory capacity is relevant, but may need to be expanded if, for example, new programmes with larger memory requirements are installed in the future. The primary memory is one of the critical factors regarding the computer's performance. If the primary memory is too small the computer needs to "page out" data from the primary memory to the hard disk which slows down the processing dramatically even if it will still work.

The option to connect a peripheral device to the computer is important in order to take backups to an external hard- disk drive for example. Hard- disk drives are vulnerable since they contain mechanical rotating parts that may stop working. The capacity is limited and may need to be expanded.

This requirement has not been addressed in the revision and stays unchanged.

Suggested requirement:

R7 Upgradeability

Categories A, B, D and F computers

A category A, B, D or F computer must be modular. The user shall be able to replace the modules without the use of special tools and it shall be possible to upgrade the computer by:

- primary memory expansion
- installation, exchange and expansion of mass storage
- installation and/or exchange of CD ROM, DVD and hard- disk drive

- at least one additional interface for external storage media and other peripheral devices.

Category C computers

The design of category C (excluding slate) computers must permit performance expansions (upgrades). At a minimum, the following expansions must be possible:

- primary memory expansion
- port for external monitor
- port for external keyboard and mouse
- at least one additional interface for external storage media and other peripheral devices.

For category C, slate computers the following are required:

- primary memory (RAM) capacity shall be 1 GB minimum
- storage capacity shall be 16 GB minimum
- storage expansion slot (example a SDHC or SDXC slot)
- minimum 1 expansion port/contact) following industry standard for accessories
- support for external monitor, keyboard and mouse.

✉ Declaration from the computer manufacture that the requirement is fulfilled (Appendix 4, Upgradeability, can be used).

The ecolabelling body may request a demonstration of disassembly, if this is considered necessary. The demonstration may take the form of a video film or an inspection visit by the ecolabelling organization. The licence applicant may also choose to arrange for a third party to verify that the product fulfils the requirements. The products that are checked must be selected randomly. The licence applicant will bear the cost of verification.

Chlorine- based plastics

PVC and other halogenated plastics are excluded from use in housings and chassis and in packaging of an ecolabelled computer. This is because there are adverse environmental impacts on disposal of these plastics and that they contain substances with undesirable health effects. When PVC ends up in the waste stream for incineration, it means more chlorine in the waste stream, etc. Chlorine is a prerequisite for the formation of the highly toxic dioxins in flue gas, but since there are several other sources of chlorine than PVC an increased incineration of PVC will not necessarily equal an increased amount of dioxin, as chlorine is not the limiting factor for the formation of dioxins in incinerators[24,25].

[24] Hjelmar, 2002: Forbrænding af PVC: Påvirkning af massestrømmene gennem et forbrændingsanlæg. DHI – Institut for Vand og Miljø

[25] Erichsen & Hauschild, 2000: Technical data for waste incineration – background for modelling of product specific emissions in a life cycle assessment context. Department of manufacturing engineering, Technical University of Denmark, 2000.

The extra amount of PVC will, however, increase the formation of acidic gases and an increased need for gas cleaning with consequent waste from gas treatment. Combustion of 1 kg of PVC produces up to 1.7 kg of salt in flue-gas cleaning[26]. So this means that you can get more waste out of an incinerator - than the amount of waste you sent into it.

PVC waste also contains a number of heavy metals, which can become an environmental problem. Cadmium for example, which is a semi-volatile metal, will to a high extent end up in the flue gases[27]. Regarding today's ecolabelling requirements this is not relevant, since the use of cadmium in PVC is no longer allowed[28].

Lead compounds are often used as a stabilizer in PVC and this is also assumed to be a potential concern regarding environment and health[29].

This requirement has not been evaluated in this revision so it stays unchanged.

Suggested requirement:

R8 Chlorine-based plastics

The enclosure and chassis must not contain chlorine-based plastics.

✉ Declaration from the computer manufacturer, showing that the requirement is met (Appendix 5, Plastics, can be used).

The usage of recycled post-consumer plastics

The possibility to require usage of recycled and post-consumer plastic has been examined

Requirements in Nordic Ecolabelling criteria shall promote quality products that are resource efficient. The requirements shall stimulate resource efficiency, including the requirements for reuse and recycling.

Resource use and waste
Increased consumption depletes the earth's resources and at the same time generates more and more waste. Society is becoming better and better at producing in a resource efficient way and utilizing the waste through reuse and recycling, but much remains. In the work on criteria development, Nordic Ecolabelling promotes sustainable production of raw materials that contribute to a good supply of future natural resources. To minimize resource consumption it is important to reduce material use, ensure recycling and further to secure good waste collection, both in production and by the consumer.

Resource efficiency

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[26] Hjelmar, 2002: Forbrænding af PVC: Påvirkning af massestrømmene gennem et forbrændingsanlæg. DHI – Institut for Vand og Miljø

[27] Ibid

[28] Ibid

[29] MST, 2000: Environmental Project No. 917, 2004. Mass flow analysis for lead 2000 – reviewed version. Environmental Protection Agency, 2000.

Resource efficiency for plastics in the manufacturing of computers can be divided into several separate ways. One is the reuse of pre-consumer plastic in the production of parts. This solution today is very well established in the manufacturing of plastic parts for computers. Nordic Ecolabelling does not consider it necessary to develop any particular requirements for recycled pre-consumer plastic in Nordic Ecolabelled products.

Another way is to use post-consumer plastic in the production of plastic parts. This plastic is collected from the consumer market and then processed for reuse in new products. More about this type of post-consumer plastic can be found at the American Association of Postconsumer Plastic Recyclers[30]. In this area there are a lot of positive initiatives from computer manufacturers, for example monitors with 65% recycled plastic. Also TV sets are to be found that contain an environmentally interesting plastic produced from recycled DVDs and TV screens with an efficient sodium sulphate- based flame retardant which has led to a CO_2 emission that is 80 % lower than that of conventional plastics in the manufacturing phase, according to one computer manufacturer.

