JRC TECHNICAL REPORTS

Development of European Ecolabel and Green Public Procurement Criteria for Desktop and Notebook Computers

TECHNICAL REPORT, TASK 1

Scope and Definitions

(Draft) Working Document

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INTRODUCTION

This draft Task report is intended to provide the background information for the revision of the EU Ecolabel and Green Public Procurement (GPP) criteria for televisions. The study has been carried out by the Joint Research Centre's Institute for Prospective Technological Studies (JRC-IPTS) with technical support from the Öko-Institut e.V. (OEKO). The work is being developed for the European Commission's Directorate General for the Environment.

The EU Ecolabel and GPP criteria form key voluntary policy instruments within the European Commission's Sustainable Consumption and Production and Sustainable Industrial Policy (SCP/SIP) Action Plan and the Roadmap for a Resource-Efficient Europe. The Roadmap seeks to move the economy of Europe onto a more resource efficient path by 2020 in order to become more competitive and to create growth and employment.

The EU Ecolabel promotes the production and consumption of products with a reduced environmental impact along the life cycle and is awarded only to the best (environmental) performing products in the market. Similarly, GPP provides common criteria for public authorities to 'green' their procurement practices.

An important part of the process for developing or revising Ecolabel and GPP criteria is the involvement of stakeholders through publication of and consultation on draft technical reports and criteria proposals and through stakeholder involvement in working group meetings. This document sets the scene for the discussions planned to take place at the two working group meetings planned in 2013/2014.

This draft Task 1 report addresses the requirements of the Ecolabel Regulation No 66/2010 for technical evidence to inform criteria revision. It consists of background information, including a description of the legal framework.

Together with a market and a technical analysis (Tasks 2 and 3) and input from stakeholders, the information will be used to determine the focus for the revision process and present an initial set of criteria proposals.

1. DEFINITION AND CATEGORISATION

1.1 Background

1.1.1 *The EU product policy framework*

The EU Ecolabel and GPP criteria form key voluntary policy instruments within the European Commission's Sustainable Consumption and Production and Sustainable Industrial Policy (SCP/SIP) Action Plan (2008) and the Roadmap for a Resource-Efficient Europe (2020). Both form important components of the European Commission's broader strategy to support green growth and eco-innovation.

On 16 July 2008 the European Commission presented the Sustainable Consumption and Production and Sustainable Industrial Policy (SCP/SIP) Action Plan. The plan includes a series of proposals on sustainable consumption and production aimed at:

- improving the environmental performance of products;
- increasing the demand for more sustainable goods and technologies;
- stimulating innovation by EU industry.

The EU Integrated Product Policy (IPP) formed a key element of the Action Plan, which proposes a combination of voluntary and mandatory instruments which seek to reduce the environmental impacts arising from products and services along all the phases of their life-cycle.

Two important voluntary policy instruments within the IPP and which were highlighted by the SCP/SIP were the EU Ecolabel and the EU Green Public Procurement (GPP), both of which are intended to promote products and services which demonstrate lower negative environmental impacts when compared with functionally alternative options belonging to the same product/service group. In doing so, these schemes can contribute to the wider objectives of competitiveness and green growth within the EU.

The Roadmap for a Resource-Efficient Europe, which was published in September 2011 and forms part of the Europe 2020 Strategy, further re-inforces the role of the EU Ecolabel and EU Green Public Procurement. The aim of the Roadmap is to move

the economy of Europe onto a more resource efficient path by 2020 in order to become more competitive and to create growth and employment. The role of the Ecolabel is highlighted as key action that will contribute towards improving products and changing consumption patterns.

Returning to the SCP/IP, the role of the Ecolabel was highlighted as complementing the information provided to consumers and in acting as a 'label of excellence' that signal to consumers that products perform better in relation to environmental criteria over the whole product life-cycle. It was also intended that the process of setting criteria for the Ecolabel provides useful information for other policy instruments, such the expanded Ecodesign Directive proposed under the Roadmap for a resource-efficient Europe.

GPP was highlighted by both the SCP/IP and the 2020 Roadmap as a route through which the Commission will provide guidance and tools for public authorities to 'green' their procurement practices. This will include the setting of common GPP criteria for products and services together with indicative targets based on the level of the best performing member states.

According to the Communication 'Building the Single Market for Green Products' from the EU Commission (COM (2013) 196), in general better information on the environmental performance of products should be facilitated. This should be done by gradually incorporating the Product Environmental Footprint (PEF) methodology as appropriate inter alia in its Green Public Procurement (GPP) and in the EU Ecolabel policies. This also includes the use of the International Reference Life Cycle Data System (ILCD) Handbook, which provides technical guidance for detailed LCA studies and the technical basis to derive product category-specific criteria. In the current revision process of Ecolabel criteria for televisions, these methodological references will be taken into account within Task 3 'Technical Analysis'.

The EU Ecolabel currently covers a wide list of products and services, with further groups being continuously added. In the EU Ecolabel work plan 2011-2015, the European Union Ecolabelling Board (EUEB) and the European Commission determined "personal computers" and "portable computers" as product categories for

revision starting 2012. It is recommended to revise the electronics groups “televisions”, “personal computers” and “notebook computers” at the same time. For desktop and notebook computers, the criteria should be merged according to the EU Ecolabel work plan.

1.1.2 *Aim and approach of Task 1*

The aim of the Task 1 report is to provide an overview of existing statistical and technical categories, relevant legislation and standards, and to propose on that basis the scope and definition of the product for the revised criteria. In a second step, feedback will be gathered from stakeholders regarding the practicability of the proposed product group definition and scope as well as the revised criteria. Based on this stakeholder feedback, the product group definition and scope might be confirmed, or otherwise a revised scope and definition of the product group will be proposed.

Focused on the proposed scope definition, and based on existing material from the previous criteria development, relevant legislation, tests and technical standards of political relevance for the product at EU and Member State level are identified and updated. Non-EU legislation and standards are also included where relevant.

1.2 Scope definition

This section provides a summary of initial findings and recommendations under **Task 1 "Definition and categorisation"** in which existing definitions under the European Ecolabel, EU Energy Star, TCO, Blue Angel and Nordic Swan were analysed (note: other relevant non-European ecolabels like e.g. EPEAT will be considered in the following tasks such as the detailed criteria analysis in Task 3). Basic information is included in the report and any other evidence is included as an **Annex** to this study.

1.2.1 *Overview*

The current scope of the EU Ecolabel criteria documents for desktop and notebook computers are defined in article 1 of the Commission Decision of 9 June 2011

"establishing the ecological criteria for the award of the EU Ecolabel for personal computers" [Decision 2011/337/EU] and of the Commission Decision of 6 June 2011 "establishing the ecological criteria for the award of the EU Ecolabel for notebook computers" [Decision 2011/330/EU].

The following table provides an overview of the different product sub-categories defined and specified by the various ecolabelling schemes reviewed by this study.

Table 1: Sub-categories for personal computers & notebook computers covered by ecolabelling schemes

	General definition for Computer	Desktop Computer	Integrated Desktop Computer	Thin Client	Integrated Thin Client	Mobile Thin Client	Keyboard	Notebook Computer	Netbook	Tablet Computer (with keyboard)	Tablet Computer (without keyboard)	E-Book Reader	Small-Scale Server	Workstation	Display
Draft EU Ecodesign Regulation	x	x	x	x				x		x (a)	x (c)		x	x	
European Ecolabel	x	x	x	x			x	x		x (a)	x (a)				x
Energy Star Computer 5.2	x	x	x	x				x		x (a)	x (c)		x	x	
Energy Star Computer 6.0, Draft 3	x	x	x	x	x	x (a)		x		x (a)			x	x	
Energy Star Displays 6.0															x
TCO		x	x (b)					x			x				x
Blue Angel	x	x	x	x			x	x	x	x (a)	x (a)	x	x	x	x
Nordic Swan	x	x	x	x				x		x (a)	x (a)		x	x	x

(a) Part of Notebook Computers / (b) Termed "All-in-one PC" / (c) Definition available ("Slate Computing Device"). Energy Star: not in scope of the labelling-scheme

1.2.2 *Summary findings on product scope definition*

The analysis of existing definitions under the European Ecolabel, EU Energy Star (including draft v6.0), TCO, Blue Angel and Nordic Swan, as well as the draft [1] EU Ecodesign Regulation and, where relevant, initial market information revealed the following findings:

1.2.2.1 Definitions of computers

- The definitions of EU Energy Star, the Blue Angel and Nordic Swan are widely identical in many aspects (general definition of computers, definitions for Desktop Computers, Integrated Desktop-Computers, Small-scale Servers, Workstations, and Thin Clients). Differences in the definitions are mostly of a stylistic nature (e.g. the order of certain sentences) and do not cause any differences in the product scope.
- While the European Ecolabel also shares the definitions of Computers, Desktop Computers, Integrated Desktop-Computers, Thin Clients and Notebooks with those of other ecolabels (Energy Star 5.2, Blue Angel, Nordic Swan), the EU Ecolabel does not include Workstations and Small-Scale servers in its scope.
- The harmonised approaches for most definitions are also partly justified by the fact that most eco-labels use the EU Energy Star criteria for energy related benchmarks [2]. It is believed that a coherent approach for energy related benchmarks is facilitated by harmonised product definitions. Nevertheless, it is noteworthy that TCO uses own product definitions despite relying on energy

[1] The analysis regarding scope and definitions has taken place at the beginning of 2013; meanwhile, the EU Ecodesign Regulation for computers and computer servers has been adopted (2013/617/EU); however, the scope and definitions of computers were not altered compared to the analysed draft regulation.

[2] While some eco-labels fully adapted the Energy Star benchmarks in its criteria documents, others – such as the European Ecolabel – require more ambitious targets which are also based on Energy Star product classes (e.g. -25% of Energy Star benchmarks).

requirements of Energy Star. However, the TCO-definitions are – despite diverging wording – largely in line with the definitions of the corresponding sub-groups under Energy Star [3].

- A major difference of the Blue Angel is a separate definition for Netbooks, whereas they are subsumed under Notebooks in all other labelling schemes.
- The separate definition of E-Book Readers in the Blue Angel scheme (Blue Angel 2011c) is tailored for small handheld devices equipped with eInk Display which are not covered by any of the other labelling schemes. This technology is specifically designed for displaying black-and-white pictures (written text) in high-quality without backlight illumination. It cannot display coloured or moving pictures. Thus, this type of device can only be used for reading e-books and not for typical computing tasks.
- Although the name "Tablet Computer" is used in various definitions (European Ecolabel, Energy Star, TCO, Blue Angel, Nordic Swan), the relatively new product group of handheld touchscreen-computers without keyboard commonly referred to as "Tablet Computer" (e.g. iPad by Apple, Galaxy Tab by Samsung) are out of scope in the criteria documents of Energy Star. The term "Tablet Computer" in the Energy Star schemes is used for Notebook Computers equipped with reversible touch-sensitive screen (and with keyboard). In turn, the new generation of handheld tablets are often termed "Slate Computing Device" and are not currently eligible for the Energy Star programme. While TCO has an own criteria set of this new type of handheld Tablets (TCO Cert. Tablets 2012), they are also covered by the European Ecolabel, the Blue Angel and the Nordic Swan under the definition for notebooks.
- While all analysed definitions include the trend to thin-client-server computing by specific definitions for Thin Clients [4], the definitions analysed do not yet

[3] Although the subgroup "All-in-one PC" is only used in the TCO definitions, the subgroup corresponds with Integrated Desktop Computers of other eco-labelling schemes.

encompass devices which only pass-on mouse and keyboard input to a server and receive back processed output data (e.g. for a display). Such devices gain increasing relevance in Thin Client-Server computing and are commonly called "Zero Clients" or "Ultra-Thin Clients". As they often do not contain a central processing unit (CPU), they fall out of the established definitions for Computers. This fact is now considered in the Draft Version 3 of Energy Star 6.0 by amending the definition for Computers as well as introducing a specific definition for Ultra-thin Clients. Regarding this product category, the overall efficiency is influenced by the efficiency of communication with the base station (if via wi-fi) or ADSL exchange and the terminal servers (what has come to be called 'cloud' storage capacity). However, this system dependency cannot practically be covered by expanding the product scope (e.g. to servers) but might be addressed indirectly by specific requirements relating to consumer choices and wi-fi communication systems.

1.2.2.2 Definitions of displays

- The definitions for displays by Blue Angel and Nordic Swan show many similarities. Nevertheless, both systems have their own specifications: While the Blue Angel emphasis the intended use (…*designed for the use with computers*), the Nordic Swan uses an upper boundary for the visible screen size (≤ 60 inches).
- The definition of computer monitors by Energy Star Version 6.0 does not clearly differentiate between displays encased in one housing together with the computer (e.g. Notebooks, Integrated Thin Clients). For the European Ecolabel, which covers both, computers and computer displays in one criteria document, this definition would require clarification.

[4] Although TCO does not specifically define Thin Clients, the energy requirements are linked to Energy Star. Thus, Thin Clients qualifying for Desktop PCs under TCO have to fulfil the Thin Client related energy requirements of Energy Star.

- The existing EU definitions in general draw a clear boundary between computer monitors and televisions by requiring television sets to be "designed primarily for the display and reception of audio-visual signals". For example, the current Energy Star Programme Requirements for Computer Displays (Energy Star Displays 6.0) explicitly exclude the following products from the scope:
  - "Products with an integrated television tuner;"
  - "Products that are marketed and sold as televisions, including products with a computer input port (e.g., VGA) that are marketed and sold primarily as televisions;"
  - "Products that are component televisions. A component television is a product that is composed of two or more separate components (e.g., display device and tuner) that are marketed and sold as a television under a single model or system designation. A component television may have more than one power cord;"
  - "Dual-function televisions / computer monitors that are marketed and sold as such." These products are, however, included in the US Energy Star requirements for *televisions*.
- However, a growing number of devices can be used as both, television and computer displays. Television sets are increasingly enabled for web browsing (so called "Smart TVs", "Connected TVs", "Hybrid TVs", and "IPTV" services) and computer monitors are being used to watch content normally only viewed on televisions (computer monitors with integrated TV tuners, "Web-TVs"). The market share of these products is likely to increase[5]. Products sold explicitly as "dual-function TV/monitors" are either categorised as computer monitors with built-in DTV tuner, but Energy Star rated as television[6], or marketed as TV with

[5] See for example: http://www.electronics.ca/presscenter/articles/1883/1/Global-Market-for-PC-TV-Tuners-to-Reach-US26-Billion-by-2018/Page1.html

[6] See for example: http://www.samsung.com/us/computer/monitors/LT27B750NDX/ZA-features

ability to be used as “dual function TV/Monitor with complete TV and PC system capabilities including word processing, e-mail, spread sheets, and internet browsing”[7].

- It is becoming more and more difficult to distinguish between the two product categories. Recent definitions use interface specifications, such as HDMI and VGA to create a distinction, but this can create problems around the consistent application of the Regulations to a subset of covered products. For example in principle, those computer monitors with HDMI interfaces should be classified as televisions and should be covered by energy labelling requirements and those without should not. On the other hand, the HDMI interfaces can also be used to connect other high definition devices like blu ray players which would not automatically classify them as televisions. Thus, ideally a definition is needed that is not based on interface connections.

1.2.2.3 Definitions of keyboards

- Only the current EU Ecolabel and Blue Angel Ecolabel cover keyboards within the scope.

1.2.3 *Recommendations for a revised scope definition*

A set of initial recommendations on a revised scope definition has been formulated based on the detailed analyses of existing and draft ecolabels and the Ecodesign scope definitions for computers. These recommendations and their implications are subject to on-going analyses as part of the criteria revision process.

- **Recommendation 1: Maintain most established definitions**. Taking into account the fact that all analysed eco-labelling schemes use widely harmonised product definitions, it is generally recommended to stick to most of the established definitions. This strategy can be justified by the fact that computers

[7] See for example: http://support.dell.com/support/edocs/monitors/w2300/En/Intro/INTRO_US.HTM

and displays are designed and manufactured for a global market. Although market-shares of individual sub-groups might vary in the various countries and world-regions, the general product designs and trends are typically identical. Thus, harmonised definitions reduce implementation efforts for manufacturers who are planning to apply for more than one eco-label. In addition, all analysed eco-labels (including the current version of the EU Ecolabel) rely on the benchmarks and/or calculation formulas provided by EU Energy Star for energy related requirements. Assuming that this harmonisation strategy will further prevail in the future, a close link to Energy Star definitions is recommended[8].

- **Recommendation 2: Widen the scope to all Energy Star sub-groups**. Regarding product scope, it should be considered to widen the scope to all sub-groups covered by the Energy Star definitions. As the Energy Star Version 6.0 for computers shall take effect from October 1, 2013, it is recommended to use these definitions for personal computers and notebook computers including all sub-product groups [9]. On the other hand, it shall be discussed if a separate product sub-category for “keyboards” shall be kept (see recommendation 4).
- **Recommendation 3: Clearly differentiate tablet computers within the scope.** It is proposed to clarify the scope to cover Tablet Computers without keyboard as this product sub-group is gaining increasing importance. In order to do so, it is advised to make use of the existing definition of TCO. Furthermore, it is advised to sharpen this definition to clearly differentiate Tablet Computers from Smartphones. This can be achieved by requiring a minimum surface area for the visible display. As today the largest smartphones on the market (e.g.

[8] This can also be justified by the fact that the EU ENERGY STAR programme follows an agreement between the Government of the US and the European Community (EU) to co-ordinate the energy labelling of office equipment. This covers the product categories computer equipment, displays and imaging equipment so that the Energy Star definitions for computers and displays are already integral part of the European policy mix on computers and computer displays.