Nordic Ecolabelling is positive to this development but is also aware of some problems connected to it. The two foremost problems are what post-consumer plastic is made of from the start, and, secondly, the availability of enough good quality recycled raw plastic. One manufacturer has solved the first problem by only using plastic from recycled DVDs and TV screens. But they then get a problem with the availability of guaranteed volumes, to use it in all their products. So, today this company only uses it for some TV products on the market. Another manufacturer has the same situation; the availability of good recycled plastic materials is only enough for use in some of their display products.

In this review Nordic Ecolabelling do not see that it is possible to introduce a requirement that demands a certain level of post-consumer plastic in all Ecolabelled products. If that would be the case, it could lead to only some few niche products being Nordic Ecolabelled from the computer manufacturer. But developing this kind of requirement, to increase the use of post-consumer plastic, is something that Nordic Ecolabelling would like to do in the future.

The usage of Bio- based plastic

The possibility to require usage of bio- based plastic has been examined.

Resource efficiency
Resource efficiency for plastics in the manufacturing of computers can be divided into several separate ways. In the section above it was discussed about the reuse of pre- and post-consumer plastic in the production of parts. The third alternative that Nordic Ecolabelling investigated in this review was so- called "Bio-based plastics."

Basic information about Bio-based plastic
Plastic is needed today to manufacture computers. For desktop computers it is possible to use less plastic then for laptop computers. But there is an increasing concern about the impact on the environment and human health from the use of plastic. The two major

[30] http://www.plasticsrecycling.org/ , 2012-06-25

sustainability concerns are: it relies on non-renewable resources, and it cannot degrade. Traditional plastics are manufactured using carbon from petroleum. Bio-based plastics are considered more sustainable because they use carbon from renewable resources, such as corn starch, soya bean protein and cellulose. In some cases, they can be biodegradable. In this review focus is on the question regarding what the plastic is based on and not its possibility to be biodegradable.

In the same way as for the use of recycled plastic in computers, some computer manufactures are starting to use Bio-based plastics in some of their products.

There are manufacturers that already have products of non-petroleum-based materials. One example is a mouse with a compostable shell. The mouse contains two wood-based materials that can be disposed of in industrial compost settings, and the remaining parts can be recycled as well. The mouse's shell is entirely made from Arboform and Biograde. Arboform, produced by Tecnaro, is based on lignin, a pulp industry by-product. The lignin is mixed with natural fibres and natural additives to create a composite that can be processed and moulded. Biograde is a wood cellulose-based material made by FKuR, which combines the cellulose with acetates to make synthetic fibre and bio-based plastic. The mouse adds onto this company's previous work with bio-plastics, which can also be found in one of its keyboards, released last year, though only 45 per cent of the keyboard is bio-based. By integrating bio- plastic into the keyboard, they estimate it saves on using about 66 tons of plastic a year[31].



Nordic Ecolabelling welcomes this this development but also see some problems with the use of bio-based plastic that have to be investigated further, such as health and safety hazards in production, land-use and GMO and cultivation methods, and in this review there are not enough resources to do so. As with the use of recycled plastic it is obvious that the availability to use bio-based plastic in products is limited so only some niche products can use bio-based plastic today.

According to recent research within EU[32] it is also questionable that bio-based plastic is not as sustainable as it seems. Although in some aspects bio-based plastics are more sustainable than traditional plastics, the analysis identified several environmental and occupational health and safety hazards in their production. Some bio-based plastics are preferable from a health and safety perspective; these include polyhydroxyalkanoates (PHAs), polylactic acid (PLA) and starch. However, they also have some potential

[31] http://www.greenbiz.com/news/2011/01/25/fujitsu-plastic-free-mouse-designed-composting , 2012-06-26

[32] Alvarez-Chavez, C.R., Edwards, S., Moure-Eraso, R. & Geiser, K. (2012) Sustainability of bio-based plastics: general comparative analysis and recommendations for improvement. *Journal of Cleaner Production.* 23:47-56.

hazards, for example, production of PHA may expose workers to chemicals that are possibly carcinogenic, and PLA production uses a tin-based chemical that could have toxic effects on the hormonal system. Some bio-based plastics are preferable from an environmental perspective, such as starch, PHA and soyaprotein. However, all bio-based plastics require land for production, which may compete with land needed for food. In addition, the feedstock for bio-based plastics may be genetically modified, or grown using toxic pesticides, which can pollute the environment.

Research is currently underway to develop a second generation of bio-based plastics from sources that do not compete with food production, for example, agricultural by-products including corn straw and algae. In addition, processing bio-based feedstocks to produce plastics requires significant amounts of energy and water, but since the processes are in their infancy and on a small-scale, they may become more efficient as they develop[33].

In this review Nordic Ecolabelling do not see that it is possible to introduce a requirement that demands a certain level of bio-based plastic in all Ecolabelled products. If that would be the case, it could lead to only some few niche products being Nordic Ecolabelled from the computer manufacturer. But developing this kind of requirement to increase the use of bio-based plastic is something that Nordic Ecolabelling would like to do in the future.

Paint & Metal and Marking of plastics

Paint & Metal
As in previous and current criteria the metallization and painting of plastic parts is prohibited in the case of desktop computers but permitted in the case of portable computers. This is because metallization and painting with metallic colours is used in portable computers to screen off electromagnetic radiation. Metal inlays (plates) offer better screening, but this is a question of price and possibly also of design (size). In displays, metal plates are required for protection since the frequencies are lower. Accordingly, no paints are used.

Marking of plastics
A standard for marking of plastics has been available now for some time. Nordic Ecolabelling has included this requirement in the criteria in order to provide a basis for an efficient recycling of ecolabelled computers. The main standard is ISO 11469.

ISO 11469 refers to ISO 1043 standard. To be precise, standard ISO 1043, parts 1 to 4 are mentioned in the requirement concerning the labelling of plastics.

Nordic Ecolabelling refers to these standards in current and previous criteria.

Exempted from this requirement are plastic parts with a flat surface of less than 200 mm^2.

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[33] Alvarez-Chavez, C.R., Edwards, S., Moure-Eraso, R. & Geiser, K. (2012) Sustainability of bio-based plastics: general comparative analysis and recommendations for improvement. *Journal of Cleaner Production.* 23:47-56.

With reference to the above, Nordic Ecolabelling find that no changes to the related requirements have to be made.

Fog paint with max. 1 w-% paint per plastic part was included as en exemption since this was not regarded as influencing the quality of the recycled plastic in any significant way.

Suggested requirements:

R9 Paint and metal

Large plastic parts (>25 g) must not be painted or metallized.

Exempted from this requirement are:

- Notebook computers
- Fog paint with max. 1w-% paint per plastic part
- Coatings made from the base polymer

✉ Declaration from the computer manufacturer, showing that the requirement has been met (Appendix 5, Plastics, can be used).

Suggested requirements:

R10 Marking of plastics

Plastic parts heavier than 25 g must carry permanent labelling specifying the material in accordance with the latest versions of ISO 11469 and ISO 1043, sections 1 to 4. This criterion does not apply to extruded plastics or light conductors in flat displays. Plastic parts covering a flat surface of less than 200 mm^2 are also exempted from this requirement.

✉ Declaration from the computer manufacturer, showing that the requirement has been met (Appendix 5, Plastics, can be used).

Additives in plastic

Additives are substances that are added to the plastic to give it certain desired properties. The most common additives are:

- **Softeners/plasticizers -** are used mainly in PVC to give it the elasticity to be bent and twisted without cracking. Phthalates are commonly used as plasticizers
- **Stabilizers -** are used to stabilize the plastic against heat, light, discoloration, degradation, etc.
- **Pigments, dyes** – are used as colourants in plastics
- **Flame retardants –** have their greatest use as additives in various plastic materials.

Nordic Ecolabelling has requirements for flame retardants in criteria version 6.x. In the revised version (7.0) requirements for softeners will be added.

Flame retardants

Plastic parts in products, such as computers and TV- sets, contain flame retardants in order to render them non-flammable. It used to be difficult and time- consuming to get the information about flame retardants used in plastics from the manufacturers. However, this cooperation has developed positively now. Today quite a few commonly used plastics including flame retardants are known to Nordic Ecolabelling from licensing.

Based on data from licensing, Nordic Ecolabelling assess that it is now possible to tighten up the requirements for flame retardants used in plastics. It is therefore suggested that two risk-phrase combinations addressing eco- toxicity, in combination with long term effects on aquatic environment, are to be included in order to avoid such substances in computer products and to reduce the risks associated with them in different stages of the computer's life cycle.

We still have limited knowledge about flame retardants that are used in printed circuit boards. Today TBBPA is the most frequently used flame retardant in printed circuit boards. TBBPA has been assessed by EU and found "acceptable" regarding human health. Regarding aquatic and terrestrial ecosystems EU has concluded that there is a need for further investigation[34]. TBBPA is currently used in over 90 % of the printed circuit boards on the market according to a report from the US EPA[35]. One reason for using this is that the printed circuit boards have to meet the fire safety requirement standard UL 94 V0[36] which is achieved by using TBBPA. With TBBPA as flame retardant it has also been possible to meet performance specifications. The specifications can be difficult to meet due to the layered structure of the printed circuit board, etc. One problem has been that the boards, for example, tend to delaminate at higher temperatures.

Halogen-free alternatives are, however, becoming more available on the market now. Products with motherboards based on printed circuit boards with halogen-free flame retardants are now to be found on the market. However TBBPA is still the dominating flame retardant in printed circuits on the market and therefore the steerability (possibility to choose other products) is not good enough to exact requirements for printed circuit boards. Printed circuit boards are thereby exempted from this requirement.

Cable insulations are also exempted from the requirement. On the external power cable a requirement on the use of phthalates has been introduced.

Flouro-organic additives which are used to improve the physical properties of plastic, provided they are not present in concentrations greater than 0.5% by weight have been exempted in this criterion as is the case with Eco Mark.

The properties of the flame retardants, known at the time of the application, are assessed by Nordic Ecolabelling. If new properties, due to different reasons, are published about a substance that has been approved in connection to a licensing, then Nordic Ecolabelling will ask the licensee to act accordingly and if necessary, in agreement with Nordic Ecolabelling, make changes to the product in order to keep the licence for the product.

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[34] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2008:152:0011:0020:EN:PDF

[35] http://www.epa.gov/dfe/pubs/projects/pcb/index.htm

[36] http://www.ul.com/global/eng/pages/offerings/industries/chemicals/plastics/

Suggested requirement:

R11 Flame retardants in plastics

Flame retardants are assessed on flame retardant product level, i.e. not on their individual ingredient level.

The use of flame retardants that can be assigned one or more of the following risk phrases at the time of application, in accordance with EU chemical legislation, is prohibited:

- H350 (R45) (may cause cancer)
- H340 (R46) (may cause heritable genetic damage)
- H360F (R60) (may impair fertility)
- H360D (R61) (may cause harm to the unborn child).
- H400 and H410 (R50/53) (Very toxic to aquatic organisms, May cause long-term adverse effects in the aquatic environment)
- H411 (R51/53) (Toxic to aquatic organisms, May cause long-term adverse effects in the aquatic environment)

Plastic parts must not contain halogenated organic flame retardants.