[9] Although the definition-text from Draft 3 Version 6.0 might theoretically undergo changes until final publication, it is reported that there is already a broad agreement on definitions part of the specifications (Viegand 2013).

Samsung Galaxy Note) have visible screen sizes of around 90 cm^2, a threshold of 100 cm^2 can be used as differentiation. This value can also be justified by the fact that the WEEE-Directive requires separate treatment for displays above 100 cm^2 in size.

- **Recommendation 4: Omit keyboard definition as a separate product.** It is to be discussed whether keyboards can achieve the Ecolabel as a standalone product. They are generally bundled together with a desktop PC or incorporated into a notebook. Stakeholder input together with the findings of Task 2 (market analysis) and Task 3 (technical analysis) will be used to guide this recommendation.
- **Recommendation 5: Improve the definition of computer displays.** In order to align with the Energy Star definitions (versions 6.0 for computers and displays), it is necessary to improve the definition of computer displays in a way that it becomes clear that it solely applies to stand-alone devices (not integrated in the housing of a computer). Furthermore, it is – from practical considerations – advised to change the Energy Star term *'Computer Monitor'* into *'External Computer Display'*. This will help to secure consistency with other Energy Star Definitions, which routinely use the term display.
- **Recommendation 6a: Create a unified criteria set for dual-function computer and television monitors.** It is recommended to cover dual-function computer / television monitors, including computer monitors with integrated television tuner within the scope of televisions. There are two main justifications seen for this:
  - It is generally recommended to follow a harmonised approach between the various (European) policies. Energy Star (EU) explicitly excludes those products from the scope of computer displays, but covers them under televisions (US); in the revision process of the Ecodesign and Energy Labelling regulations for televisions it is proposed to prepare one set of ecodesign and energy labelling requirements for *all* electronic displays, including televisions and computer monitors;

- Computer displays with TV capabilities have additional energy-relevant components compared to computer displays without TV tuner (built-in tuner, speakers, sound cards, as well as integrated functions like HDD and DVD/Blu-ray disks) which make them more comparable to televisions.

- **Recommendation 6b: Consider the potential for a unified scope for <u>all forms of displays (computer displays and television displays)</u>.** Given the increasing level of integration of the televisions and the display sub-category all products could be unified into one scope (with possibly different criteria sets for the sub-categories). There are then a number of possible options for how this could work:

  - *<u>Option 1: Full integration of criteria sets for computer displays and television displays.</u>* The computer displays and television displays criteria would be fully integrated to become the 'display' product group and would be removed from the computer scope. TVs <u>and</u> computer displays would need their own Ecolabel license

  - *<u>Option 2: Integrated criteria set for computer displays and television displays transposed to the computer scope.</u>* The computer displays and television displays would be fully integrated to become the 'display' product group, with the full set of criteria then transposed into the computer scope unchanged.

  - *<u>Option 3: Incorporate TV/displays for bundled products into the computer scope</u>*. Integrated TV/display criteria would be relevant only for Ecolabel applicants selling a bundled product (i.e. desktop PC + computer display or dual function TV/computer). All other applicants for displays would need a TV/display license.

  Both recommendations 6a and 6b will need to be informed by the emerging market and technical analysis (Task 2 and 3 of this study) as well as stakeholders' input during the further course of the study. It should be discussed if this integrated approach proposed within the revision process of ecodesign

and energy labelling for televisions should be followed and *all* computer and television displays could be covered by an overall scope on “Displays” with specific requirements for the different sub-categories. The different ways in which products are sold within the EU market may also inform the revisions.

1.2.4 *Proposed scope and definitions for ‘Personal Computers and Notebook Computers’ for the revision of the EU ecolabel criteria*

According to the recommendations above we propose the following set of definitions, largely [10] based on Energy Star Draft 3 Version 6.0. The potential implications of these revised definitions for the EU Ecolabel and the criteria revision process are cross-checked in Table 2 (below) which also highlights where further research is considered to be needed to support decision-making.

‘Computer’ *means a device which performs logical operations and processes data. For the purposes of his 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) *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.*

[10] Red blue: Proposed amendments or additions to the original definitions of Energy Star Draft 3 Version 6.0

'Desktop Computer' *means 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 and are designed for use with an external display, keyboard, and mouse. Desktop computers are intended for a broad range of home and office applications.*

a) ***'Integrated Desktop Computer'*** *means 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. As a subset of Desktop Computers, Integrated Desktop Computers are typically designed to provide similar functionality as Desktop systems.*

'Notebook Computer' *means a computer designed specifically for portability and to be operated for extended periods of time both with and without a direct connection to an AC mains 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 as that used in Desktops.*

A portable computer with a reversible touch-sensitive screen and an integrated physical keyboard is considered to be a Notebook Computer.

a) ***'Mobile Thin Client'*** *means 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.

***'Tablet Computer'** (often referred to as 'slate computer') means a wireless, portable computer that is primarily for battery mode usage and has a touch screen interface. This means that connection to mains via an adapter is considered to be mainly for battery charging purposes and the onscreen virtual keyboard or a digital pen is in place of a physical keyboard. Devices with a visible display area of less than 100 cm^2 are not considered to be Tablet Computers under this specification.*

If a detachable keyboard docking station is supplied together with the Tablet Computer for the intention of the product being converted to a notebook computer, then the product is considered to be a notebook computer under this specification.

***'Small-scale Server'** means 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 such 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 65 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).*

'Thin Client' *means 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., program 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'*** *means a Thin Client in which computing hardware and display are 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 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'*** *means 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).*

'Workstation' *means 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) *Provide supplemental power support for high-end graphics (e.g., PCI-E 6-pin 12V 97 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) *Do not provide support for Uniform Memory Access (UMA) graphics;*
d) *Provide 5 or more PCI, PCI-E, or PCI-X slots;*
e) *Provide 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 multicore processor); and/or*
f) *Qualification by 2 or more Independent Software Vendor (ISV) product certifications; these certifications can be in process, but shall be completed within 3 months of qualification.*

1.2.5 *Proposed scope and definitions for 'Displays' for the revision of the EU ecolabel criteria*

The following proposed scope and definitions are based on the recommendations 6a and 6b provided in section 1.2.3 and include all display products in one scope. The definitions for computer displays are based on Energy Star draft v6.0, the definitions for television displays are based on the existing EU regulations on ecodesign and energy labelling[11].

'Displays' *cover television sets, television monitors, dual-function TV/monitors, and external computer displays.*

[11] Marked blue: proposed amendments or additions to the original definitions

'External Computer Display' *means an electronic device encased in a single housing, typically with a diagonal screen size greater than 12 inches and a pixel density greater than 5,000 pixels per square inch (pixels/in^2), that displays a computer's user interface and open programs, allowing the user to interact with the computer, typically using a keyboard and mouse.*

The following products are not considered to be external computer displays under this specification:

a) *Products with a viewable diagonal screen size greater than 61 inches;*
b) *Products with an integrated television tuner;*
c) *Products that are marketed and sold as televisions, including products with a computer input port (e.g., VGA) that are marketed and sold primarily as televisions;*
d) *Products that are component televisions. A component television is a product that is composed of two or more separate components (e.g., display device and tuner) that are marketed and sold as a television under a single model or system designation. A component television may have more than one power cord;*
e) *Dual-function televisions / computer monitors that are marketed and sold as such;*
f) *Mobile computing and communication devices (e.g., tablet computers, electronic readers, smartphones);*
g) *Products that must meet FDA specifications for medical devices that prohibit power management capabilities and/or do not have a power state meeting the definition of Sleep Mode.*

'Enhanced-Performance Display' *means an external computer display that has all of the following features and functionalities:*

a) *A contrast ratio of at least 60:1 measured at a horizontal viewing angle of at least 85°, with or without a screen cover glass;*

b) *A native resolution greater than or equal to 2.3 megapixels (MP); and,*

c) *A colour gamut size of at least sRGB as defined by IEC 61966 2-1. Shifts in colour space are allowable as long as 99% or more of defined sRGB colours are supported.*

'Television set' *means a product designed primarily for the display and reception of audio-visual signals, which is,*

1. *marketed and sold to the consumer as a television,*
2. *placed on the market under one model or system designation,*
3. *and which consists of:*

(a) A display;

(b) One or more tuner(s)/receiver(s) and optional additional functions for data storage and/or display such as digital versatile disc (DVD), hard disk drive (HDD) or videocassette recorder (VCR), either in a single unit combined with the display, or in one or more separate units;

'Television monitor' *means a product designed to display on an integrated screen a video signal from a variety of sources, including television broadcast signals, which optionally controls and reproduces audio signals from an external source device, which is linked through standardised video signal paths including cinch (component, composite), SCART, HDMI, and future wireless standards (but excluding non-standardised video signal paths like DVI and SDI), but cannot receive and process broadcast signals. Television monitors are products marketed and sold to the consumer primarily as televisions.*

'Dual-function TV/monitor' *means*

- *Either an external computer display with an integrated television tuner that is marketed and sold primarily as computer display;*

- *A television monitor with a computer input port (e.g., VGA) that is marketed and sold primarily as television;*
- *And/or products that are marketed and sold as dual-function TV/monitors.*

Products with' internal computer display' (e.g. integrated desktop computers, notebook computers) are not included in the scope. Products with internal display that are designed to be operated mainly by batteries (e.g. Tablets, Smartphones) are not included in the scope.

Displays, such as digital photo frames whose primary function is to produce digital images and have generally less than 15 inches diagonal screen size, are not included in the scope.

The following table presents an initial overview of the proposed changes to the current EU Ecolabel scope based on the definitions provided by the new Energy Star version 6.0. They cover market innovations such as tablet PCs and products gaining increasing market relevance as integrated or mobile thin clients. The information gaps and uncertainties as well as possible implications of extending the scope will be investigated further during the course of this on-going study (market analysis, technical analysis).

Table 2: Cross check of proposed changes to the current EU Ecolabel scope

Scope sub-category	Included with current Ecolabel scope	Cross check of the implications of each product segment				
		Alignment with Energy Star v.6.0?	**Significant variation in life cycle assumptions?**	**Market relevance to the EU Ecolabel?**	**Market relevance to GPP?**	**Open issues requiring further investigation**
Tablet PC	Yes, within notebooks	No, specifically excluded	Energy consumption is very low for the functionality. Bill of quantities may be similar in composition to some elements of LED backlit notebook.	High profile consumer product with 142% growth in sales during 2012 increase[12].	tbc	○ Verification of assumptions about low energy consumption ○ Literature search for tablet LCA's ○ Comparison of bill of quantities with notebook
Integrated Thin Client / Mobile Thin Client	Not explicitly for this sub-categories (thin clients included)	Yes	May achieve improved material / energy efficiency compared to Desktop / Notebook PCs. However, overall efficiency may depend on the efficiency of the terminal server / cloud storage capacity.	Business product understood to be of rising market significance. Their significance may also increase in the domestic market, with the introduction of new notebook concepts.	tbc	○ Literature search for Thin Client LCA ○ Comparison with desktop / notebook PC LCA ○ Verification of assumptions about material/energy efficiency & system approach (server, cloud storage capacity)
Workstation	No	Yes	More information is needed on the bill of quantities, which may contain larger and more robust components (processors, graphic cards, hard drives, memory etc.) compared to desktop PCs. The function and functional unit may be different.	Market significance to be confirmed.	tbc	○ Function and functional unit: how do they vary? ○ Comparison of bill of quantities required with desktop PC products of similar form factor
Small-scale server	No	Yes	More information is needed on the bill of quantities, which may contain larger and more robust drives and cooling systems. The function and functional unit is understood to be different.	The form factor is accessible to SME's. Market significance to be confirmed.	tbc	○ Function and functional unit: how do they vary? ○ Comparison of bill of quantities required with desktop PC form factors
Keyboard (as separate device)	Yes	No	---	Decreasing relevance due to the trend to notebooks (integrated keyboard) and devices with touchpads.	---	○ Proposed to be excluded as separate product category from the scope of revised EU Ecolabel

[12] Source: GSK, *Tablets still in the fast lane*, 29th August 2012, http://www.gfk.com/press_information/press_releases010222/index.en.html

1.2.6 *Stakeholder feedback on scope and definitions*

During the course of the revision process a questionnaire was sent out to selected stakeholders. The target groups were industry, Member States, NGOs and research institutions. The response rate was 18% (10 respondents) consisting of 4 Member States, 5 manufacturers (2 international and 3 EU) and 1 component manufacturer. The specific suggestions from the individually answering stakeholders regarding the proposed revised scope and definitions are reflected below.

Do you think the present scope of the criteria documents (Article 1) is relevant and precise?

- Yes (answer for EU Ecolabel on desktop PCs)
- Desktop and Notebook computers: no problem
- Most of the present scope and criteria is relevant and precise.
- No, there is no tablet computer in the Article 1's product definition.
- In notebook computers, the definition of tablet computer is insufficient. But Energy Star V6.0 has suspended the definition. In personal computers, notebook computers, small-scale servers, and workstations should not be exempt from the definition.
- There is some uncertainty over which computing products fall under the scope of the current EU Ecolabel and EU GPP criteria. For example, under the EU GPP criteria it is stated that "Notebook computers (includes tablet personal computers)". It is unclear if the term "tablet personal computer" includes slate type computing devices such as the iPad or whether it is limited to notebook PC type devices with touch sensitive screens. Under the EU Ecolabel it is stated that , "For the purpose of this Decision, tablet personal computers, which may use touch-sensitive screens along with or instead of other input devices shall be considered notebook computers". This definition suggests that slate type devices would be covered under the scope of the EU Ecolabel.

- It comprises computer displays which can be used / are used as a television, which also could be included in the EU Ecolabel Criteria for Televisions.
- The product group "personal computers" cannot encompass "thin clients" because the thin clients are devices that rely on a connection to remote resources. A personal computer instead is a product that must be able to be used also by itself without remote connections.
- The notebook group should not include tablet PCs. The product "tablet" has three major differences that distinguish it from the classic "notebook":
  - 1) The processing capability is very limited and confined with respect to the notebook
  - 2) The use of the tablet, according to the current market is mainly for multimedia, from internet browsing, phone calls, photography, music and chat.
  - 3) Hardware of tablet is very different from the notebook: it has a slim module (unlike most notebooks) and hardware components that standard notebook does not have. Different hardware needs different criteria and therefore different rules about eco-label.
- Tablets should be framed as a standalone product.
- It is suggested that the Commission refers to the Ecodesign implementing measures on computers for further guidance on suitable product terminologies and to harmonise these definitions across all EU initiatives.

Are you aware of relevant computer products that did not fit into the current scope of the EU Ecolabel for Desktop and Notebook Computers?

- Desktop and Notebook computers: no
- Tablet computer is not considered in the scope of EU Ecolabel for Desktop and Notebook Computers.

- It is uncertain whether slate type devices would currently be included under the scope of the GPP criteria or EU Ecolabel.
- The displays of some notebook computers are detachable and can be used as a tablet. In some cases it is difficult to clearly define if a device is a tablet connected with a docking or a notebook computer.
- Computers made from re-used part and components, although environmentally beneficial in other ways, will not fit into the current scope due to underperformance, in use, of used components.

Do you have any suggestions to broaden or focus the current scope of the EU Ecolabel for Desktop and Notebook Computers?

- Yes, add tablet computers into the EU Ecolabel scope.
- Remove tablets from the group "notebook" and create a group in its own right.
- Focus on desktop and notebook computers. Devices such as computer monitors should be considered as displays and be part of the EU Ecolabel Criteria for Televisions
- There could be a separate category for computers using reused parts and components, in recognition of their lesser environmental impact over the life-cycle of the product.
- Displays: There are more and more new devices that could be part of this category: the signage displays (very often used on B2B markets and probably not in the Ecolabel scope) which are very often with screens bigger than 60", and most of them are working with small but regular PCs.
- It can be desirable to include as many types of products as possible. It is difficult to foresee the use pattern in place the next years. The criteria of computers and televisions should work in a way to tackle the merging of televisions and displays.
- The Commission could also consider including other types of devices such as:

- Workstation personal computers
- Mobile workstation personal computers
- Ultra-thin clients
- Mobile thin clients
- Small scale servers
- Discrete Graphics Cards (as a separate product group)
- External power cables for all computer types

Would you agree to base the scope and definitions of the EU Ecolabel on those provided by Energy Star Draft 3 Version 6.0?

- It could be acceptable.
- Yes, if indeed this work will continue.
- Agree. Because most eco-labels use the Energy Star criteria for their energy related benchmark.
- Harmonisation with most of the Energy Star definitions is supported.
- Yes, as it seems a sound standard, but look to add LCA considerations
- Yes, but consideration of the Ecodesign measures on computers should also be taken into account.
- Unsure. Some things are good, while others are to be reviewed.
- Disagree. Because the draft version will be revised, it could encounter some problems for operating internal controlled procedure.

Would you agree to additionally introduce a specific definition for 'Tablet Computers' (also referred to as 'slate computers') into the EU Ecolabel?

- Yes, absolutely
- Yes, a definition would be useful
- Agree, but we would like to refer to Energy Star Version 6.1.

- The Commission should be aware that “Tablet computers” and “Slate computers” can be two very different types of products. The Commission should refer to the Ecodesign measure on computers for definitions.
- It is necessary to give a clear definition of a detachable keyboard docking station. In the case of the Microsoft Surface tablet, if we consider the detachable cover-tablet as a detachable keyboard docking station, the Surface is not a tablet but a notebook.