The maximum permitted concentration for impurities is 0.1% by weight in homogeneous material.

The manufacturer of the flame retardant must certify that there are reasonable grounds for concluding that the flame retardant used cannot be considered to have the health and environmental effects according to the risk phrases listed above.

Exempted from the requirement are:

- Printed circuit boards and cable insulations. These parts must not, however, contain any PBB (polybrominated biphenyls), PBDE (polybrominated diphenyl ethers), decaBDE or chlorinated paraffins (maximum permitted concentration for impurities is 0.1% by weight in homogeneous material).
- Plastic parts lighter than 25 g. These parts must not, however, contain any PBB (polybrominated biphenyls), PBDE (polybrominated diphenyl ethers), decaBDE or chlorinated paraffins (maximum permitted concentration for impurities is 0.1% by weight in homogenous material).
- Plastic parts that are demonstrably reused and marked in accordance with requirement R10. These parts must not, however, contain any PBB (polybrominated biphenyls), PBDE (polybrominated diphenyl ethers), decaBDE or chlorinated paraffins.
- Flouro-organic additives which are used to improve the physical properties of plastic, provided they are not present in concentrations greater than 0.5% by weight.

✉ The computer manufacturer must provide a list with all plastic parts > 25g in the product and information about which plastic they are made of, and declare that the requirement regarding halogenated organic flame retardants is fulfilled. Appendix 6, Plastics in computer, Computer manufacturer's Declaration must be used.

✉ Declaration from the manufacturer of the plastic (resin) in plastic parts >25g of which flame retardants that are used in the plastic by filling out Appendix 7, Flame retardants in plastics, Plastic manufacturers' Declaration.

- ✉ The manufacturer of flame retardants, used in plastics in plastic parts > 25g, must certify that the requirements for flame retardants are fulfilled by filling out Appendix 8, Flame retardant manufacturer's declaration and submit an MSDS for each flame retardant.
- ✉ Confidential information can be sent directly to Nordic Ecolabelling.

Softeners/Phthalates

Softeners as phthalates are commonly used in cables. Power cables are cables that the user is in contact with and are commonly present where people stay.

Facts about phthalates

Phthalates are mainly used as softeners in plastics and rubber, and the content of phthalates can be up to 40 % of the final product. Particularly notable is the use of DEHP (di (ethylhexyl) phthalate), as softeners in PVC. Softeners are not firmly bound to the PVC polymer. Phthalates can therefore leak out from plastic products throughout their life. This diffuse distribution means that phthalates are found almost everywhere in the environment[37].

DEHP, dibutyl phthalate (DBP) and benzyl butyl phthalate (BBP) are classified as toxic and may impair fertility and cause birth defects. DBP is also classified as environmentally hazardous and highly toxic to aquatic organisms. The three most dangerous phthalates (DEHP, DBP and BBP) are banned in toys and childcare articles. For the three less hazardous substances (DINP, DIDP and DNOP) the ban addresses toys and childcare articles that can be placed in the mouth.

In June 2011 two new phthalates were added to the EU Candidate list by Echa[38]. These new phthalates are to be found as plasticizers in floor coverings, cables etc. All together there are 7 phthalates on the EU Candidate list today and they are:

Substance:	**CAS-nr:**
Diisoheptyl phthalate	71888-89-6
Butyl benzyl phthalate (BBP)	85-68-7
1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters	68515-42-4
Dibutyl phthalate (DBP)	84-74-2
Bis(2-ethylhexyl) phthalate (DEHP)	117-81-7
Diisobutyl phthalate	84-69-5
Bis(2-methoxyethyl) phthalate	117-82-8

[37] Kemikalieinspektionen, http://www.kemi.se/templates/Page____3283.aspx

[38] http://echa.europa.eu/candidate-list-table

Phthalates in cables:

About 25 per cent of all plasticized PVC[39] is used by the wire, cable and electrical industries.

PVC's elasticity for bending and twisting without cracking is a safety feature which makes it particularly suitable for a wide range of applications. This flexibility is provided by the addition of plasticizers, such as DEHP[40] that are mixed with the PVC before it is extruded around the metal wires to insulate and sheath.

Higher Molecular Weight phthalates as DPHP are also used in wires and cables but are currently not considered to be problematic according to European Council for Plasticisers and Intermediates (ECPI).[41]

To prohibit phthalates in the computer is connected to some difficulties, amongst others related to REACH[42]. REACH regards components such as a power supply as an article which implies that the phthalate content can be accepted due to the relatively high weight of the article in relation to the weight of the phthalate content. When an article such as a power supply is bought by a computer manufacturer it is normally not possible to get any information about the internal cabling content.

Not all suppliers to computer manufacturers and not all computer manufacturers seem to have started yet to plan for the future restriction regarding phthalates as far as Nordic Ecolabelling has seen. So the steerability of it is not good enough to require too much now. Nordic Ecolabelling though still think that the effect of a limited requirement on the use of phthalates would be valuable in order to focus on problems associated with the use of phthalates. Nordic Ecolabelling therefore suggest only to focus on the power cable that is used to connect the computer to the mains. Only cables equipped with male/female connector to connect to the computer or AC-adapter are addressed, not cables that are hardwired to the equipment. The volume of the plastic in a ”normal” power cable of a desktop computer is considerably high compared to the volume of the plastic in other cables inside the computer. Cables used internally in a PC are limited to short distances and are of a lower diameter compared to external power cables mainly due to the lower voltage levels inside the PC. The power cable is also exposed more to human contact and mechanical stress. So by focusing on the power cable in this requirement it should be a good approach to start with. The manufacturers have the possibility to redesign this in order to meet our requirements when necessary. Alternatives[43] are available on the market today, even halogen-free cables. If no halogen-free alternatives are to be preferred, phthalates can still be used (and are used) in cables, such as PINP and DIDP, which are not on the candidate list of REACH. The price of a halogen- free cable is approximately 10 to 30% higher than for a PVC- based today. In the coming revisions Nordic Ecolabelling will investigate if it will be possible to introduce a more comprehensive requirement.