Would you agree to include ‘Workstations’ within the scope of the EU Ecolabel, as proposed by EU Energy Star?

- It could be acceptable.
- Yes, a definition would be useful
- Agree. It is included within the Energy Star V6.0
- Yes, workstation computers are often used within government premises. However, special care needs to be taken with these products as they are often used in mission critical tasks where energy efficiency and other environmental design features are very much secondary considerations.
- Certainly, but in "Workstation" include uniprocessor models. Also "5 or more PCI, PCI-E or PCI-X slots" is not relevant, you only need 3. Instead add the criterion "a motherboard with an automatic system shutdown in the event of high temperature, and a raid system, with at least support 0/1 ."
- No. Since years our customers are satisfied with the information provided via the IT Eco Declaration, i.e. the ECMA-370 standard.

Would you agree to include ‘Small Scale Server’ within the scope of the EU Ecolabel as proposed by EU Energy Star?

- Yes, a definition would be useful
- Agree. It is included within the Energy Star V6.0

- Yes, although sales of these products will be lower than many other types of computers they are still being sold. If a product is being sold then purchasers should be able to procure products that have reduced environmental impacts.
- In EU Energy Star it is not clear if "Small Scale server" also include the NAS (Network Attached Storage) or not. Looking at the characteristics required I think yes, but it seems to me should be stated
- If there is no CPU it is proposed not to consider the device. In the case of KVM clients (keyboard video mouse hub) they could be taken into account by calculating the total impacts of the server and all the connected clients divided by the number of clients (so the device applying for the ecolabel would be the small-scale server together with its terminals).
- No. Since years our customers are satisfied with the information provided via the IT Eco Declaration, i.e. the ECMA-370 standard.

Would you agree to include further sub-categories for Thin Clients (Integrated Thin Clients, Mobile Thin Clients, Ultra-slim Thin Clients) within the scope of the EU Ecolabel as proposed by EU Energy Star?

- Yes, a definition would be useful
- Agree, ultra-slim Thin Clients are excluded
- Yes, a single definition of “thin client” no longer accurately describes the products on the market. Therefore, further definitions should be included.
- No. Since years our customers are satisfied with the information provided via the IT Eco Declaration, i.e. the ECMA-370 standard.
- Under this definition there are many possible functions that these devices can offer or can't. You are mentioning the no-CPU thin clients (sometimes named as zero-clients or ultra-thin clients). Technically many of the no-CPU thin clients are KVM devices (keyboard video mouse hub) and they offer limited services compared to other thin clients (in terms of distance between the "server" and the "client", in terms of number of clients connected to a server); these KVM

devices could be standalone or integrated in monitors. It is recommended to not consider these KVM devices as we are not considering the docking stations, nor the input peripherals such mouse, keyboard, trackball, etc. On the contrary as soon as there is some kind of CPU in the thin client it could be included in the thin client family.

- Ultra-thin client (UTC) definition: It is not clear if UTC from all manufacturers can interface with multiple devices (KVM in general are not able but some UTC can), and even a KVM can display windowed remote applications. This definition has to be carefully reviewed.
- Concern is raised about the functional unit and boundary for measuring the impact of this new type of product – how does it fit into the scope? Measurement and verification would be challenges.

Would you agree to exclude 'Keyboards' as a separate product from the scope of the EU Ecolabel for Computers?

- Agree.
- Yes, they are clearly outside of range
- No, because the environmental performance of keyboards is not dictated by the requirements on computers. As such either environmental criteria for keyboards should be included in the personal computer specification or a separate set of criteria should be developed.

Would you agree to exclude dual-function television/computer monitors (e.g. external computer displays with an integrated television tuner) from the scope of computer displays?

- Agree
- Yes, they would appear to be outside of range
- Yes. Since years our customers are satisfied with the information provided via the IT Eco Declaration, i.e. the ECMA-370 standard.

- We never had a lot of experience with this kind of products, but the proposed EU Energy Star is satisfactory.
- These should only be excluded if they are going to be covered by separate EU Ecolabel and EU GPP criteria on televisions. Any requirements placed on these products should not be excessively different from the requirements on computer displays without a television tuner (i.e. major differences could promote the unnecessary inclusion of TV tuners into computer displays to take advantage of more lenient requirements).

Would you agree to follow the approach proposed by the revision process of the EU Ecodesign and Energy Labelling regulations for televisions to cover all computer and TV displays (including computer displays without integrated TV tuner) by an overall scope on "Displays" with specific requirements for the different sub-categories?

- Agree
- Yes, it appears to make things less complicated
- Yes, as long as the set of criteria is based on the existing set of criteria used in the ecolabel for television
- There are now few technological differences between TVs and computer monitors. However, there are significant differences in how the products are used which could impact on the actual efficiency of the products during use (e.g. luminance levels and the use of Automatic Brightness Control (ABC)). It is suggested that the test procedures for TVs and computer displays should be similar but account for the luminance differences and the different uptake of ABC technology. Energy Star has recognised that these differences still exist and have chosen to develop separate specifications for computer displays and TVs.
- The categories "monitor", "monitor / TV" and "television" should be distinct and specific as they are three different products for hardware and use. At least to be divided into two categories: "PC monitor" and "monitor / TV and televisions."

- The proposal to amalgamate TVs and displays requires further technical investigation as new devices may include additional energy using features such as Wi-Fi transmitters and graphic cards. It may be more accurate to call the criteria set “multi-media displays” and have separate sub-criteria / allowances for the different types of sub-products. The testing standards that may be required for different sub-products needs to be considered – consistency will need to be ensured.

Do you have a preference for any of options presented under recommendation 6b?[13]

- Option 1.
- Option 1. Monitors must have a separate Ecolabel certification, but a monitor without TV tuner must have criteria other than those with tuner and television sets.
- Preferred option 1 if the criteria of the display group is based on the existing set of criteria used in the ecolabel for television.
- No current preferences

1.3 Existing legislation, standards, and labelling schemes

In this section legislation, standards, and labelling schemes at EU level and, as far as relevant, at Non-EU level are brought together which may be of significance to the revision of the EU Ecolabel for personal computers, notebook computers, and displays.

[13] Option 1: Full integration of criteria sets for computer displays and television displays, computer displays to be removed from the computer scope; Option 2: Integrated criteria set for computer displays and television displays transposed to the computer scope; Option 3: Incorporate TV/displays for bundled products into the computer scope.

1.3.1 *Legislative background*

1.3.1.1 Ecodesign

Computers

For computers, the Commission Regulation (EU) No 617/2013 of 26 June 2013 is implementing the Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements of computers and computer servers.

Displays

For displays other than televisions and television monitors (ENER Lot 3), a draft of the ecodesign Working Document on displays was discussed at the Consultation Forum meeting back in October 2009. Designing a separate measure for displays, however, has proven to be difficult because the convergence of products has made it difficult to clearly define separate product categories.

Traditional product category definitions relied on different input signals and the presence of a tuner for televisions. Any display can be designed to accept a variety of input signals, including broadcast signals for which a tuner is required. Also the importance of the tuner/receiver regarding energy consumption has decreased significantly. Furthermore, the experience with the current definitions on televisions and television monitors in the Regulations is not positive regarding providing a clear distinction for products on the market. Therefore, it has been decided to merge the review work on the television Regulations with the work on the draft Regulation on display products and to prepare one set of ecodesign and energy labelling requirements for all electronic displays, including televisions, computer monitors and digital photo frames.

On 8 October 2012, a discussion paper on the review of the Ecodesign and Energy Labelling Regulation for televisions and on the draft Regulation on electronic displays, including computer monitors, was presented and discussed with stakeholders at a Consultation Forum Meeting. Currently, the proposals discussed at this meeting are being amended and an impact assessment on the draft regulations

on electronic displays has been started. It is expected that the TV review under Ecodesign will terminate before the end of this project. In this context, the Commission has also investigated the benefits and methodologies for setting potential ecodesign requirements on material efficiency for televisions (Ardente & Mathieux 2012). The result of this study and comments received from stakeholders shall be considered in the process of preparing the Regulations on electronic displays.

Standby

Commission Regulation (EC) No 1275/2008 of 17 December 2008 is implementing the Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment. According to Annex I of the regulation, information technology equipment intended primarily for use in the domestic environment are falling under the scope of this regulation.

Currently, stage 2 is applicable for products placed on the market from 7 January 2013, with the following requirements regarding power consumption for standby- and off-mode, as well as power management or similar functions:

- Power consumption in 'off mode': Power consumption of equipment in any off-mode condition shall not exceed 0.50 W.
- Power consumption in 'standby mode(s)': The power consumption of equipment in any condition providing only a reactivation function, or providing only a reactivation function and a mere indication of enabled reactivation function, shall not exceed 0.50 W. The power consumption of equipment in any condition providing only information or status display, or providing only a combination of reactivation function and information or status display shall not exceed 1.00 W.
- Availability of off mode and/or standby mode: Equipment shall, except where this is inappropriate for the intended use, provide off mode and/or standby mode, and/or another condition which does not exceed the applicable power

consumption requirements for off mode and/or standby mode when the equipment is connected to the mains power source.

- Power management: When equipment is not providing the main function, or when other energy-using product(s) are not dependent on its functions, equipment shall, unless inappropriate for the intended use, offer a power management function, or a similar function, that switches equipment after the shortest possible period of time appropriate for the intended use of the equipment, automatically into:
  - standby mode, or
  - off mode, or
  - another condition which does not exceed the applicable power consumption requirements for off mode and/or standby mode when the equipment is connected to the mains power source. The power management function shall be activated before delivery.

According to the Regulation on Ecodesign for Computers (EU 617/2013), ecodesign requirements for standby and off mode electric power demand of electrical and electronic household and office equipment are not fully appropriate for the characteristics of computers. Thus, the requirements of Commission Regulation (EC) No 1275/2008 of 17 December 2008 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for standby and off mode electric power demand of electrical and electronic household and office equipment shall not apply to computers. Consequently, specific requirements for power management, as well as for sleep mode, off mode and lowest power state in computers are set in the Ecodesign Regulation for Computers, and Regulation (EC) No 1275/2008 on Standby has been amended accordingly (EU 801/2013).

Networked Standby

The draft *Commission Regulation on Networked Standby amending Commission Regulation (EC) No 1275/2008 with regard to ecodesign requirements for standby,*

off mode electric power consumption of electrical and electronic household and office equipment, and amending Commission Regulation (EC) No 642/2009 with regard to ecodesign requirements for televisions has been presented to the Regulatory Committee for vote.

Given that computers being subject to a product-specific ecodesign implementing measure will be exempted from the scope of Commission Regulation (EC) No 1275/2008, ecodesign requirements for networked standby related to computers are included in the Commission Regulation with regard to ecodesign requirements for computers (EU 617/2013).

External Power supplies

The Commission Regulation (EC) No 278/2009 of 6 April 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for no-load condition electric power demand and average active efficiency of external power supplies shall apply to external power supplies that are placed on the market with computers.

1.3.1.2 Energy Labelling

There is no Commission Regulation with regard to energy labelling of computers.

1.3.1.3 REACH

The European chemicals regulation REACH 1907/2006/EC entered into force on 1st of June 2007. Under the REACH Regulation, certain substances that may have serious and often irreversible effects on human health and the environment can be identified as Substances of Very High Concern (SVHCs). If identified, the substance is added to the Candidate List, which includes candidate substances for possible inclusion in the Authorisation List (Annex XIV). Those SVHC that are included in Annex XIV become finally subject to authorisation. By this procedure REACH aims at ensuring that the risks resulting from the use of SVHCs are controlled and that the substances are replaced where possible.

In this regard, REACH also introduced new obligations concerning general information requirements on substances in articles. Producers and importers of articles that contain substances of very high concern (SVHC) included in the candidate list, will be required to notify these to the Agency (ECHA) if both of the following conditions are met:

- The substance is present in those articles in quantities totalling over 1 t/y per producer or importer;
- The substance is present in those articles above a concentration of 0.1% weight by weight (w/w).

Notification will not be required in case the SVHC has already been registered for this use by any other registrant (Article 7(6)), or exposure to humans or environment can be excluded (Article 7(3)).

In addition, Article 33(1) requires producers and importers of articles [14] containing more than 0.1% w/w of an SVHC included in the candidate list, to provide sufficient information to allow safe handling and use of the article to its recipients. As a minimum, the name of the substance is to be communicated.

The provisions of Article 33(1) apply regardless of the total amount of the SVHC used by that actor (no tonnage threshold) and regardless of a registration of that use. Furthermore, this information has to be communicated to consumers, on request, free of charge and within 45 days (Article 33(2)).

1.3.1.4 CLP

The Regulation (EC) No 1272/2008 of the European Parliament and the Council of 16 December 2008 on the classification and packaging of substances and mixtures entered into force on 20 January 2009.

[14] Applies either to components (e.g. if imported to form part of a product assembled in the EU) or for imported products as a whole (complex articles)

The purpose of the so called CLP-Regulation is to identify hazardous chemicals and to inform their users about particular threats with the help of standard symbols and phrases on the packaging labels and through safety data sheets. The purpose of the globally harmonised system (UN-GHS) is to make the level of protection of human health and the environment more uniform, transparent and comparable as well as to simplify free movement of chemical substances, mixtures and certain specific articles within the European Union.

Substances had to be classified until 1 December 2010 pursuant to Directive 67/548/EEC and mixtures until 1 June 2015 pursuant to Directive 1999/45/EC. Differing from this provision, the classification, labelling and packaging of substances and preparation may already be used before 1 December 2010 and 1 June 2015 in accordance with the provisions of the CLP/GHS-Regulation. After these dates the provisions of the CLP-Regulation are mandatory. The REACH-Regulation is complemented by the CLP-Regulation.

1.3.1.5 F-gases

Fluorinated gases (F-gases), such as Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF_6), or Nitrogen trifluoride (NF_3), are a family of man-made gases used in a range of industrial applications. Because they do not damage the atmospheric ozone layer, they are often used as substitutes for ozone-depleting substances. However, F-gases are powerful greenhouse gases, with a global warming effect up to 23 000 times greater than carbon dioxide (CO_2), and their emissions are rising strongly[15]. SF_6 and NF_3 emissions occur during the manufacture of LCD screens for use in monitors and televisions. LCD manufacturers use F-GHGs to clean chemical vapour deposition chambers and plasma etch silicon containing materials.

[15] Source: http://ec.europa.eu/clima/policies/f-gas/index_en.htm

To control emissions from fluorinated greenhouse gases the European Union has adopted the "F-gas Regulation" which covers all other key applications in which F-gases are used. The F-gas Regulation follows two tracks of action:

- Improving the prevention of leaks from equipment containing F-gases. Measures comprise: containment of gases and proper recovery of equipment; training and certification of personnel and of companies handling these gases; labelling of equipment containing F-gases; reporting on imports, exports and production of F-gases.
- Avoiding F-gases in some applications where environmentally superior alternatives are cost-effective. Measures include restrictions on the marketing and use of certain products and equipment containing F-gases.

The Regulation has been supplemented by 10 implementing acts or "Commission Regulations". Furthermore, reporting provisions have been introduced to facilitate monitoring of the Regulation's measures and ensure that its objectives are being met.

The F-gas Regulation was adopted in 2006. In November 2012 the European Commission proposed a revision of the F-gas Regulation that would tighten up its requirements[16]. This followed a review of the adequacy of the Regulation, a public consultation in 2011 and an open stakeholder conference in 2012 on options for strengthening EU measures to reduce F-gas emissions in order to contribute to the transition to a low-carbon economy. As proposed by the Commission, the revised Regulation would reduce F-gas emissions by two-thirds of today's levels by 2030 and ban the use of F-gases in some new equipment where viable climate-friendly alternatives are readily available.

1.3.1.6 RoHS

The Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment 2011/65/EU (commonly referred to as the RoHS-Directive) restricts the use of six hazardous substances in electrical and electronic

[16] Source: http://ec.europa.eu/clima/policies/f-gas/legislation/docs/com_2012_643_en.pdf

equipment to be sold in the EU. The Directive 2011/65/EU replaces Directive 2002/95/EC, which entered into force on 1st July 2006. The RoHS-Directive covers the following substances:

- Lead
- Mercury
- Cadmium
- Hexavalent chromium
- Polybrominated biphenyls (PBB)
- Polybrominated diphenyl ether (PDBE)

The RoHS-Directive limits the use of these substances to concentrations not exceeding 0.1% by weight of homogenous material. For Cadmium the threshold level is at 0.01%.

Exemptions from these provisions are only possible if at least one of the following reasons applies:

- Substitution is not possible from a scientific and technical point of view;
- The negative environmental, health and consumer safety impacts caused by substitution are likely to outweigh the benefits;
- The reliability of substitutes is not ensured.

Applications for exemptions have to be submitted to the European Commission and require a justification including comprehensive information on the substance-application and possible substitutes. All applications undergo a technical analysis as well as a stakeholder consultation. Currently, there are various exemptions for mercury in fluorescent lamps (see Annex III of the Directive), which are of relevance for computer monitors with CFL-backlight systems.

Similar pieces of legislation are in place in various countries, including Switzerland, China, South-Korea and California.

During the preparation of RoHS 2011/65/EU, an extension of the list of restricted substances was discussed. Preparatory studies, in particular the review of restricted substances under RoHS (Öko-Institut 2008), revealed that further relevant hazardous substances are used in EEE.