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[39] http://www.dehp-facts.com/cables

[40] Ibid

[41] http://www.plasticisers.org/plasticisers/high-phthalates

[42] Regulation (EC) No 1907/2006

[43] www.nexans.se

Proposed requirement:

R12 Softeners/Phthalates

The External power cable delivered with the computer, or the display, must be free from phthalates listed on the REACH Candidate List[44]. Reference shall be made on the date of application.

The maximum permitted concentration for impurities is 0.1% by weight in homogeneous material.

✉ The manufacturer of the computer must certify that the requirement is fulfilled and include a specification of the material that is used in the cable.

Nickel in metal parts

Allergy towards nickel is seen in up to 17% of females and 3% of men, and earlier the most frequent cause was contact with different products made of bright metal such as buttons, zippers, or jewellery. This led to implementation of regulation that limited the release of nickel from consumer products, and these measures has resulted in a decrease in the occurrence of allergy towards nickel. However, recently it has been described that other types of consumer products, e.g. mobile phones and computers may release substantial amounts of nickel and thus be a cause of nickel allergy. Therefore it is relevant to ensure that computers labelled with the Nordic Ecolabel do not release nickel[45].

Proposed requirement:

R13 Nickel in metal parts

Metal parts that may come in contact with the skin during normal use of the computer must not contain nickel.

✉ Declaration from the manufacturer that the requirement is fulfilled.

Mercury content

Mercury- free background lighting in displays and notebooks is commercially available today. Light emitting diodes are used as the light source in a technique called LED. Nordic Ecolabelling therefore suggest that mercury should be prohibited as background lighting in displays and notebooks in this criterion.

[44] article 59(1) of Regulation (EC) No 1907/2006

[45] Nickel allergy and dermatitis following the use of a laptop computer. Jensen P, Jellesen MD, Møller P, Frankild S, Johansen JD, Thyssen JP. J Am Acad Dermatol 2012, 67(4).

Forms of mercury
Mercury is a naturally occurring element that is found in air, water and soil. It exists in several forms: elemental or metallic mercury, inorganic mercury compounds, and organic mercury compounds[46].

Sources of mercury
Mercury is an element in the earth's crust. Humans cannot create or destroy mercury. Pure mercury is a liquid metal, sometimes referred to as quicksilver that volatizes readily. It has traditionally been used to make products like thermometers, switches, and some light bulbs[47].

Health effects of mercury
Mercury exposure at high levels can harm the brain, heart, kidneys, lungs, and immune system of people of all ages. Research shows that most people's fish consumption does not cause a health concern. However, it has been demonstrated that high levels of methylmercury in the bloodstream of unborn babies and young children may harm the developing nervous system, making the child less able to think and learn[48].

Proposed requirement:

R14 Mercury in LCD displays

Mercury is prohibited in background lighting in all displays.

✉ Declaration from the manufacturer that the requirement is fulfilled.

Nano metals

As far as Nordic Ecolabelling know biocides are not used today in computers but nano silver has been mentioned as a biocide used to achieve an anti-bacterial effect on the PC-keyboard surface.

Nano silver has an anti-bacterial effect that in itself is extra problematic. The usage of nano silver is today debated in a similar way as anti-bacterial products were during the 1990s. Silver is very toxic to aquatic organisms and bacteria in the soil[49]. There is also a study that shows development of antibiotic resistance to bacteria that are exposed to nano silver, which is worrying from environmental point of view. Several environmental experts question the usage of silver for anti-bacterial purposes and are of the opinion that the potential negative effects on the environment will exceed the positive effects declared by producers and retailers. Each year more than 1000 kg of nano silver is used in

[46] http://www.epa.gov/hg/about.htm

[47] Ibid

[48] Ibid

[49] M. Adolfsson-Erici og M. Allmyr: "Antibakteriellt behandlade konsumentprodukter – källa till exponering av människa och miljö?", Institutionen för Tillämpad Miljövetenskap, ITM, Stockholms universitet, ISSN: 1653-9168, 2007
http://www.stockholm.se/upload/Fackforvaltningar/Miljöförvaltningen/Dokument/rapporter/0703_antibakt eriellt_konsumentprodukter.pdf

environmentally sensitive environments[50] but still the effects on the environment are not very well known. On the Hohenstein Institute in Bönnigheim in Germany studies are conducted on the effects of nano silver on the environment. The project started in 2011 and is being carried out in cooperation with 16 partners from universities, the industry and authorities from several countries. The main task is to find out what effect textile products, that have been treated with nano silver and are used daily, have on the environment.

Even if there is no information that nano silver is used on a PC keyboard today, it is important that Nordic Ecolabelling have a standpoint in this issue and suggest the following requirement to be included in the criteria:

Suggested requirement:

R15 Nano metals

Nano metals, for example nano silver, nano gold and nano copper, shall not actively have been added to the surface of the product or be part of the product's surface.

Nano particles here are defined as industrially produced particles with at least one of its dimensions under 100 nm. Traces of Nano particles that not have been added in order to give the product a certain property are exempted from this requirement.

✉ Declaration from the computer manufacturer that nano metals have not actively been added to the surface of the product or are part of the product's surface.

Requirements on packaging

Packaging

For some products packaging constitutes a significant part of the volume and weight. For other products, the packaging is secondary. Packaging components may consist of materials that have harmful effects on both environment or health such as PVC or other halogenated plastics, which can cause environmental problems on disposal. Another important aspect is the recycling of the materials used in the packaging. Recycling of the packaging material is mandatory in the Nordic countries. Producers and retailers have to be connected to a recycling solution. In Sweden producers have joined REPA to fulfil their obligations regarding the recycling of packaging material.

The following statement about packaging material can be found in the EU Ecolabel criteria for computers:

"*Packaging is an integral part of the goods supply chain. It is used to protect goods from damage, allows efficient distribution, informs the consumer and in some cases, although less for office IT equipment, helps to promote goods. Environmental issues relating to the packaging include resource consumption, primary energy consumption whilst making the packaging, environmental effects of chemicals used in the packaging (particularly chlorinated plastics) and the process of making it and waste generation.*

[50] http://www.afbw.eu/?p=555 (9/5-11)

Although this represents a very small proportion of the total environmental impact of office IT equipment, as with any consumer products, it is important to consider packaging and it is also easy for producers to put simple conditions in place when tendering. For example, the quantity and type of packaging used and the opportunities for recycling should be considered".

Manufacturers of IT equipment have a clear interest to use recycled material in their packaging. Regarding cardboard it has not been possible to find the optimum level of recycled content in a packaging box. One producer requires usage of more than 50% recycled material in the cardboard box. Another manufacturer claims that the quality/ function of the box deteriorates when the portion of recycled cardboard becomes too high. The stability and strength of the packaging will not be good enough. To compensate for that, by increasing the amount of material in the walls of the box, becomes contra- productive at a certain concentration. Recycling cardboard requires only 75% of the energy required to make new cardboard[51]. Weak packaging can also result in damaged products in the end which in turn can lead to production of replacement products. The optimum level of recycled material depends on the weight and volume of the goods contained in the packaging.

New alternative packaging materials are now available and used to some extent already. Bamboo can for example be used as an alternative to paper and corrugated boards. One large computer manufacturer already today uses bamboo in the packaging material for a number of their products.

Another manufacturer uses corrugated cardboard made from a minimum of 25% post-consumer recycled content and moulded fibre made entirely from post-consumer recycled content.

Also other solutions are to be found today on the PC market. Packaging material, made from 100 per cent recycled thermoformed cushions, enables the PCs to be stacked together and requires less packaging material. This new material also helps minimize shipping costs.

Also 100% post-consumer moulded fibre (paper pulp) packaging is used which can typically be readily recycled in municipal waste streams. The use of polystyrene packaging is discouraged wherever possible by this manufacturer who instead encourages the use of moulded pulp and fibre and LDPE (Low-density polyethylene). In the internal packaging specification of this company the requirements are:

For corrugated fibreboard the recycled content shall be min 50%. No specific percentage for plastic since the availability of the different plastic types varies. For example, polyurethane foams are currently produced using a process that does not permit recycled resin to supplement prime material while some HDPE (High-density polyethylene) materials can achieve up to 100% recycled content. The requirement is as high percentage as possible.

The conclusion of the above is that new packaging solutions are now available and are being developed. Some solutions will be adopted on a large scale in the future. The tradetional packaging materials such as cardboard are still very much used and are increasing in volume compared to the economic growth of the world[52] according to EC Nova

[51] http://www.bir.org/industry/paper/

[52] http://ec.europa.eu/research/energy/pdf/gp/gp_events/biorefinery/bs4_05_gahle_en.pdf

Institute on behalf of EU. Expansion is at the expense of plastic materials. Still, plastic material is used. Therefore focus is on cardboard material regarding recycled content. PVC will be banned regarding plastic materials.

Nordic Ecolabelling suggest introducing two requirements for packaging, one requirement for the use of recycled material and the other for prohibition of usage of halogenated organic substances in plastic materials in packaging.

Proposed requirement

R16 Recycled material in packaging

When cardboard boxes are used, they shall be made of at least 80% post-consumer recycled material.

✉ Declaration of compliance from computer manufacturer. Only primary packaging, as defined in Directive Packaging , is subject to the requirement (Appendix 9, Packaging may be used).

R17 Plastic materials in packaging

Plastic material used as packaging material must not consist of, or contain, halogenated organic substances.

✉ Declaration from the computer manufacturer Description of the packaging materials used (Appendix 9, Packaging may be used).

User information

Instructions for use

It is important that consumers are equipped with instructions on how to reduce the environmental impact of the computer such as by utilizing the existing energy-saving settings.

One sub-requirement, "Advice on how consumers can take advantage of the manufacturer's offer to take back used products" has been removed from the requirement because it was almost equal to another sub-requirement (i.e. Advice on how used products and their packaging are recycled or disposed of in an environmentally acceptable way (deposit system, handling and recycling as well as scrapping) by the manufacturer or a third party. Information shall also be provided on where users can dispose of used products). The other sub-requirements are all still relevant and up- to- date.

Suggested requirement:

R18 Instructions for use

The following information must be provided to consumers, for example in the instruction manual or information sheets for the individual product:

- Recommendations on the use of the energy-saving functions. This must include information about the effect that power consumption, and accordingly operating costs, may increase if these functions are deactivated.