According to Recital 10 of RoHS 2011/65/EU the use of the following substances should be considered as a priority for the first review:

- Hexabromocyclododecane (HBCDD)
- Bis (2- ethylhexyl) phthalate (DEHP)
- Butyl benzyl phthalate (BBP)
- Dibutyl phthalate (DBP)

Once new scientific evidence is available, it will be necessary to investigate, whether other hazardous substances, especially those which were subject to previous assessments should also be included in the list of restricted substances.

Currently, a “Study for the Review of the List of Restricted Substances under RoHS 2 Directive” commissioned by DG Environment is on-going. Results on the developed methodology for identification and assessment of substances, on the identification and assessment results and on draft recommendations for inclusion of substances in the list of restricted substances of RoHS are expected in December 2013[17].

1.3.1.7 Electromagnetic Compatibility

Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC regulates the electromagnetic compatibility of equipment. It aims to ensure the functioning of the internal market by requiring equipment to comply with an adequate level of electromagnetic compatibility. Equipment shall be so designed and manufactured, having regard to the state of the art, as to ensure that:

[17] See http://www.umweltbundesamt.at/rohs2

- the electromagnetic disturbance generated does not exceed the level above which radio and telecommunications equipment or other equipment cannot operate as intended;
- it has a level of immunity to the electromagnetic disturbance to be expected in its intended use which allows it to operate without unacceptable degradation of its intended use.

The manufacturer shall also provide information on any specific precautions that must be taken when the apparatus is assembled, installed, maintained or used, in order to ensure that, when put into service, the apparatus is in conformity with the protection requirements set out in the Directive.

1.3.1.8 Low Voltage

Directive 2006/95/EC on the “harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits” applies to all ‘electrical equipment’ designed for use with a voltage rating of between 50 and 1 000 V for alternating current (AC) and between 75 and 1 500 V for direct current (DC). It requires products to have protection against hazards arising from the electrical equipment itself or hazards which may be caused by external influences on the electrical equipment.

1.3.1.9 WEEE

The Directive on waste electrical and electronic equipment (WEEE) 2012/19/EU (commonly referred to as WEEE-Directive) regulates the separate collection, treatment and recycling of end-of-life electrical and electronic equipment. The Directive 2012/19/EU replaces Directive 2002/96/EC of 27 January 2003, which entered into force on 1st of July 2006. Amongst others, Directive 2012/19/EU requires member states to achieve quantitative collection targets (e.g. 65% of the average weight of EEE placed on the market in the three preceding years). It also requires

Member States to ensure that producers provide for the financing of the collection, treatment, recovery and environmentally sound disposal of WEEE (Article 12)[18].

The WEEE-Directive classifies EEE in various categories. In this system, computers are classified under category 3 “IT and telecommunication equipment”. Nevertheless, this classification is under transition and will follow a new system from the 15th of August 2018 onwards. Under this new system, computers and computer displays will not be classified in one single category, but instead fall under the following three of the six new categories:

- Category 2: Screens, monitors, and equipment containing screens having a surface greater than 100 cm^2
- Category 4: Large equipment (any external dimension more than 50 cm)
- Category 6: Small IT and telecommunication equipment (no external dimension more than 50 cm)

Annex V of the Directive also contains minimum targets for recovery and recycling[19]. For category 3 equipment (IT and telecommunication equipment), these targets are 75 % for recovery and 65 % for recycling. From 15th of August 2015, these targets will be raised to 80 % for recovery and 70 % for recycling[20].

Furthermore, Annex VII of the Directive specifies substances, mixtures and components that have to be removed from any collected WEEE for selective treatment. Regarding computers and computer monitors, the following components are of particular relevance:

- mercury containing components, such as switches or backlighting lamps,

[18] While this requirement is mandatory for WEEE from private households, for WEEE from users other than private households, Article 13 allows alternative agreements for financing.

[19] Here, ‘recovery’ is defined in line with the Waste Framework Directive (2008/98/EC) as any type of material and energy recovery, while ‘recycling’ is specifically defined as material recovery not without energy recovery, use as fuel or for backfilling operations.

[20] From 15th of August 2015, preparation for re-use also accounts for this recycling target.

- batteries,
- printed circuit boards of mobile phones generally, and of other devices if the surface of the printed circuit board is greater than 10 square centimetres,
- plastic containing brominated flame retardants,
- liquid crystal displays (together with their casing where appropriate) of a surface greater than 100 square centimetres and all those back-lighted with gas discharge lamps,
- external electric cables.

1.3.2 *Standards and testing procedures*

1.3.2.1 Computers

The following analysis on standards and testing procedures for televisions is initially based on the EuP preparatory study lot 3 “Personal Computers (desktops and laptops) and Computer Monitors” (EU Ecodesign Lot 3 2007). The standards listed in the EuP Task 1 report have been analysed regarding validity, revisions or possible withdrawals. Additionally, current ecolabelling schemes have been analysed regarding information on possibly new standards or testing procedures.

IEC 60950

- Title/Scope: Information technology equipment – Safety
- Organisation: IEC (International Electrotechnical Commissions)
- Status/Year: International Standard, publication date 10 May 2012 (edition 2.1 consolidated with amendment 1)
- Issues[21]: IEC 60950-1 is applicable to mains-powered or battery-powered information technology equipment, including electrical business equipment and

[21] Source: http://webstore.iec.ch/preview/info_iec60950-1%7Bed2.0%7Den_d.pdf

associated equipment, with a RATED VOLTAGE not exceeding 600 V. Also applicable are components and subassemblies intended for incorporation in information technology equipment. The standard includes the basic requirements for the safety of information technology equipment. Application of a safety standard is intended to reduce the risk of injury or damage due to electric shock; energy related hazards; fire; heat related hazards; mechanical hazards; radiation; chemical hazards.

IEC 62018

- Title/Scope: Power consumption of information technology equipment - Measurement methods
- Organisation: IEC (International Electrotechnical Commissions)
- Status/Year: International Standard; publication date: 16 June 2003 (edition 1.0)
- Issues[22]: This International Standard defines the test methods used to measure power consumption of information technology equipment (ITE) under various modes of operation for the purpose of energy management.

IEC 62301 ed2.0

- Title/Scope: Household electrical appliances - Measurement of standby power
- Organisation: IEC (International Electrotechnical Commissions)
- Status/Year: International Standard published 27 January 2011
- Issues[23]: The standard specifies methods of measurement of electrical power consumption in standby mode. It specifies the general conditions for measurements (test room, power supply, supply-voltage waveform and power measurement accuracy) as well as selection and preparation of appliance/equipment for measurement, and test procedure. The scope is

[22]Source: http://webstore.iec.ch/webstore/webstore.nsf/Artnum_PK/30727

[23] Source: http://webstore.iec.ch/webstore/webstore.nsf/Artnum_PK/44782

product specific. The standard is applicable to mains powered electrical household appliances (this includes also computers and displays). The objective of the standards is to provide a method of test to determine the power consumption of a range of appliances and equipment in standby mode. The standard defines “standby” mode as the lowest power consumption when connected to the mains. The standard is dedicated to the measurement of energy consumption for the use phase of the equipment.

ISO 7779

- Title/Scope: Acoustics - Measurement of airborne noise emitted by information technology and telecommunications equipment
- Organisation: ISO (International Organisation for Standardisation)
- Status/Year: International Standard; publication date: 2010
- Issues[24]: ISO 7779:2010 specifies procedures for measuring and reporting the noise emission of information technology and telecommunications equipment. The basic emission quantity is the A-weighted sound power level which may be used for comparing equipment of the same type but from different manufacturers, or for comparing different equipment. ISO 7779:2010 is suitable for type tests and provides methods for manufacturers and testing laboratories to obtain comparable results.

IEEE 1680.1

- Title / Scope: IEEE Standard for Environmental Assessment of Personal Computer Products
- Organisation: Institute of Electrical and Electronics Engineers (IEEE) Standards Association

[24] Source: http://www.iso.org/iso/catalogue_detail.htm?csnumber=54363

- Status / Year / Revision: Publication: 2009. The existing IEEE 1680.1 Standard for Environmental Assessment of Personal Computer Products, Including Notebook Personal Computers, Desktop Personal Computers, and Personal Computer Displays is currently being updated. During the fall of 2011 and into 2012, Study Groups worked to develop preliminary material to assist in the launch of the 1680.1 Standard update. In late 2012 or early 2013, a Working Group will be convened for the update of the 1680.1 Standard.
- Issues[25]: This Standard provides a clear and consistent set of performance criteria for the design of personal computer products, and provides an opportunity to secure market recognition for efforts to reduce the environmental impact of electronic products. The environmental performance criteria of this Standard are intended to define a measure of environmental leadership in: the design and manufacture of personal computer products; the delivery of specified services that are associated with the sale of the product; and in associated corporate performance characteristics. This Standard is defined with the intention that the criteria are technically feasible to achieve, but that only products demonstrating the leading environmental performance currently available in the marketplace would meet them at the time of their adoption. As the environmental performance of products that are available in the marketplace improves, it is intended that the criteria will be updated and revised to set a higher performance standard for leadership products. Note: EPEAT®'s rating system for computers and displays are based on the IEEE 1680 and 1680.1 standards.

ECMA 383

- Title/Scope: Measuring the Energy Consumption of Personal Computing Products.

[25] Source: http://grouper.ieee.org/groups/1680/1680.1/

- Organisation: ECMA International (industry association dedicated to the standardization of information and communication systems)
- Status/Year: Publication of 3rd Edition in December 2010
- Issues[26]: This standard applies to desktop and notebook computers as well as integrated desktop computers that are marketed as final products. This Standard specifies:
  - A test procedure to enable the measurement of the power and/or energy consumption in each of the power modes.
  - Formulas for calculating the TEC (Typical Energy Consumption) for a given period (normally annual).
  - A majority profile that should be used with this Standard which enables conversion of average power into energy within the TEC formulas.
  - A system of categorisation enabling like for like comparisons of energy consumption between the products.
  - A pre-defined format for the presentation of results.

  This Standard does not set any pass/fail criteria for the products. Users of the test results should define such criteria.

ECMA 74

- Title/Scope: Measurement of Airborne Noise emitted by Information Technology and Telecommunications Equipment.
- Organisation: ECMA International (industry association dedicated to the standardization of information and communication systems)
- Status/Year: Publication of 12th Edition in December 2012

[26] Sources: http://www.ecma-international.org/publications/standards/Ecma-383.htm; http://www.ecma-international.org/publications/files/ECMA-ST/ECMA-383.pdf

- Issues[27]: This standard applies to information technology and telecommunications equipment, ITT equipment, meaning equipment for information processing, and components thereof, used in homes, offices, server installations, telecommunications installations, or similar environments.

  ECMA 74 specifies methods for the measurement of airborne noise emitted by information technology and telecommunications equipment. Hitherto, a wide variety of methods have been applied by individual manufacturers and users to satisfy particular equipment or application needs. These diverse practices have, in many cases, made comparison of noise emission difficult. This Standard simplifies such comparisons and is the basis for declaration of the noise emission level of information technology and telecommunications equipment. In order to ensure accuracy, validity and acceptability, this Standard is based on the basic Standards for determining the sound power level and for determining the emission sound pressure level at the operator position(s) and bystander position(s). Furthermore, implementation is simplified by conformance with International Standards.

ENERGY STAR Test Method for Computers

- Title / Scope: ENERGY STAR® Program Requirements Product Specification for Computers, Draft 3 Test Method, Rev. Nov-2012
- Organisation: Energy Star
- Status / Year / Revision: Published 29 November 2012; the Energy Star specification and test method for determining the energy use of computers is currently under revision.

[27] Sources: http://www.ecma-international.org/publications/standards/Ecma-074.htm; http://www.ecma-international.org/publications/files/ECMA-ST/ECMA-074.pdf

- Issues[28]: The test requirements shall be conducted on all eligible computer products and workstation computer products. The final version of the test method is expected to be published in 2013. Former Energy Star test methods of Energy Star for computers are the basis for several other ecolabelling schemes such as TCO, Blue Angel, etc.

Japanese Top Runner Test Standard on Computers

- Title/Scope: Final Report of the General Resources Energy Investigation Committee, Energy Savings Standards Section, Computer and Hard Disk Drive Judging Standards Subcommittee.
- Organisation: General Resources Energy Investigation Committee, Energy Savings Standards Section, The Computer and Hard Disk Drive Judging Standards Subcommittee
- Status/Year: 2009
- Issues[29]: The former scope has been expanded. Computers with the composite theoretical performance of 50,000 mega calculations to < 200,000 mega calculations per second (formerly considered a part of the super computer class) were added. Review of categories to match the actual conditions of use in the market: For the definition of server computers and client computers, due to advancing technologies it was decided that they should be defined based on the intended form (conditions) of use at the time of design rather than on vague categorization using main memory capacity and other factors. For server computers, advances in technology have resulted in problems such as the mainframe server and open-frame server classes becoming mixed. As a result, it was decided to change the basis for categorization from factors such as the

[28] Source: http://energystar.gov/products/specs/sites/products/files/Draft%203%20Version%206%200%20Test%20Method%20for%20Computers.pdf

[29] Sources: http://www.eccj.or.jp/top_runner/index.html, http://www.eccj.or.jp/top_runner/pdf/tr_computers_magneticdiscunits_dec2009.pdf

main memory capacity to the CPU type. For client computers, the categories compact desktop and netbook were added to the existing notebook and desktop categories.

EPRI / ECOVA Test Protocol for Internal Power Supplies

- Title/Scope: Generalized Test Protocol for Calculating the Energy Efficiency of Internal Ac-Dc and Dc-Dc Power Supplies, Revision 6.6
- Organisations: EPRI (Electric Power Research Institute) and ECOVA
- Status/Year/Revision: April 2012
- Issues[30]: This document specifies a test protocol for calculating the energy efficiency of internal ac-dc and dc-dc power supplies. Internal power supplies are located in the same housing as the product that they power. An example of this type of power supply is a desktop computer power supply that has multiple output voltages. External power supplies – often referred to as ac adapters – are contained in a housing separate from the devices they power and are not included in the scope of this document.

1.3.2.2 Displays

IEC 62301

See section 1.3.2.1.

ISO 7779

See section 1.3.2.1.

IEEE 1680.1 standard

See section 1.3.2.1.

[30] Source: http://efficientpowersupplies.epri.com/pages/Latest_Protocol/Generalized_Internal_Power_Supply_Efficiency_Test_Protocol_R6.6.pdf

ISO 9241 "300" subseries

- Title / Scope: Ergonomics of human-system interaction - Part 300
- Organisation: International Organization for Standardization (ISO)
- Status / Year: Publication date June 2009
- Issues: The ISO 9241 "300" subseries establishes requirements for the ergonomic design of electronic visual displays. These requirements are stated as performance specifications, aimed at ensuring effective and comfortable viewing conditions for users with normal or adjusted-to-normal eyesight. Test methods and metrology, yielding conformance measurements and criteria, are provided for design evaluation. The ISO 9241 "300" subseries is applicable to the visual ergonomics design of electronic visual displays for a diversity of tasks in a wide variety of work environments. The former ISO 13406-2:2001 standard "Ergonomic requirements for work with visual displays based on flat panels -- Part 2: Ergonomic requirements for flat panel displays" has been withdrawn and revised by the ISO 9241-302, 303, 305 and 307 standards

EN 50279

- Title / Scope: EN 50279 - Visual Display Units - Measuring Methods For Low Frequency Electric And Magnetic Near Fields
- Organization: CENELEC (European Committee for Electrotechnical Standardization)
- Status / Year: Published December 1997
- Issues: Measuring methods for low frequency electric and magnetic near fields

ENERGY STAR Test Method for Displays

- Title / Scope: ENERGY STAR Test Method for Determining Displays Energy Use Version 6.0 – Rev. Jan-2013
- Organisation: Energy Star

- Status / Year: Published January 2013
- Issues[31]: The test method for determining the energy use of displays is applicable to all products eligible for qualification under the ENERGY STAR Product Specification for Displays. Note: The U.S. Department of Energy (DOE) has published the Test Procedure for Television Sets Notice of Proposed Rulemaking (77 FR 2830). Any product that is included in DOE's scope of coverage for TVs shall ultimately be tested according to the Test Procedure for Television Sets Final Rulemaking published by DOE.

VESA Flat Panel Display Measurements (FPDM) Standard, Version 2.0

- Title / Scope: Flat Panel Display Measurements (FPDM2) Version 2 Update
- Organization: Video Electronics Standards Association
- Status / Year: May 2005
- Revision: The FPDM standard has been replaced by the Information Display Measurements Standard (IDMS) published by the Society for Information Display (SID), see below

INFORMATION DISPLAY MEASUREMENTS "STANDARD" (IDMS)

- Title / Scope: Information display measurements standard
- Organization: Society for Information Display (SID), International Committee for Display Metrology (ICDM), Video Electronics Standards Association (VESA)
- Status / Year: Version 1.03, June 2012
- Issues: This document consists of standard measurement procedures to quantify electronic display characteristics and qualities. However, it is also a document that discusses display metrology or the science of display

[31] Source: http://energystar.gov/products/specs/sites/products/files/Final_Version_6%200_Displays_Program_Requirements.pdf

measurements in that it reveals some of the problems associated with making display measurements, contains diagnostics to reveal those problems, and offers solutions to these measurement difficulties. The measurements in the document shall be considered to be a listing from which the desired measurement methods can be selected depending upon the needs of the user.

1.3.3 *Environmental labelling schemes and criteria analysis*

In this section, current ecolabelling schemes have been analysed with regard to their criteria. In the light of the fast technological progress of televisions and displays, only those labelling schemes and criteria published or revised subsequently to the current EU Ecolabel criteria are listed below.

1.3.3.1 Computers

Blue Angel "Personal Computers" (RAL-UZ 78a)

- Title/Scope: Blue Angel "Personal Computers (Desktop Computers, Integrated Desktop Computers, Workstations, Thin Clients"), RAL-UZ 78a
- Organisation: Federal Ministry for the Environment Nature Conservation and Nuclear Safety
- Status/Year: Edition March 2012
- Issues: The Blue Angel eco-label for Personal Computers may be awarded to products with the following environmental properties:
  - low energy consumption
  - Long-lived and recyclable design,
  - Avoidance of environmentally damaging materials.
- Test Methods / Standards for the Blue Angel "Personal Computers": Energy Consumption according to *Energy Star Requirements for Computers, Version 5.0*. Energy efficiency of internal power supplies according to the *Generalized Test Protocol for Calculating the Energy Efficiency of Internal Ac-Dc and Dc-Dc*

Power Supplies, Revision 6.5. Noise emissions according to ISO 7779:2010 and ECMA-74:2008.

- Criteria:
  - Requirements for energy consumption for
    - Desktop Computers and Integrated Desktop Computers
    - Workstations
    - Thin Clients
  - (Energy) requirements for
    - Power Management
    - Internal Power Supplies
  - Material Requirements
  - Requirements for Displays (applicable to Integrated Desktop Computers only)
  - Longevity
  - Recyclable Design
  - Noise Emissions
  - Consumer Information

Blue Angel "Computer Keyboards" (RAL-UZ 78b)

- Title/Scope: Blue Angel "Computer Keyboards", RAL-UZ 78b
- Organisation: Federal Ministry for the Environment Nature Conservation and Nuclear Safety
- Status/Year: Edition January 2011
- Issues: The Blue Angel eco-label for Computer Keyboards may be awarded to products with the following environmental properties:
  - Long-lived and recyclable design,

- Avoidance of environmentally damaging materials,
- Ergonomic design.

- Criteria:
  - Longevity/ Reparability
  - Recyclable Design
  - Material Requirements
  - Use of Biocidal Silver
  - Noise Emissions
  - Ergonomics
  - Consumer Information

Blue Angel "Notebook Computers" (RAL-UZ 78d)

- Title/Scope: Blue Angel "Notebook Computers", RAL-UZ 78d
- Organisation: Federal Ministry for the Environment Nature Conservation and Nuclear Safety
- Status/Year: Edition January 2011
- Issues: The Blue Angel eco-label for Notebook Computers may be awarded to products with the following environmental properties:
  - low energy consumption
  - long-lived and recyclable design,
  - avoidance of environmentally damaging materials.
- Test Methods / Standards for the Blue Angel "Notebook Computers": Energy Consumption according to *Energy Star Requirements for Computers, Version 5.0*. Energy efficiency of internal power supplies according to the *Generalized Test Protocol for Calculating the Energy Efficiency of Internal Ac-Dc and Dc-Dc Power Supplies, Revision 6.5*. Noise emissions according to ISO 7779:2010 and ECMA-74:2008.

- Criteria:
  - Requirements for energy consumption
  - (Energy) requirements for
    - Power Management
    - Internal Power Supplies
  - Material Requirements
  - Use of biocidal silver
  - Requirements for Displays
  - Longevity (Reparability, upgradability, capability enhancement)
  - Recyclable Design
  - Noise Emissions
  - Consumer Information

Blue Angel "Netbooks" (RAL-UZ 135)

- Title/Scope: Blue Angel "Netbooks (Small portable computers)", RAL-UZ 135
- Organisation: Federal Ministry for the Environment Nature Conservation and Nuclear Safety
- Status/Year: Edition July 2011
- Issues: The Blue Angel eco-label for Netbooks may be awarded to products with the following environmental properties:
  - Low energy consumption
  - Durable and recyclable design,
  - Avoidance of environmentally damaging materials.
- Test Methods / Standards for the Blue Angel "Notebook Computers": Energy Consumption according to *Energy Star Requirements for Computers, Version 5.0*. Noise emissions according to ISO 7779.

- Criteria:
  - Requirements for energy consumption
  - Longevity (Reparability, capability enhancement)
  - Requirements for Design and Components (recyclable design, material requirements for plastics in cases and case parts, display)
  - Brightness of the Display
  - Noise Emissions
  - Guarantee
  - Consumer Information

ENERGY STAR specification for Computers (Version 5.2)

- Title/Scope: ENERGY STAR® Program Requirements Product Specification for Computers; Eligibility Criteria Version 5.2
- Organisation: ENERGY STAR is a joint program of the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy
- Status/Year/Revision: Effective date: 1 July 2009. The Energy Star specification for computers is currently under revision[32]. The Version 6.0 ENERGY STAR Computers specification shall take effect April 28, 2014.
- Issues: The Energy Star program requirements for computers subsume the following product categories: Desktop Computers, Integrated Desktop Computers, Notebook Computers, Workstations, Small-scale Servers that are marketed and sold for non-data centre use, and Thin Clients.
- Test Methods / Standards for ENERGY STAR Qualification:
  - ENERGY STAR Test Method for Computers, Rev. Aug-2010.

[32] Materials related to this revision process are provided here: https://energystar.gov/products/specs/node/143

  - EPRI Generalized Internal Power Supply Efficiency Test Protocol, Rev. 6.4.2 for Internal and External Power Supplies

- Criteria:
  - Power supply requirements (Internal / External Power Supplies IPS / EPS)
  - Power management requirements (Sleep Mode, Display Sleep Mode, Wake on LAN WoL, Wake management)
  - Power consumption requirements for different modes, specified for the different product categories
  - User information requirements

Nordic Ecolabel (Nordic Swan)

- Title/Scope: Nordic Ecolabelling of Computers
- Organisation: Nordic Ecolabelling organisation (the Nordic Ecolabel is the official Ecolabel of the Nordic countries, established by the Nordic Council of Ministers)
- Status/Year: Version 6.4, 08 June 2009 – 30 June 2014
- Issues: Nordic Ecolabelled computers meet strict environmental requirements making their environmental impact among the lowest in their category. The environmental issues associated with computers are mainly due to power consumption but also the amount of waste produced. Since the service life of a computer is often very short, discarded computers represent a considerable waste problem. They also contain hazardous substances such as flame retardants and lead.
- Criteria: The requirements in this document, which a computer must fulfil to be awarded the Nordic Ecolabel, focus on the following aspects:
  - power consumption
  - design (upgradeability and disassembling)
  - plastics and their additives, e.g. flame retardants

- heavy metals
- recycling of discarded products
- performance such as noise level, ergonomics and electrical and magnetic fields

- Revision: no information available

TCO Certified Desktops 4.0

- Title/Scope: TCO Certified Desktops 4.0
- Organisation: TCO Development (Sweden)
- Status/Year: 5 March 2012
- Issues: The criteria are applicable to all desktop computers, such as desk-side computers and computers of tower type.
- Test Methods / Standards for TCO Certified Displays:
  - Own TCO Test Methods
  - Energy consumption measurements shall be taken in accordance with the most recently published version of the Energy Star standard for computers. The Energy consumption of the external power supply shall follow the U.S. Environmental Protection Agency's (EPA) demands for compliance with The International Efficiency Protocol requirement for level V, equivalent to the Energy Star version 2.0 for external power supplies, also covering battery chargers[33].
- Criteria:

[33] The international efficiency marking protocol provides a system for power supply manufacturers to designate the minimum efficiency performance of an external power supply, so that finished product manufacturers and government representatives can easily determine a unit's efficiency. This mark does not serve as a consumer information label, but rather demonstrates the performance of the external power supply when tested to the internationally supported "Test Method for Calculating the Energy Efficiency of Single-Voltage External Ac-Dc and Ac-Ac Power Supplies", cf. section 1.3.2.1

  - Visual ergonomics
  - Work load ergonomics
  - Emissions
  - Electrical safety
  - Environmental requirements:
    - Climate (energy consumption, energy consumption external power supply)
    - Environmentally hazardous substances
    - Product lifetime (warranty and spare parts)
    - Preparation for recycling
    - Product packaging
  - Corporate social responsibility
- Revision: no information available

TCO Certified All-in-one PCs 2.0

- Title/Scope: TCO Certified All-in-one PCs 2.0
- Organisation: TCO Development
- Status/Year: 5 March 2012
- Issues: The criteria are applicable to all-in-one PCs, defined as a PC and a display in a single unit. Other terminology the document may cover is Integrated Network PCs and Thin Clients.
- Test Methods / Standards for TCO Certified Displays:
  - Own TCO Test Methods
  - Energy consumption measurements shall be taken in accordance with the most recently published version of the Energy Star standard for computers. The Energy consumption of the external power supply shall follow the U.S.

Environmental Protection Agency's (EPA) demands for compliance with The International Efficiency Protocol requirement for level V, equivalent to the Energy Star version 2.0 for external power supplies, also covering battery chargers[34].

- Criteria:
  - Visual ergonomics
  - Work load ergonomics
  - Emissions
  - Electrical safety
  - Environmental requirements:
    - Climate (energy consumption, energy consumption external power supply)
    - Environmentally hazardous substances
    - Product lifetime (warranty and spare parts)
    - Preparation for recycling
    - Product packaging
  - Corporate social responsibility
- Revision: no information available

[34] The international efficiency marking protocol provides a system for power supply manufacturers to designate the minimum efficiency performance of an external power supply, so that finished product manufacturers and government representatives can easily determine a unit's efficiency. This mark does not serve as a consumer information label, but rather demonstrates the performance of the external power supply when tested to the internationally supported "Test Method for Calculating the Energy Efficiency of Single-Voltage External Ac-Dc and Ac-Ac Power Supplies", cf. section 1.3.2.1

TCO Certified Edge All-in-one PCs 1.0

- Title/Scope: TCO Certified Edge All-in-one PCs 1.0
- Organisation: TCO Development
- Status/Year: 10 May 2010
- Issues: TCO Certified Edge is a supplemental certification for TCO Certified All-in-one PCs - recognizing best in class products in a specific sustainability attribute.
- Criteria: Current qualifying criteria are:
  - Minimum 50% post-consumer recycled plastic content

  To apply for a TCO Certified Edge certificate it is also necessary that the product is certified according to the regular TCO Certified programme.
- Revision: no information available

TCO Certified Notebooks 4.0

- Title/Scope: TCO Certified Notebooks 4.0
- Organization: TCO Development
- Status/Year: 5 March 2012
- Issues: The criteria are applicable to notebook computers, defined as a portable stand-alone mobile computer that includes a keyboard, a display, a processor unit and memory storage device. Other terminologies related to notebook computers are laptop, netbook, portable computer etc. A tablet or slate PC is not covered by these criteria, but shall be tested according to the TCO Certified Tablets criteria document (see below).
- Test Methods / Standards for TCO Certified Notebooks:
  - Own TCO Test Methods
  - Energy consumption measurements shall be taken in accordance with the most recently published version of the Energy Star standard for computers.

The Energy consumption of the external power supply shall follow the U.S. Environmental Protection Agency's (EPA) demands for compliance with The International Efficiency Protocol requirement for level V, equivalent to the Energy Star version 2.0 for external power supplies, also covering battery chargers[35].

- Criteria:
  - Visual ergonomics
  - Work load ergonomics
  - Emissions
  - Electrical safety
  - Environmental requirements:
    - Climate (energy consumption, energy consump. external power supply)
    - Environmentally hazardous substances
    - Product lifetime (warranty and spare parts)
    - Preparation for recycling
    - Product packaging
  - Corporate social responsibility
- Revision: no information available

[35] The international efficiency marking protocol provides a system for power supply manufacturers to designate the minimum efficiency performance of an external power supply, so that finished product manufacturers and government representatives can easily determine a unit's efficiency. This mark does not serve as a consumer information label, but rather demonstrates the performance of the external power supply when tested to the internationally supported "Test Method for Calculating the Energy Efficiency of Single-Voltage External Ac-Dc and Ac-Ac Power Supplies", cf. section 1.3.2.1

TCO Certified Edge Notebooks 1.0

- Title/Scope: TCO Certified Edge Notebooks 1.0
- Organisation: TCO Development
- Status/Year: 09 February 2011
- Issues: TCO Certified Edge is a supplemental certification for TCO Certified Notebooks - recognizing best in class products in a specific sustainability attribute.
- Criteria: Current qualifying criteria are:
  - High Brightness / Daylight Readable. A Display shall retain its readability and high picture quality even when used in bright outdoor environments. Readability in daylight conditions depends on the differences between the lumination and illumination of the screen. The lumination is the screen's brightness and is the amount of light energy coming out of the display. Illumination is the amount of ambient light shining onto the screen. Daylight readability depends on how well the display can counteract the diminishing effects of ambient light.

  To apply for a TCO Certified Edge certificate it is also necessary that the product is certified according to the regular TCO Certified programme.
- Revision: no information available

TCO Certified Tablets 2.0

- Title/Scope: TCO Certified Tablets 2.0
- Organisation: TCO Development
- Status/Year: 1 November 2012
- Issues: The criteria are applicable to tablet computers with a display size > 4''; the intended use of tablet computers certified according to the TCO criteria shall not be mobile communication with the product held to the head. Tablet computers, slate computers or simply "tablets" are defined as a wireless,

portable computer that is primarily for battery mode usage and has a touch screen interface. This means that connection to mains via an adapter is considered to be mainly for battery charging purposes and the onscreen virtual keyboard or a digital pen is in place of a physical keyboard.

- Test Methods / Standards for TCO Certified Notebooks:
  - Own TCO Test Methods
  - The Energy consumption of the external power supply shall follow the U.S. Environmental Protection Agency's (EPA) demands for compliance with The International Efficiency Protocol requirement for level V, equivalent to the Energy Star version 2.0 for external power supplies, also covering battery chargers[36].
- Criteria:
  - Visual ergonomics
  - Work load ergonomics
  - Emissions
  - Electrical safety
  - Environmental requirements:
    - Climate (energy consumption)
    - Environmentally hazardous substances
    - Product lifetime (warranty and spare parts)
    - Preparation for recycling

[36] The international efficiency marking protocol provides a system for power supply manufacturers to designate the minimum efficiency performance of an external power supply, so that finished product manufacturers and government representatives can easily determine a unit's efficiency. This mark does not serve as a consumer information label, but rather demonstrates the performance of the external power supply when tested to the internationally supported "Test Method for Calculating the Energy Efficiency of Single-Voltage External Ac-Dc and Ac-Ac Power Supplies", cf. section 1.3.2.1

        - Product packaging
    - Corporate social responsibility
- Revision: no information available

EPEAT

- Title/Scope: Computer-Display Criteria
- Organisation: Green Electronics Council (GEC)
- Status/Year: no information available
- Issues: EPEAT-registered electronic products meet environmental measures referred to as criteria. They reflect several categories of environmental attributes covering the full lifecycle of electronic products. Products are measured against both required and optional criteria. A product must meet all of the required criteria in its category to be added to the registry. It is then rated Bronze (meets all required criteria), Silver (all required plus at least 50% of optional criteria) or Gold (all required plus at least 75% of optional criteria).
- Test Methods / Standards for EPEAT of Computers:
    - All of the criteria used in EPEAT are based on ANSI-approved public standards, which provide technical details for every criterion and specify how a manufacturer must demonstrate compliance.
    - Currently, EPEAT registration is based on the 1680 family of Environmental Assessment Standards.
- Criteria: The "PC and Displays" standards address[37]:
    - Corporate performance
    - Materials selection
    - Reduction/elimination of environmentally sensitive materials

[37] Source: http://www.epeat.net/resources/criteria-discussion/pc-display-criteria/

  - Design for end of life
  - Packaging
  - Energy conservation
  - Product longevity/life extension
  - End-of-life management
- Revision: no information available

Detailed criteria analysis of current ecolabelling schemes for computers

The following table provides an in-depth analysis of the detailed criteria of current ecolabels for computers. The criteria are structured along their life-cycle phases. As the analysed ecolabels were developed subsequently to the current EU Ecolabel, diverging criteria are marked bold in order to point out possible amendments for the EU Ecolabel revision process.