- Information on the power consumption of the computer during operation, in energy-saving mode and in off-mode and information about the effect that the consumption of mains current can be reduced to zero if the plug of the computer or the power source of the portable computer is removed or if the mains socket is turned off.
- Maximum declared sound power (A-weighted sound power level according to ISO 7779 and ISO 9296) during operation and in idle mode.
- Information on the guarantee and the availability of spare parts.
- Information on the design of the equipment and expansion or upgrading of for example the processor and memory.
- Information on the type of batteries and accumulators used and on the user's obligation to leave used batteries and accumulators at a return station and not dispose of them with household waste.
- Information that the product has been designed to permit the reuse and recycling of parts.
- Advice on how used products and their packaging are recycled or disposed of in an environmentally acceptable way (deposit system, handling and recycling as well as scrapping) by the manufacturer or a third party. Information shall also be provided on where users can dispose of used products.
- Information on how the customer can use the service and support function.
- Statement that the product has been granted a Nordic Ecolabel and a short account of what this means with references to further information about Nordic Ecolabelling on the Internet (http://www.ecolabel.se).
- The instructions must state that the regulations in force in the country/municipality in question must be observed when disposing of batteries and accumulators.
- The instructions for use must be in the official language(s) of the Nordic country in which the Nordic Ecolabelled product is sold.
- The instruction manual must be available in printed or electronic form. If the manual is made available in an electronic form, information on how the computer is connected and started and information on how to print out the manual must be provided in printed form.

✉ A copy of the manual or copies of the relevant pages

Requirements as to performance properties

Requirements as regards efficiency/functioning are not primarily set for environmental reasons. With these requirements, Nordic Ecolabelling aims to guarantee the high quality of the ecolabelled products.

Noise

Noise is primarily a health issue. The main indoor noise sources are ventilation systems, office machines, home appliances and neighbours according to a WHO[53] report about

[53] http://www.who.int/docstore/peh/noise/ComnoiseExec.htm

community noise. In contrast to many other environmental problems, noise pollutant continues to grow and it is accompanied by an increasing number of complaints from people exposed to it.

The growth in noise pollution is unsustainable because it involves direct, as well as cumulative, adverse health effects. Noise can cause noise-induced hearing impairment, disturbances of rest and sleep, psychophysiological mental health and performance problems according to the same report. Research in recent years has shown that exposure to constant noise can cause an increase of the stress hormones in the body. Stress can cause heart failure, immunity problems, hypertension, and strokes according to another WHO report[54].

With reference to the above, sound requirements are relevant in ecolabelling criteria for computers. A low sound emission is required for a healthy usage of the computer. Nordic Ecolabelling adopted sound requirements according to "Statskontoret Technical Standard TN 26:6 Acoustical Noise Emission of Information Technology Equipment". Statskontoret is the Swedish Agency for Administrative Development. In the latest evaluation of these criteria the sound levels required were found to be adequate and just as strict as those in other Ecolabelling schemes. The required levels will also be used in the new criteria version. For category F no limit is defined but a sound report is required for information purposes.

Proposed requirement

R19 Noise emission

The computer must fulfil the requirements as to maximum (A-weighted) sound power level LwAd (bel(A)) during operation and idle mode in accordance with the following:

	Operating, LwAd	**Idle mode, LwAd**
Category A, B and D	4.2 bel (A)	3.8 bel (A)
Category C and E	4.0 bel (A)	3.5 bel (A)
Category F	Sound report	

Operating (HDD load): The hard- disk drive is activated (RAL-UZ-78 3.2.2.1 (1) or ISO7779/A1:2001, No C.9.3.2).
E.g.: Test programme "Diskload" of all HDD with parameter: "Diskload c: -t7200 dac960_loc c:12" (c=Drive name).
Idle mode: The computer operates in Idle mode (RAL-UZ-78 3.2.2.1 (3) or ISO7779:2001, No C. 15.3.1). The OS is running, but no additional programme is started. HDD is running without I/O (only spindle motor in operation). All other devices are connected but not activated.

The sound power level of the computer must be measured in accordance with ISO 7779 or RAL-UZ 78 and declared in accordance with ISO 9296. If the sound power level measurement is carried out on one appliance only the factor K = 3.0 dB(A) shall be added to the measured value. Factor K allows for measurement errors when the same device is tested using the same method at different times under different conditions and for deviations in production.

✉ Measurement results with a description of the method of measurement used and details of who performed the measurement.

[54] http://www.cardioblog.org/entry/noise-pollution-triggers-heart-disease-who-study/

Ergonomics

It is important to guarantee that ecolabelled computers achieve a certain level of ergonomics in order for the user to feel comfortable with the product. The requirement levels in the current version are assessed to be very good. The standard referenced to in the requirement was upgraded to the latest version (ISO 9241-300 series) in the current criteria (version 6.x). Therefore these requirements are not tightened up now.

Specific requirements have been included for the slate computer in order not to make it possible to license smartphones which are similar to slate computers in many ways, but are primarily intended to be used as phones. If though a slate computer, that meet our requirements for licensing has a phone function, it will be possible to license since its primary usage is not as a phone but as a computing device.

R20 Ergonomics

Displays and notebook computers must, with regard to ergonomics, be tested and meet all relevant mandatory requirements in the latest valid version of the standards of ISO 9241-300 series.

Alternatively, displays must be certified according to TCO Displays 5.0 or later version, and notebook computers must be certified according to TCO Notebooks 3.0 or later version.

External keyboards sold with computers in category A and D shall comply with and be tested according to ISO 9241-4.

The following additional requirements apply for a Slate computer:

- The display size shall be minimum 7 inches.
- The slate computer shall have a virtual keyboard that is full size in the meaning that standard positioning of fingers is possible

✉ Certificate from the computer manufacturer that the additional requirements on the Slate computer are fulfilled (when applicable).

At least one of the following documentation requirements must be fulfilled.

✉ A certificate from the computer manufacturer confirming that all relevant mandatory requirements of the latest version of the standards of ISO 9241-300 respectively ISO 9241-4 are met. The certificate shall be signed by the person at the computer manufacturer's who has the ultimate responsibility for the products' specification. An organization chart in which the above person's position is indicated shall be submitted.

✉ The TCO certificate for the product. For displays, TCO Displays V5.0 or later, for notebook computers, TCO Notebooks 3.0 or later.