Table 3: Overview – Analysis of current ecolabel criteria for computers

Label (Details)	**EU Ecolabel 2011** (PC, Displays, Key-boards, Notebooks, Thin Clients)	**Nordic Swan 2009** (PCs, Displays, Notebooks, Workstations, Thin Clients, Small-Scale Server)	**Blue Angel 2012**	**TCO 2012 / TCO Certified Edge 2012** (Desktops, Notebooks, All-in-one PCs, Tablets)	**Energy Star Version 5.2 2009** (PCs, Note-books, Work-stations, Thin Clients, Small-Scale Server)	**EPEAT** (R: required; O: optional)
MANUFACTURING						
Corporate environmental and/or social responsibility	---	• **Code of conduct => plan for ethical production** (sub-contractors & producers => UN Global Compact)	---	• **Corporate Social responsibility** (good labour relations and working conditions by proving accordance with ILO, UN Convention on the Rights of the Child, the health and safety legislation, the labour law in the manufacturing country • **Environmental management certification** (EMAS, ISO 14001) for each manufacturing plant	---	• R: Demonstration of **corporate environmental policy** consistent with ISO 14001 • R: Self-certified **environmental management system** for design and manufacturing organizations • O: Third-party certified environmental management system for design and manufacturing organizations • R: **Corporate report consistent with Performance Track or GRI** • O: Corporate report based on GRI

Label (Details)	**EU Ecolabel 2011** (PC, Displays, Keyboards, Notebooks, Thin Clients)	**Nordic Swan 2009** (PCs, Displays, Notebooks, Workstations, Thin Clients, Small-Scale Server)	**Blue Angel 2012**	**TCO 2012 / TCO Certified Edge 2012** (Desktops, Notebooks, All-in-one PCs, Tablets)	**Energy Star Version 5.2 2009** (PCs, Notebooks, Workstations, Thin Clients, Small-Scale Server)	**EPEAT** (R: required; O: optional)

Limitation of hazardous substances during production / in the product	• Products shall not contain
	  ○ Substances or mixtures with certain risks (R phrases)
	  ○ Substances of very high concern
	• Plastics shall additionally not contain
	  ○ DNOP, DINP, DIDP
	  ○ A chlorine content > 50% by weight
	  ○ Biocidal products not included in Annex IA to Directive 98/8/EC
	• Limit value ≤ 0,1 mg for mercury in fluorescent lamps
		• Products shall not contain
		  ○ Flame retardants
		  ▪ Plastics: with certain risks (R phrases); incl. some exemptions
		  ▪ PBB, PBDE, decaBDE and chlorinated paraffins in printed circuit boards and certain plastic parts
		  ○ **Chlorine based plastics (enclosure, chassis)**
		• Limit value ≤ 14 mg for mercury content in background lightning of displays and integrated desktop computers; mercury prohibited in backlighting of notebook computers
			• Plastics shall not contain (incl. some exemptions)
			  ○ Substances with certain risks (R phrases)
			  ○ **Flame retardants containing halogenated organic compounds**
			  ○ **Halogenated polymers shall not be permitted**
			• **Plastic components < 25 g as well as the carrier material of printed circuit boards must not contain any PBBs, PBDEs or chlorinated paraffins.**
			• The monitor backlight shall not contain any mercury (limit value ≤ 0,1 mg)
			• **Notebooks: The use of biocidal silver on touch-sensitive surfaces shall not be permitted**
				• Products shall not contain
				  ○ Flame retardants in plastics:
				  ▪ with certain risks (R phrases); incl. some exemptions
				  ▪ containing **organically bound bromine or chlorine**
				  ▪ containing **Antimony(III) oxide (Sb_2O_3)**
				  ▪ containing **Tri-o-cresyl phosphate**
				  ○ **PBB, PBDE and HBCDD**
				  ○ **Plastics with chlorine and bromine as part of the polymer** (excluding printed wiring board laminates and cable insulation)
				• No RoHS-substances (Cd, Hg, Pb, CrVI), except for Limit values for mercury in background lightning system
				• Certified Edge criteria: **halogen free plastics in the display**
					---	• R: Compliance with provisions of European RoHS Directive upon its effective date
						• O: Elimination of intentionally added cadmium
						• R: Reporting on amount of mercury used in light sources (mg)
						• O: Low threshold for amount of mercury used in light sources
						• O: Elimination of intentionally added mercury used in light sources
						• O: **Elimination of intentionally added lead in certain applications**
						• O: **Elimination of intentionally added hexavalent chromium**
						• R: Elimination of intentionally added SCCP flame retardants and plasticizers in certain applications

Label (Details)	**EU Ecolabel 2011** (PC, Displays, Key-boards, Notebooks, Thin Clients)	**Nordic Swan 2009** (PCs, Displays, Notebooks, Workstations, Thin Clients, Small-Scale Server)	**Blue Angel 2012**	**TCO 2012 / TCO Certified Edge 2012** (Desktops, Notebooks, All-in-one PCs, Tablets)	**Energy Star Version 5.2 2009** (PCs, Note-books, Work-stations, Thin Clients, Small-Scale Server)	**EPEAT** (R: required; O: optional)
				• **Announcement of 12 non-halogenated hazardous substances likely to be banned in the next TCO version of Certified Desktops (2014)**		• O: **Large plastic parts free of certain flame retardants classified under European Council Directive 67/548/EEC** • O: Batteries free of lead, cadmium and mercury • **O: Large plastic parts free of PVC**
Ergonomics	---	• **Requirements for displays and notebook computers according ISO 9241-300 series or according TCO Displays / TCO Notebooks criteria** • **Requirements for external keyboards according ISO 9241-4** • **Slate-Computer: minimum display size >7''; "full size" virtual keyboard**	• **Netbooks: brightness of the display (luminance adjustment)** • Desktops / integrated desktops, Workstations, Thin Clients, Notebooks: ---	• **Visual ergonomics**; characteristics for o Image detail o Luminance o Luminance contrast o Reflection o Screen colour o Desktops: only display resolution • **Work load ergonomics** o Desktops: easily accessible (USB) connections o Notebooks: separate display, keyboard and input device; keyboard requirem. o All-in-one PCs: Vertical tilt; Vertical	---	---

Label (Details)	**EU Ecolabel 2011** (PC, Displays, Key-boards, Notebooks, Thin Clients)	**Nordic Swan 2009** (PCs, Displays, Notebooks, Workstations, Thin Clients, Small-Scale Server)	**Blue Angel 2012**	**TCO 2012 / TCO Certified Edge 2012** (Desktops, Notebooks, All-in-one PCs, Tablets)	**Energy Star Version 5.2 2009** (PCs, Note-books, Work-stations, Thin Clients, Small-Scale Server)	**EPEAT** (R: required; O: optional)
				height adjustment ○ Tablets: --- ○ Certified Edge criteria: full function ergonomic display stand		
Design for recycling	• Easy disassembly • Circuit boards / other precious metal containing components shall be easily removable to enhance recovery of high value material • Plastic material in covers / housings shall have no surface coatings incompatible with recycling or reuse • Plastic parts: one polymer or compatible polymers for recycling; marking • Information on hazardous substances • External plastic case of the system unit, monitor and	• Easy disassembly • Possibility to separate substances, preparations and components listed in Annex II of WEEE Directive • Plastic parts: one polymer or compatible polymers for recycling; marking of plastics • Large plastic parts must not be painted or metallized (exemption: Notebooks) • **90% by weight of plastics and metals in the enclosure and chassis must be technically suitable for material recovery (except incineration)**	• Easy (manual) / efficient disassembly (use of universal tools, by one person alone); • Rechargeable batteries must be easy to remove without use of any tools • Electrical modules must be easily removable from the case • Plastic parts: single polymer or compatible polymers for recycling; max. 4 types of plastics; plastic cases max. 2 separable polymers • Material coding of plastics • No metallic coating of plastic case parts (notebooks: no electroplating)	• Material coding of plastics • No more than 2 different types of plastic material parts weighing more than 100 grams or 25 grams (Tablets) • No external/internal metallization of the Desktop / all-in-one PC's outer plastic casing • **Requirements for All-in-one PCs preparation for recycling of mercury lamps (avoidance of damage)** • Certified Edge criteria: **Product shall contain a minimum of 65% recycled plastic** by weight of total weight of plastic parts in the product	---	• R: Identification of materials with special handling needs • R: Elimination of paints or coatings that are not compatible with recycling or reuse • R: Easy disassembly of external enclosure • R: Marking of plastic components • R: Identification and removal of components containing hazardous materials • O: Reduced number of plastic material types • O: Molded/glued in metal eliminated or removable • R: Minimum 65 percent

Label (Details)	**EU Ecolabel 2011** (PC, Displays, Keyboards, Notebooks, Thin Clients)	**Nordic Swan 2009** (PCs, Displays, Notebooks, Workstations, Thin Clients, Small-Scale Server)	**Blue Angel 2012**	**TCO 2012 / TCO Certified Edge 2012** (Desktops, Notebooks, All-in-one PCs, Tablets)	**Energy Star Version 5.2 2009** (PCs, Notebooks, Workstations, Thin Clients, Small-Scale Server)	**EPEAT** (R: required; O: optional)
	keyboard shall have a post-consumer recycled content of not less than 10% by mass		• Post-consumer recyclate material may be used in case parts and chassis • **90% of the mass of plastics and metals of the case parts and chassis must be recyclable as material (no incineration)** • **Disassembly instructions for end-of-life recyclers or treatment facilities to recover valuable resources**			reusable/recyclable • O: Minimum 90 percent reusable/recyclable • O: Manual separation of plastics • O: Marking of plastics • R: Declaration of postconsumer recycled plastic content (%) • O: Minimum content of postconsumer recycled plastic • O: Higher content of postconsumer recycled plastic • R: Declaration of renewable/bio-based plastic materials content (%) • O: Minimum content of renewable/bio-based plastic material • R: Declaration of product weight (lbs)
Packaging	• Cardboards: at least 80% recycled material	**---**	---	• **The packaging shall not contain lead (Pb), cadmium (Cd), mercury**	---	• R: **Reduction/elimination of intentionally**

Label (Details)	**EU Ecolabel 2011** (PC, Displays, Key-boards, Notebooks, Thin Clients)	**Nordic Swan 2009** (PCs, Displays, Notebooks, Workstations, Thin Clients, Small-Scale Server)	**Blue Angel 2012**	**TCO 2012 / TCO Certified Edge 2012** (Desktops, Notebooks, All-in-one PCs, Tablets)	**Energy Star Version 5.2 2009** (PCs, Note-books, Work-stations, Thin Clients, Small-Scale Server)	**EPEAT** (R: required; O: optional)
	• Plastic bags: at least 75% recycled material or biodegradable / compostable			**(Hg) or hexavalent chromium (CrVI)** • **Plastic packaging material shall not contain organically bound halogens** • **Non-reusable packaging components > 25g shall be possible to separate into single material types without the use of tools**		**added toxics in packaging** • R: Separable packing materials • O: Packaging 90% recyclable and plastics labelled • R: Declaration of recycled content in packaging • O: Minimum postconsumer content guidelines • **O: Provision of take-back program for packaging** • O: Documentation of reusable packaging
USE						
Energy savings	• Desktop PCs, integrated desktop PCs and thin clients as well as Notebook PCs: energy efficiency requirements (exceeding Energy Star 5.0 requirements) • Displays: Max. energy consump-tion values for	• **Computers / Displays: Visible on/off- switch** • Requirements for energy efficiency referring to the most current Energy Star specification • **Slate Computer:** ○ **requirements for AC-adapter** ○ **battery must be possible to swap;**	• Requirements for energy efficiency ○ Desktop PCs, Integrated Desktop PCs, Notebooks: energy efficiency requirements (exceeding Energy Star 5.0 requirements) ○ Workstations / Thin Clients /	• Requirements according to most recently published Energy Star • Requirements for **external power supplies** • Tablets: only requirements for external power supplies	• Requirements for internal and **external power supplies (EPS with integral cooling fans)** • Maximum TEC (typical energy consumption) values for Desktops, Integrated	• R: ENERGY STAR® • O: Early adoption of new ENERGY STAR® specification • **O: Renewable energy accessory available** • **O: Renewable energy accessory standard**

Label (Details)	**EU Ecolabel 2011** (PC, Displays, Keyboards, Notebooks, Thin Clients)	**Nordic Swan 2009** (PCs, Displays, Notebooks, Workstations, Thin Clients, Small-Scale Server)	**Blue Angel 2012**	**TCO 2012 / TCO Certified Edge 2012** (Desktops, Notebooks, All-in-one PCs, Tablets)	**Energy Star Version 5.2 2009** (PCs, Notebooks, Workstations, Thin Clients, Small-Scale Server)	**EPEAT** (R: required; O: optional)
	○ Active-mode (exceeding Energy Star 5.0 requirements) ○ Maximum energy consumption in on mode (maximum brightness) ≤ 100 W ○ Sleep mode ○ Off-Mode • Power management requirements (10 minutes inactivity => display sleep; 30 minutes inactivity => computer sleep); network requirements for power management • Computers: Requirements for internal power supplies	**replacement battery must be available as option or spare part; battery replacement can be done at a repair shop** • **Energy Star requirements for external power supplies**	Netbooks: Energy Star 5.0 requirements • Power-management requirements (15 minutes inactivity => display's sleep or off mode; 30 minutes inactivity => sleep mode); • Network requirements for Wake on LAN and wake management • Requirements for internal power supplies • **Netbooks: requirements for external power supplies; on/off-switch**		Desktops and Notebooks incl. certain allowances for memory, graphics and storage • Maximum power consumption requirements for Workstations, Small scale servers and thin clients • Power management requirements for Sleep Mode, display sleep mode, Wake on LAN (WoL) and wake management for all product categories (except sleep mode for small scale servers and thin clients)	

Label (Details)	**EU Ecolabel 2011** (PC, Displays, Key-boards, Notebooks, Thin Clients)	**Nordic Swan 2009** (PCs, Displays, Notebooks, Workstations, Thin Clients, Small-Scale Server)	**Blue Angel 2012**	**TCO 2012 / TCO Certified Edge 2012** (Desktops, Notebooks, All-in-one PCs, Tablets)	**Energy Star Version 5.2 2009** (PCs, Note-books, Work-stations, Thin Clients, Small-Scale Server)	**EPEAT** (R: required; O: optional)
Emissions / electrical safety	Noise requirements for the personal computer system and Notebook PCs	• **Requirements for displays and notebook computers according prEN50279 regarding electrical and magnetic fields (TCO certificate)** • Noise requirements for computers in operating and idle mode	Noise requirements for Personal and Notebook Computers	• **Alternating electric fields** • **Alternating magnetic fields** • **Acoustic noise** (applies only when FPD is equipped with integrated moving parts such as a fan) • **Electrical safety**	---	---
User instructions	• Power consumption & savings; • Tips for reducing energy consumption • Repair information • A note stating that the computer / notebook / display draws some power when in off-mode	• Power consumption & savings; • Tips for reducing energy consumption • **Information on expansion / upgrading of processor, memory & clock frequency** • **Information on appropriate battery disposal & recycling** • Information on guarantee & availability of spare parts • Repair information	• Power consumption & savings; • Tips for reducing energy consumption (regular defragmentation, screen savers, reduction in monitor brightness) • A note stating that the computer draws power even when in off-mode • Reparability info • **Capacity expansion options**	---	• Power management settings; timing settings for various power management features; instructions for properly waking from Sleep Mode	---
END OF LIFE						
Reduction of waste	• Information on proper disposal and take-back policy	• Information on proper disposal and take-back policy	• Information on proper disposal **(special information regarding disposal**	• Information on proper disposal and take-back policy	---	• **R: Provision of product take-back service** • **O: Auditing of**

Label (Details)	**EU Ecolabel 2011** (PC, Displays, Key-boards, Notebooks, Thin Clients)	**Nordic Swan 2009** (PCs, Displays, Notebooks, Workstations, Thin Clients, Small-Scale Server)	**Blue Angel 2012**	**TCO 2012 / TCO Certified Edge 2012** (Desktops, Notebooks, All-in-one PCs, Tablets)	**Energy Star Version 5.2 2009** (PCs, Note-books, Work-stations, Thin Clients, Small-Scale Server)	**EPEAT** (R: required; O: optional)
			of batteries)			**recycling vendors** • **R: Provision of rechargeable battery take-back service**
Durability / life time extension	• Availability of spare parts should be ensured for at least 5 years from that time the production ceases • PCs shall have exchangeable / upgradeable memory & graphic cards; expansion capability (PCs: presence of at least 4 USB interfaces; Note-books: at least 3 USB interfaces, connection for an external monitor) • PCs shall be designed so that major components (incl. memory drives, CPUs and cards) can be exchanged / upgraded easily by the end-user	PCs/Notebooks: • Upgradeability without special tools (working memory, mass storage; CD ROM, DVD, HDD; port for ext. monitor, keyboard & mouse; at least one additional interface for ext. storage media and other periphal devices) **Tablet Computers** • **Working memory capacity >1 GB** • **Storage capacity >16 GB** • **Storage expansion slot** • **Minimum 1 expansion port following industry standard for accessories** • **Support for external keyboard, monitor, mouse**	• Availability of spare parts should be ensured for at least 5 years from that time the production ceases • Upgrade / exchange / expansion options for Memory, storage capacity, optical drive; presence of at least 4 USB interfaces; • Notebooks: minimum 3 USB interfaces and connector for external display • Netbooks: exchangeable or extendable RAM; minimum 2 USB ports and port for external monitor	• Product warranty for at least 1 year • Availability of replacement parts should be guaranteed **for 3 years** from that time the production ceases	---	• R: Availability of additional **three year warranty or service agreement** • **R: Upgradeable with common tools** • **O: Modular design** • O: Availability of replacement parts

Summary of the criteria analysis for computers

Here we summarise new criteria and criteria areas that feature within other ecolabels and could be considered within the scope of the EU Ecolabel revision. The criteria are grouped by lifecycle phase:

- Manufacturing phase:
  - Corporate environmental and/or social responsibility: Nordic Swan, TCO and EPEAT require CSR aspects and an Environmental Management System during the manufacturing process of computers.
  - Restriction of hazardous substances:
    - For touch-sensitive surfaces the use of biocidal silver shall not be permitted (Blue Angel)
    - TCO had announced a list of 12 non halogenated hazardous substances which are likely to be banned in the next version of TCO Certified desktops to be published in the first quarter of 2014 (TCO).
    - Halogen free plastics in the displays (TCO Certified Edge)
    - *Note: A further, in-depth analysis of the different approaches to hazardous substances is conducted in a separate Task report.*
  - Ergonomics: detailed addressed by TCO criteria; Nordic Swan refers to ISO and TCO; Blue Angel: only criteria for Netbooks
  - Design for recycling:
    - Specific requirements for easy disassembly by end-of-life recyclers or treatment facilities to recover valuable resources (Blue Angel)
    - Requirements for preparation for recycling of mercury lamps to avoid damage (TCO Certified Edge)
    - Different requirements for minimum content recycled plastic (TCO Cert. Edge: 65%; Blue Angel / EPEAT: optional)

        - 90% (Nordic Swan, Blue Angel, EPEAT optional), or 65% (EPEAT required) of the mass of plastics and metals of the case parts and chassis must be recyclable as material (no incineration)
    - Packaging: only addressed by TCO and EPEAT
        - The packaging shall not contain lead (Pb), cadmium (Cd), mercury (Hg) or hexavalent chromium (CrVI); Plastic packaging material shall not contain organically bound halogens (TCO)
        - Non-reusable packaging components > 25g shall be possible to separate into single material types without the use of tools (TCO)
        - Provision of take-back program for packaging (EPEAT, optional)
- Use phase
    - Energy savings
        - Criteria for External Power Supplies (Energy Star, TCO, Blue Angel for Netbooks)
        - On/off-control (Nordic Swan; Blue Angel for Netbooks)
        - Requirements for Slate Computers (Nordic Swan)
    - Emissions / electrical safety: electrical safety only addressed by TCO criteria; electric and magnetic fields: TCO / Nordic Swan referring to TCO; noise emissions: Nordic Swan, Blue Angel, TCO
    - User instructions: Power management settings (Energy Star); capacity expansion / upgradeability options (Nordic Swan, Blue Angel)
- End of life phase:
    - Reduction of waste: Special information regarding disposal of batteries (Blue Angel); Provision of product and rechargeable battery take-back service (EPEAT)
    - Longevity: Specific upgrade requirements for Tablets (Nordic Swan) and Netbooks (Blue Angel)

1.3.3.2 Displays

Blue Angel "Computer Monitors" (RAL-UZ 78c)

- Title/Scope: Computer Monitors RAL-UZ 78c
- Organisation: Federal Ministry for the Environment Nature Conservation and Nuclear Safety
- Status/Year: Edition January 2012
- Issues: The Blue Angel eco-label for computer monitors may be awarded to devices with the following environmental properties:
  - low power consumption;
  - product longevity;
  - recyclable design;
  - avoidance of environmentally harmful materials.
- Test Methods / Standards for the Blue Angel "Computer Monitors": The Blue Angel accepts the „TCO Certified Displays 5.2" certificate for compliance with the following Basic Criteria:
  - Reparability
  - Material Selection and Labelling
  - Ergonomics

  However, the present Basic Criteria include additional requirements for computer monitors that go beyond the criteria set forth in „TCO Certified Displays 5.2" the compliance with which needs to be additionally verified by the applicant.
  - Other measurements shall be taken in accordance with the ENERGY STAR Program Requirements for Displays (Version 5.0) (see below).
  - Ergonomics shall be tested according to DIN EN ISO 9241-307
- Criteria:

- Power Consumption in On Mode, Sleep and Off Modes
- Power-Saving Requirements
- Recyclable Design
- Material Requirements
- Backlight and Liquid Crystal Compounds
- Ergonomics
- Consumer Information

ENERGY STAR Program Requirements for Displays (Version 6.0)

- Title/Scope: ENERGY STAR® Program Requirements Product Specification for Displays Eligibility Criteria Version 6.0
- Organisation: ENERGY STAR is a joint program of the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy
- Status/Year/Revision: The Version 6.0 ENERGY STAR Display Products specification has taken effect on June 1, 2013.
- Issues: ENERGY STAR qualified displays include computer monitors, digital picture frames and professional signage which meet stringent energy efficiency requirements in On, Sleep, and Off Modes.
- Test Methods / Standards for ENERGY STAR Qualification:
  - ENERGY STAR Test Method for Determining Displays Energy Use Version 6.0 – Final Sep 2012.
  - "Video Electronics Standard Association (VESA) Flat Panel Display Measurements (FPDM) Standard version 2.0 test patterns" (shall be used only for products that cannot be tested using the IEC 62087-2011 Dynamic Broadcast-Content Signal).
  - IEC 62087, Ed 3.0: Methods of Measurement for the Power Consumption of Audio, Video and Related Equipment.

  - IEC 62301-2011: Household Electrical Appliances – Measurement of Standby Power.
  - Test Method for Calculating the Energy Efficiency of Single-Voltage External Ac-Dc and Ac-Ac Power Supplies, Aug. 11, 2004
- Criteria:
  - On Mode requirements,
  - Sleep Mode requirements,
  - Off Mode requirements,
  - Luminance reporting requirements,
  - General requirements: External Power Supply and Power management.
- Revision: The Version 6.0 ENERGY STAR Display Products specification has been taken effect on June 1, 2013. Compared to the prior version, the version 6.0 specifications establish new On-Mode power consumption requirements for displays with a viewable diagonal screen size from 12 to 30 inches and for computer monitors greater than 30 inches. They also establish a new maximum Sleep Mode power requirement of 0.5 W for all displays, and a power management requirement that all computer monitors must enter Sleep Mode after the connection to a host is discontinued. In addition, this specification
  - Establishes an allowance in Sleep Mode for multiple networking and control protocols, including Gigabit Ethernet or Wi-Fi protocols, and additional capabilities, such as occupancy sensors or memory, implemented in a single product,
  - Adds a definition for enhanced-performance displays and establishes an allowance in On Mode for products that meet that definition,
  - Establishes a hierarchy under the Test Method for testing network connected products in Sleep Mode and lighting conditions for testing products with automatic brightness control (ABC) enabled by default.

For future revisions EPA is interested in exploring expanding the scope of products to those greater than 61" in diagonal screen size in the next specification revision. EPA and DOE will explore with stakeholders whether touch screen functionality impacts On Mode power consumption to determine to what extent the next specification development process should address touch screen functionality.

TCO Certified Displays 6.0

- Title/Scope: TCO Certified Displays 6.0
- Organisation: TCO Development
- Status/Year: March 2012
- Issues: In addition to all TCO Certified criteria, displays need to fulfil requirement for visual ergonomics, including luminance, contrast and colour performance. For best in class displays, the add-on “TCO Certified Edge” certification is available. It requires the display to show leading edge performance in a particular area (see below, TCO Certified Edge Displays 1.2). As part of TCO Development’s continued commitment to sustainable IT, the major changes in TCO Certified Displays 6 focus primarily on CSR requirements. Environmental and image quality criteria have also been enhanced as part of this update.
- Test Methods / Standards for TCO Certified Displays:
  - Own TCO Test Methods
  - Energy consumption measurements shall be taken in accordance with the most recently published version of the Energy Star standard for displays.
- Criteria:
  - Visual ergonomics
  - Work load ergonomics
  - Emissions

  - Electrical safety
  - Environmental requirements:
    - Climate (energy consumption)
    - Environmentally hazardous substances
    - Product lifetime (warranty and spare parts)
    - Preparation for recycling
    - Product packaging
  - Corporate social responsibility (based on the eight ILO core conventions and local legislation.
- Revision: no information available

TCO Certified Edge Displays 1.2

- Title/Scope: TCO Certified Edge Displays 1.2
- Organisation: TCO Development
- Status/Year: November 2012
- Issues: TCO Certified Edge is a supplemental certification for TCO Certified Displays - recognizing best in class displays in a specific sustainability attribute.
- Criteria: Current qualifying criteria are:
  - Halogen free display
  - Minimum 65% post-consumer recycled plastic content
  - Full function ergonomic display stand

  To comply with TCO Certified Edge Displays it is enough to fulfil only one of the cutting edge criteria. To apply for a TCO Certified Edge certificate it is also necessary that the product is certified according to the regular TCO Certified program.
- Revision: no information available

Nordic Ecolabel (Nordic Swan)

- Title/Scope: Nordic Ecolabelling of Computers
- Organisation: Nordic Ecolabelling organisation (the Nordic Ecolabel is the official Ecolabel of the Nordic countries, established by the Nordic Council of Ministers)
- Status/Year: Version 6.4 from 8 June 2009 – 30 June 2014
- Issues: Nordic Ecolabelled computers meet strict environmental requirements making their environmental impact among the lowest in their category. The environmental issues associated with computers are mainly due to power consumption but also the amount of waste produced.
- Test Methods / Standards for Nordic Ecolabelling of Computers:
  - The power consumption requirements are fully or partially harmonised with the ENERGY STAR specification for computers (version 5.0) and ENERGY STAR specification for monitors/displays (version 5.0).
  - Sound power level: The sound power level of computers must be measured in accordance with ISO 7779 or RAL-UZ 78 and declared in accordance with ISO 9296. Alternatively displays must be certified according to TCO Displays 5.0 or later version
  - Ergonomics: must meet all relevant mandatory requirements in the latest valid version of the standards of ISO 9241-300 series.
  - Electric and magnetic fields: Displays and notebook computers must fulfil the requirements applicable to electrical and magnetic fields in accordance with prEN50279, category A.
- Criteria: The requirements focus on the following aspects:
  - power consumption
  - design (upgradeability and disassembling)
  - plastics and their additives, e.g. flame retardants

  - heavy metals
  - recycling of discarded products
  - performance such as noise level, ergonomics and electrical and magnetic fields
- Revision: In the next criteria revision, the following issues will be considered:
  - The possibility of further harmonization with other eco-labels.
  - The possibility to extend the product group and enable the Nordic Ecolabelling of PDAs, game consoles and computer accessories.
  - The possibility of requiring that the computer should be made of recycled plastic.
  - Requirements as to recycling of materials in the production process and reductions in waste quantities during manufacture.
  - The possibility to ban PVC.
  - Requirements as to the use of rare metals.
  - The possibility to tighten requirements on displays, such as by prohibiting the use of mercury.
  - The possibility of tightening requirements relating to the use of flame retardants, other chemicals and heavy metals.
  - The possibility of tightening requirements relating to power consumption.
  - The possibility of tightening requirements relating to noise.

EPEAT

- Title/Scope: Computer-Display Criteria
- Organisation: Green Electronics Council (GEC)
- Status/Year: no information available

- Issues / Test Methods / Standards / Criteria for EPEAT of Displays[38]: same as for computers, cf. section 1.3.3.1
- Revision: no information available

Detailed criteria analysis of current ecolabelling schemes for displays

The following table provides an in-depth analysis of the detailed criteria of current ecolabels for displays. The criteria are structured along their life-cycle phases. As the analysed ecolabels were developed subsequently to the current EU Ecolabel, diverging criteria are marked bold in order to point out possible amendments for the EU Ecolabel revision process.

[38] Source: http://www.epeat.net/resources/criteria-discussion/pc-display-criteria/

Table 4: Overview – Analysis of current ecolabel criteria for displays

	EU Ecolabel 2011	Nordic Swan 2009	Blue Angel 2012	TCO 2012 / TCO Certified Edge 2012	Energy Star 2013	EPEAT (R: required; O: optional)
MANUFACTURING						
Corporate environmental and/or social responsibility	---	• **Code of conduct => plan for ethical production** (sub-contractors & producers => UN Global Compact)	---	• **Corporate Social responsibility** (good labour relations and working conditions by proving accordance with ILO, UN Con-vention on the Rights of the Child, the health and safety legislation, the labour law in the manufacturing country • **Environmental management certification** (EMAS, ISO 14001) for each manufacturing plant	---	• R: Demonstration of **corporate environmental policy** consistent with ISO 14001 • R: Self-certified **environmental management system** for design and manufacturing organizations • O: Third-party certified environmental management system for design and manufacturing organizations • R: **Corporate report consistent with Performance Track or GRI** • O: Corporate report based on GRI
Limitation of hazardous substances during production / in the product	• Products shall not contain ○ Substances or mixtures with certain risks (R phrases)	• Products shall not contain ○ Flame retardants ▪ Plastics: with certain risks (R phrases); incl.	• Plastics shall not contain (incl. some exemptions) ○ Substances with certain risks (R phrases)	• Products shall not contain ○ **PBB, PBDE and HBCDD** ○ Flame retardants in plastics:	• Harmonization with EU RoHS	• R: Compliance with provisions of European RoHS Directive upon its effective date • O: Elimination of

	EU Ecolabel 2011	Nordic Swan 2009	Blue Angel 2012	TCO 2012 / TCO Certified Edge 2012	Energy Star 2013	EPEAT (R: required; O: optional)
	○ Substances of very high concern • Plastics shall additionally not contain ○ DNOP, DINP, DIDP ○ A chlorine content > 50% by weight ○ Biocidal products not included in Annex IA to Directive 98/8/EC • Limit value ≤ 0,1 mg for mercury in fluorescent lamps	some exemptions ○ **Chlorine based plastics (enclosure, chassis)** • Limit value ≤ 14 mg for mercury content in background lightning of displays and integrated desktop computers; mercury prohibited in backlighting of notebook computers	○ **Flame retardants containing halogenated organic compounds** ○ **Halogenated polymers shall not be permitted** • **Plastic components < 25 g as well as the carrier material of printed circuit boards must not contain any PBBs, PBDEs or chlorinated paraffins.** • The monitor backlight shall not contain any mercury (limit value ≤ 0,1 mg)	▪ with certain risks (R phrases); incl. some exemptions ▪ containing **organically bound bromine or chlorine** ▪ containing **Antimony(III)oxide (Sb_2O_3)** ▪ containing **Tri-o-cresyl phosphate** ○ **Plastics with chlorine and bromine as part of the polymer** (excluding printed wiring board laminates and cable insulation) • No RoHS-substances (Cd, Hg, Pb, CrVI), except for Limit values for mercury in background lightning system • Certified Edge criteria: **halogen free plastics in the display**		intentionally added cadmium • R: Reporting on amount of mercury used in light sources (mg) • O: Low threshold for amount of mercury used in light sources • O: Elimination of intentionally added mercury used in light sources • O: **Elimination of intentionally added lead in certain applications** • O: **Elimination of intentionally added hexavalent chromium** • R: Elimination of intentionally added SCCP flame retardants and plasticizers in certain applications • O: **Large plastic parts free of certain flame retardants classified under European**

	EU Ecolabel 2011	Nordic Swan 2009	Blue Angel 2012	TCO 2012 / TCO Certified Edge 2012	Energy Star 2013	EPEAT (R: required; O: optional)
						Council Directive 67/548/EEC • O: Batteries free of lead, cadmium and mercury • **O: Large plastic parts free of PVC**
Ergonomics	---	• **Requirements according ISO 9241-300 series or according TCO Displays criteria**	• **Requirements according ISO 9241-307 or according TCO Displays criteria**	• **Visual ergonomics**; characteristics for o Image detail o Luminance o Luminance contrast o Reflection o Screen colour • **Work load ergonomics** o Vertical tilt o Vertical height o Certified Edge criteria: full function ergonomic display stand	---	---
Design for recycling	• Easy disassembly • Circuit boards / other precious metal containing components shall be easily removable to enhance recovery of high value material • Plastic material in covers / housings shall have no surface coatings incompatible with	• Easy disassembly • Plastic parts: one polymer or compatible polymers for recycling; marking • **90% by weight of plastics and metals in the enclosure and chassis must be technically suitable for material recovery (except incineration)** • Large plastic parts must not be painted or	• Easy disassembly • Information on hazardous substances • No more than 2 different types of plastic material parts weighing more than 100 grams • Material coding of plastics • No external/internal metallization of the outer plastic casing • **Disassembly**	• Information on hazardous substances • No more than 2 different types of plastic material parts weighing more than 100 grams • Material coding of plastics • No external/internal metallization of the outer plastic casing • **Requirements for preparation for recycling of mercury lamps (avoidance of damage)**	• Easy disassembly	• R: Identification of materials with special handling needs • R: Elimination of paints or coatings that are not compatible with recycling or reuse • R: Easy disassembly of external enclosure • R: Marking of

	EU Ecolabel 2011	Nordic Swan 2009	Blue Angel 2012	TCO 2012 / TCO Certified Edge 2012	Energy Star 2013	EPEAT (R: required; O: optional)
	recycling or reuse • Plastic parts: one polymer or compatible polymers for recycling; marking • Information on hazardous substances • External plastic case of the monitor shall have a post-consumer recycled content of not less than 10% by mass	metallized • Information on hazardous substances	**instructions for end-of-life recyclers or treatment facilities to recover valuable resources**	• Certified Edge criteria: **Product shall contain a minimum of 65% recycled plastic** by weight of total weight of plastic parts in the product		plastic components • R: Identification and removal of components containing hazardous materials • O: Reduced number of plastic material types • O: Molded/glued in metal eliminated or removable • R: Minimum 65 percent reusable/recyclable • O: Minimum 90 percent reusable/recyclable • O: Manual separation of plastics • O: Marking of plastics • R: Declaration of postconsumer recycled plastic content (%) • O: Minimum content of postconsumer recycled plastic • O: Higher content of

	EU Ecolabel 2011	Nordic Swan 2009	Blue Angel 2012	TCO 2012 / TCO Certified Edge 2012	Energy Star 2013	EPEAT (R: required; O: optional)
						postconsumer recycled plastic • R: Declaration of renewable/bio-based plastic materials content (%) • O: Minimum content of renewable/bio-based plastic material • R: Declaration of product weight (lbs)
Packaging	• Cardboards: at least 80% re-cycled material • Plastic bags: at least 75% recycled material or biodegradable / compostable	**---**	---	• **The packaging shall not contain lead (Pb), cadmium (Cd), mercury (Hg) or hexavalent chromium (CrVI)** • **Plastic packaging material shall not contain organically bound halogens** • **Non-reusable packaging components > 25g shall be possible to separate into single material types without the use of tools**	---	• R: **Reduction/ elimination of intentionally added toxics in packaging** • R: Separable packing materials • O: Packaging 90% recyclable and plastics labelled • R: Declaration of recycled content in packaging • O: Minimum postconsumer content guidelines • **O: Provision of take-back program for packaging**