Electric and magnetic fields

As mentioned above in the chapter "Motivation for Nordic Ecolabelling" electromagnetic fields have been discussed regarding their hazardous properties.

This requirement addressed originally the radiation from CRT monitors as mentioned in chapter 2. It has not been evaluated particularly in the revision. The reference to the standard prEN50279, category A, has been changed however, to the standard SS 436 14 90, category A, due to the reason that the former is not available publicly (any more). The later standard is.

Suggested requirement:

R21 Electric and magnetic fields

Displays and notebook computers must fulfil the requirements applicable to electrical and magnetic fields in accordance with SS 436 14 90, category A.

During measurement the portable computer must be connected to a Class 1 AC adapter with a grounded plug. The requirement also applies when the notebook computer is connected to a docking unit.

At least one of the following documentation requirements must be fulfilled.

✉ A certificate confirming that the requirements concerning electric and magnetic fields according to SS 436 14 90, category A, are met. The certificate must be signed by the person who has the ultimate responsibility for the design of the product. An organization chart showing the position of this person must be included. Measurement results with a description of the method of measurement used and details of who performed the measurement.

✉ The TCO certificate for the product. For displays TCO Display V5.0 or later, for portable computers TCO Notebooks 3.0 or later.

Electrical safety

This revision has been examined in case the requirement for electrical safety should again be included in the criteria.

The requirement for electrical safety was removed from the criteria, version 5.0, when the CE marking became mandatory. Since CE marking is a self-declaration and as such can vary in "quality" regarding actions taken to certify the fulfilment of the requirements Nordic Ecolabelling decided to reassess the need for a dedicated electrical safety requirement in order to guarantee high quality of the ecolabelled product also in this respect.

Electrical safety concerns the electrical design of apparatus with respect to its electrical insulation and other arrangements that are intended to prevent accidents resulting from contact with live components, and the risk of fire or explosion as a result of electrical flashover due to inadequate or faulty electrical insulation.

It is the manufacturer who is responsible for ensuring that a product is safe. In order to assess the safety of products, the authorities, together with the industry, have compiled standards for different product groups.

Standards are often international and apply, at least, throughout the European Economic Area. When a new product is developed, it is appropriate at an early stage to determine which standard the product shall comply with. The computer and the internal or external power supply/supplies shall be certified in accordance with EN/IEC 60 950-1.

The manufacturer produces technical documentation for the product. When the product has been developed and manufactured, the manufacturer produces a Declaration of Conformity. Products falling under IEC / EN 60 950-1 must be able to demonstrate that the product complies with EU requirements in the directives: LVD (Low Voltage Directive), EMC (Electromagnetic Compatibility), R & TTE (Radio & Telecommunications Terminal if there is such equipment) and ErP (Energy related Products).

The product can be CE-marked when these documents are available. The manufacturer always has the possibility to use an independent test body to test the product. A number of test bodies are accredited to certify products.

In the Nordic countries there are governmental organizations who conduct inspections of the above areas, especially in the form of market surveillance.

The reason for deletion in version 5.0 was that the CE-label covers electrical safety. Nordic Ecolabelling does not find any reason to develop a new requirement for electrical safety again. Nordic Ecolabelling has been in contact with the Swedish National Electrical Safety Board and some large manufacturer of computers. They all agree that there are no reasons to have a specific requirement for electric safety. The CE-label covers electrical safety and there is a well-developed market control done by governmental organizations in the Nordic countries and the EU. So the conclusion from Nordic Ecolabelling is therefore not to include this requirement again into the criteria.

5 Changes from previous version

Below follows a summary of the changed requirement for these criteria.

Version 6.3 number	Version 7.0 number	Requirement name	Change description
R3	R3	Energy & power consumption (categories A-E)	The requirement has been changed regarding the validity of licence in relation to new version of Energy Star requirements.
R5	R4	Energy & power consumption, display (categories A-E)	The requirement has been changed regarding the validity of licence in relation to new version of Energy Star requirements.
R6	R5	Energy efficiency of external power supply	The Energy Star requirements do not include external power supplies any more. Therefore requirement has been changed to refer to International Efficiency Marking Protocol
R12	R11	Flame retardants in plastic parts	The requirement has been strengthened by including also ban on risk phrases connected to aquatic organisms for plastics >25 g.
New	R12	Softeners/Phthalates	The use of phthalates from the candidate list of REACH as of 2012-06-30 is prohibited in external power cables delivered with the product.
New	R13	Nickel in metal parts	Nickel in metal parts in contact with user
R13	R14	Mercury in LCD displays	Mercury has been prohibited in background lighting.
New	R15	Nano metals	The use of nano metals on the surface of the product.
New	R16	Recycled material in the packaging	When cardboard boxes are used, they shall be made of at least 80% post-consumer recycled material.
New	R17	Plastic materials in packaging	Plastic material used as packaging material must not consist of, or contain, halogenated organic substances.
R14	R19	Instructions for use	Following sub-requirement (text block) has been removed from the requirement: "Advice on how consumers can take advantage of the manufacturer's offer to take back used products".
R17	R22	Electric and magnetic fields	The reference to the standard prEN50279, category A, has been changed to the standard SS 436 14 90, category A, due to the reason that the former is not available publicly (any more).

6 New requirements

In a forthcoming revision it might be of interest to take a look again at some of the following requirements. Knowledge about available flame retardants increases and halogen- free alternatives have been developed.

- The LCD module manufacturing, emission of greenhouse gases (sulphur hexafluoride, SF_6 and others)
- Flame retardants in plastic (alternatives, documentation / assessment of the properties)
- Additives in plastic (phthalates)
- Reused- and Bioplastic
- Electric and magnetic fields (also from wireless communication)
- Ergonomic requirements
- Packaging