	EU Ecolabel 2011	Nordic Swan 2009	Blue Angel 2012	TCO 2012 / TCO Certified Edge 2012	Energy Star 2013	EPEAT (R: required; O: optional)
						• O: Documentation of reusable packaging
USE						

Energy savings	• Maximum energy consumption values for
	  ○ Active-mode (exceeding Energy Star requirements)
	  ○ Maximum energy consumption in on mode (maximum brightness) ≤ 100 W
	  ○ Sleep mode
	  ○ Off-Mode
	• Power management requirements (10 minutes inactivity => display sleep)
		• **Clearly visible hard or soft on/off- switch**
		• Requirements for energy efficiency referring to Energy Star specification
		• **Energy Star requirements for external power supplies**
			• Requirements for energy efficiency
			  ○ On mode referring to Energy Star measurements
			  ○ Maximum energy consumption in on mode **≤ 16 W**
			  ○ Sleep mode
			  ○ Off mode
			• Power-saving requirements (15 minutes inactivity => sleep or off mode)
				• Requirements according to most recently published Energy Star
				• Requirements for **external power supplies**
					• Requirements for **external power supplies**
					• Maximum energy consumption values for
					  ○ On-mode (calculation formula); **differentiation regarding Automatic Brightness Control (ABC)**
					  ○ Sleep mode (incl. **power allowances for bridging or network or additional capabilities**)
					  ○ Off-mode
					• Power management (15 minutes inactivity => sleep or off mode)
						• R: ENERGY STAR®
						• O: Early adoption of new ENERGY STAR® specification
						• **O: Renewable energy accessory available**
						• **O: Renewable energy accessory standard**

	EU Ecolabel 2011	Nordic Swan 2009	Blue Angel 2012	TCO 2012 / TCO Certified Edge 2012	Energy Star 2013	EPEAT (R: required; O: optional)
					• **Luminance reporting requirements**	
Emissions / electrical safety	---	• **Requirements according prEN50279 regarding electrical and magnetic fields (TCO certificate)**	**---**	• **Alternating electric fields** • **Alternating magnetic fields** • **Acoustic noise** (applies only when FPD is equipped with integrated moving parts such as a fan) • **Electrical safety**	---	---
User instructions	• Power consumption & savings; • Tips for reducing energy consumption • Repair information	• Power consumption & savings; • Tips for reducing energy consumption • Repair information	• Power consumption & savings; • Tips for reducing energy consumpt. (screen savers, reduction in monitor brightness) • **A note stating that the computer draws power even when in off-mode** • Repair information	---	---	---
END-OF-LIFE						
Reduction of waste	• Information on proper disposal and take-back policy	• Information on proper disposal and take-back policy	• Information on proper disposal	• Information on proper disposal and take-back policy	---	• **R: Provision of product take-back service** • **O: Auditing of recycling vendors** • **R: Provision of rechargeable battery take-back service**

	EU Ecolabel 2011	Nordic Swan 2009	Blue Angel 2012	TCO 2012 / TCO Certified Edge 2012	Energy Star 2013	EPEAT (R: required; O: optional)
Durability / life time extension	• Availability of spare parts should be ensured for at least 5 years from that time the production ceases	---	• Requirements regarding warranty and spare parts (for **3 years**) according to TCO Certified Displays 5.2	• Product warranty for at least 1 year • Availability of replacement parts should be guaranteed **for 3 years** from that time the production ceases	---	• R: Availability of additional **three year warranty or service agreement** • **R: Upgradeable with common tools** • **O: Modular design** • O: Availability of replacement parts

Summary of the criteria analysis for displays

Here we summarise new criteria and criteria areas that feature within other ecolabels and could be considered within the scope of the EU Ecolabel revision. The criteria are grouped by lifecycle phase:

- Manufacturing phase:
  - Corporate environmental and/or social responsibility: Nordic Swan, TCO and EPEAT require CSR aspects and an Environmental Management System during the manufacturing process of displays and televisions.
  - Restriction of hazardous substances: The current ecolabelling schemes partially go beyond the EU Ecolabel criteria in terms of
    - Halogenated organic compounds (Nordic Swan, Blue Angel, TCO),
    - Halogenated polymers (Nordic Swan, Blue Angel, TCO)
    - PBB, PBDE, HBCDD and chlorinated paraffins (Blue Angel, TCO)
    - Antimony(III)oxide and Tri-o-cresyl phosphate (TCO)
    - Halogen free plastics in the displays (TCO Certified Edge), large plastic parts free of certain flame retardants classified under European Council Directive 67/548/EEC and/or free of PVC (optional, EPEAT)
  - Ergonomics: addressed by TCO criteria; Blue Angel and Nordic Swan refer to TCO criteria
  - Design for recycling:
    - Disassembly instructions for end-of-life recyclers or treatment facilities to recover valuable resources (Blue Angel)
    - Requirements for preparation for recycling of mercury lamps to avoid damage (TCO Certified Edge)
    - Product shall contain a minimum of 65% recycled plastic (TCO Certified Edge)

        - Quantitative requirement of plastics and metals that must be technically suitable for material recovery (Nordic Swan)
    - Packaging:
        - TCO criteria have exclusion criteria for certain substances in packaging materials (RoHS substances, organically bound halogens); also EPEAT requires reduction/elimination of intentionally added toxics in packaging
        - Non-reusable packaging components > 25g shall be possible to separate into single material types without the use of tools
        - Provision of take-back program for packaging (Optional requirement EPEAT)
- Use phase
    - Energy savings
        - Criteria for External Power Supplies (TCO, Energy Star, Nordic Swan)
        - Only Nordic Swan requires a clearly visible on/off-switch
        - On mode: maximum energy consumption 16 W (Blue Angel); no maximum energy consumption (Nordic Swan rev. 2013, TCO, Energy Star)
        - Requirements for new features (automatic brightness control, power allowances for bridging or network or additional capabilities), as well as luminance requirements (Energy Star)
        - Renewable energy accessory available (optional criteria, EPEAT)
    - Emissions / electrical safety: addressed by TCO criteria; Nordic Swan refers to TCO
    - User instructions: Notification that the computer draws power even when in off-mode (Blue Angel)
- End of life phase:

- Different requirements for guaranteed availability of replacement parts after production ceases (Blue Angel and TCO: 3 years);
- Three year warranty or service agreement (EPEAT),
- Products being upgradeable with common tools, modular design (EPEAT)

1.4 Green Public Procurement (GPP) of desktop and notebook computers

1.4.1 *Scope and definitions*

The current European GPP criteria cover computers and monitors. This includes the following six sub-categories:

- Personal computer (Desktop PCs, Integrated Desktop PCs, Thin Client)
- Computer display (where supplied with a computer)
- Keyboard (where supplied with a computer)
- External power supply (where supplied with a computer)
- Notebook computers (includes tablet personal computers)
- Discrete graphics processing unit (where supplied with a computer)

The detailed definitions are taken from the Agreement between the Government of the United States of America and the European Community on the coordination of energy-efficiency labelling programs for office equipment.

1.4.2 *GPP criteria for desktop and notebook computers*

According to the latest EU GPP Criteria for office IT equipment (EU GPP criteria IT 2012), the **core** GPP criteria [39] for PCs, notebooks and monitors focus on energy consumption in the specifications, based on Energy Star requirements. Additionally, simple criteria have been included addressing the lifetime of products.

[39] Core GPP criteria address the most significant environmental impacts, and are designed to be used with minimum additional verification effort or cost increases.

In the **comprehensive** and **award** GPP criteria[40], further aspects are included:

- Energy management functions on the hardware itself
- Noise emissions
- The use of mercury in LCD monitor backlighting
- The disassembly of equipment
- Recycled content and recyclability
- The use of flame retardants with certain risk phrases (carcinogenic, mutagenic or harmful to reproduction) in plastic parts

Table 5: Core and comprehensive GPP criteria for desktop / notebook computers and monitors

CORE criteria	COMPREHENSIVE criteria
• All products shall meet the latest ENERGY STAR standards for energy performance.	• All products shall meet the latest ENERGY STAR standards for energy performance.

• PCs shall be designed so that:
  • The memory is readily accessible and can be changed or upgraded.
  • The hard disk (or parts that perform functions of hard disk) and, if available, the CD drive and/or DVD drive, can be changed.
	• PCs shall be designed so that:
	  1. The memory is readily accessible and can be changed or upgraded.
	  2. The hard disk (or parts that perform functions of hard disk) and, if available, the CD drive and/or DVD drive, can be changed.

• Notebooks shall be designed so that the memory is easily accessible and can be changed or upgraded.	• Notebooks shall be designed so that the memory is easily accessible and can be changed or upgraded.
• The background lighting of LCD monitors **shall not contain more than 3.5 mg of mercury on average per lamp**.	• The background lighting of LCD monitors **shall not contain mercury**.

• The 'Declared A-weighted Sound Power Level' (re 1 pW) of PCs or notebooks, according to paragraph 3.2.5 of ISO 9296, measured in accordance with ISO 7779 (or equivalent standards), shall not exceed:
For PCs:
  • 4.0 B(A) in the idle operating mode (equivalent to 40 dB(A)).
  • 4.5 B(A) when accessing a hard-disk drive
	• The 'Declared A-weighted Sound Power Level' (re 1 pW) of PCs or notebooks, according to paragraph 3.2.5 of ISO 9296, measured in accordance with ISO 7779 (or equivalent standards), shall not exceed:
	  1. For PCs:
	  • 4.0 B(A) in the idle operating mode (equivalent to 40 dB(A)).
	  • 4.5 B(A) when accessing a hard-disk drive

[40] Comprehensive GPP criteria are intended for use by authorities who seek to purchase the best environmental products available on the market, and may require additional administrative effort or imply a certain cost increase compared to other products with the same functionality.
Award criteria: Contracting authorities will have to indicate in the contract notice and tender documents how many additional points will be awarded for each award criterion. Environmental award criteria should, altogether, account for at least 15 % of the total points available.

CORE criteria	COMPREHENSIVE criteria
(equivalent to 45 dB(A)). For notebooks: • 3.5 B(A) in the idle operating mode (equivalent to 35 dB(A)). • 4.0 B(A) when accessing a hard-disk drive (equivalent to 40 dB(A)).	(equivalent to 45 dB(A)). 2. For notebooks: • 3.5 B(A) in the idle operating mode (equivalent to 35 dB(A)). • 4.0 B(A) when accessing a hard-disk drive (equivalent to 40 dB(A)).
• User instructions and/or training courses for IT support on green management of IT products shall be supplied	• User instructions and/or training courses for IT support on green management of IT products shall be supplied
• Packaging: Where cardboard boxes are used, they shall be made of **at least 50%** recycled material. Where plastic bags or sheets are used for the final packaging, they shall be made of at **least 50%** recycled material or they shall be biodegradable or compostable, in agreement with the definitions provided by the EN 13432.	• Packaging: Where cardboard boxes are used, they shall be made of **at least 80%** recycled material. Where plastic bags or sheets are used for the final packaging, they shall be made of **at least 75%** recycled material or they shall be biodegradable or compostable, in agreement with the definitions provided by the EN 13432.
• Energy management functions shall be present on the hardware itself • (for all products)	• Energy management functions shall be present on the hardware itself • (for all products)
• The tenderer shall guarantee the availability of spare parts for **at least 3 years** from the time that production ceases.	• The tenderer shall guarantee the availability of spare parts for **at least 5 years** from the time that production ceases.
	• Substances in plastic parts hazardous to health: Plastic parts heavier than 25g do not contain flame retardant substances or preparations that are assigned any of the following risk phrases as defined in Council Directive No. 1272/2008: • R45 (may cause cancer). • R46 (may cause heritable genetic damage). • R60 (may impair fertility). • R61 (may cause harm to the unborn child).
AWARD criteria	**AWARD criteria**
Additional points will be awarded for ease of disassembly and ease of recycling plastic parts: • Connections shall be easy to find, accessible with commonly available tools, and as standardised as possible. • Plastic parts heavier than 25g shall have a permanent marking identifying the material, in conformity with ISO 114 69: 2000 or equivalent standard. Excluded from this criterion are extruded plastic materials and the light-guide of flat panel displays. • Plastic parts shall be of one polymer or compatible polymers, except for the cover, which shall consist of no more than two types of polymer, which are separable	Additional points will be awarded for ease of disassembly and ease of recycling plastic parts: • Connections shall be easy to find, accessible with commonly available tools, and as standardised as possible. • Plastic parts heavier than 25g shall have a permanent marking identifying the material, in conformity with ISO 114 69: 2000 or equivalent standard. Excluded from this criterion are extruded plastic materials and the light-guide of flat panel displays. • Plastic parts shall be of one polymer or compatible polymers, except for the cover, which shall consist of no more than two types of polymer, which are separable
	Recycled content and recyclability (for PCs, notebooks and monitors). Additional points will be awarded if the external plastic case of the system unit, monitor and keyboard has a post-consumer recycled content of not less than 10% by mass.

According to AEA (2010), a number of Member States have developed their own Green or Sustainable Public Procurement schemes (GPP/SPP) with some variations in criteria having been developed for the same product groups. There are, however, a number of similarities between the criteria of the countries being reviewed by AEA (2010). These similar criteria can be summarised under the following headings, with energy and upgradeability the most quoted criteria:

- Energy.
- Restriction of hazardous substances/chemicals.
- Upgradeability.
- Recycled content and recyclability.
- Noise.
- Disposal.
- Energy management functions on the hardware itself.

Criteria included by the countries reviewed in 2010, but that do not form part of the EU's criteria[41] are (see also Table 6 and Table 7):

- Recycled content of equipment. (Belgium, Finland, Germany, Sweden)
- Disposal of end of life equipment. (Denmark, Germany, Netherlands)
- Energy management settings. (Belgium, Denmark, Germany, Germany, Netherlands)

Table 6: The Similarities of Aspects Addressed for Personal Computers (Source: AEA 2010)

Criteria	Energy	Detailed substance restrictions	Upgradeability / design	Recycled content	Recyclability of product or its components	Noise	Dis-posal
Austria	X		X		X		
Belgium	X	X	X	X	X	X	X
Denmark	X		X		X	X	X
Finland	X	X				X	X
France	X			X			X

[41] Note: The review is related to the former 2008 set of EU GPP criteria for office IT equipment.

Criteria	Energy	Detailed substance restrictions	Upgradeability / design	Recycled content	Recyclability of product or its components	Noise	Dis-posal
Germany	X	X	X	X	X	X	X
Netherlands	X						X
Norway	X	X	X			X	
Sweden	X	X		X		X	X
UK	X	X	X		X	X	
EU	X	X	X		X	X	

Table 7: The Similarities of Aspects Addressed for Monitors (Source: AEA 2010)

Criteria	Energy	Detailed substance restrictions	Upgradeability / durability	Recyclability of product or its components	Availability of parts
Austria	X		X		X
Belgium	X	X	X	X	X
Denmark	X			X	
Finland		X			
France	X				
Germany	X	X	X	X	X
Netherlands	X				
Norway	X				X
Sweden	X	X			
UK	X	X	X	X	
EU	X	X		X	

According to a survey conducted by CEPS (2012), office IT equipment is, from among 10 surveyed product groups, the second best one in terms of inclusion of green criteria into public procurement processes, regardless of the fact that such criteria coincide or not with the EU core GPP criteria. For computers and monitors, 63% and 66% of the contracts include at least one core criterion, whereas 39% (computers) and 66% (monitors) of the contracts include all core criteria into public procurement. Regarding computers, contracting authorities seem to pay greater attention to the energy performance of the devices (63%) than to upgradability or replaceability of components (39%).

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Blue Angel Keyboards 2011	Blue Angel: Basic Criteria for Award of the Environmental Label. Computer Keyboards, RAL-UZ 78b. http://www.blauer-engel.de/en/products_brands/vergabegrundlage.php?id=216
Blue Angel Monitors 2012	Blue Angel: Basic Criteria for Award of the Environmental Label. Computer Monitors, RAL-UZ 78c. http://www.blauer-engel.de/en/products_brands/vergabegrundlage.php?id=239
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CEPS 2012	The uptake of Green Public Procurement in the EU27; 2012; http://ec.europa.eu/environment/gpp/pdf/CEPS-CoE-GPP%20MAIN%20REPORT.pdf and http://ec.europa.eu/environment/gpp/pdf/CEPS-CoE-GPP%20ANNEXES.pdf
CLP Regulation 2008	Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 http://www.reach-clp-helpdesk.de/en/CLP-en/CLP-en.html
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EMC Directive 2004	DIRECTIVE 2004/108/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC
Energy Star Computers 2009	Energy Star Program Requirements for Computers. Version 5.2.; https://www.energystar.gov/ia/partners/product_specs/program_reqs/Computers_Program_Requirements.pdf?9ed9-e3be
Energy Star Computers 2012	Energy Star Program Requirements for Computers. Draft 3 Version 6.0 of 29 November 2012 http://energystar.gov/products/specs/sites/products/files/Draft%203%20Version%206%200%20Specification%20for%20Computers.pdf
Energy Star Displays 2013	Energy Star Program Requirements for Displays. Version 6.0 taking effect on 01 June 2013 http://energystar.gov/products/specs/sites/products/files/Final_Version_6%200_Displays_Program_Requirements.pdf?c937-0a76
EPEAT (without year)	EPEAT's Computer-Display Criteria http://www.epeat.net/resources/criteria-discussion/pc-display-criteria/

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