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Development of European Ecolabel for Televisions

TECHNICAL REPORT

Criteria Proposals – Revision v3

(Draft) Working Document

Candela Vidal-Abarca Garrido, Dritan Osmani, Nicholas Dodd, Oliver Wolf (JRC-IPTS)

Kathrin Graulich, Dirk Bunke, Rita Groß, Ran Liu, Andreas Manhart, Siddharth Prakash (Öko-Institut e.V. – Institute for Applied Ecology)

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Joint Research Centre
Institute for Prospective Technological Studies (IPTS)

Contact information
Candela Vidal-Abarca Garrido
Address: Joint Research Centre, Edificion EXPO, Calle Inca Garcilaso 3, E-41092 Sevilla, Spain
E-mail: Candela.VIDAL-ABARCA-GARRIDO@ec.europa.eu
Tel.: +34 954 488 483

http://ipts.jrc.ec.europa.eu/

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1. INTRODUCTION

This document is intended to provide the background information for the revision of the Ecolabel 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 Oeko-Institut. The work is being developed for the European Commission's Directorate General for the Environment.

The main purpose of this document is to evaluate the current criteria and discuss if the criteria are still relevant or should be revised, restructured or removed. This document is complemented and supported by the preliminary report, which consists of a series of task reports[1] addressing:

- Scope and definitions (Task 1 report),
- Market analysis (Task 2 report),
- Technical analysis (Task 3 report),
- Improvement potential (Task 4 report), and
- First criteria proposals (Task 5 report).

Furthermore, during the course of the revision process two general questionnaires on the scope and improvement potential as well as queries specific to certain criteria were sent out to selected stakeholders. The target groups were industry, Member States, NGOs and research institutions. The specific information, views and suggestions arising from questions about the scope, improvement potential and criteria revision were reflected mainly in the Task 1 and Task 4 reports and taken into consideration as far as possible in the proposals for the criteria revision.

The first draft version of the technical report (Task 5) has built the basis for the first Ad-Hoc Working Group (AHWG) meeting taken place in October 2013. The current revised Task 5 report provides an update of the criteria development process based on new information (stakeholders' discussion at the AHWG meeting, further stakeholder inputs following the meeting, further desk research).

[1] The previous Task 1-5 reports and further information can be downloaded at http://susproc.jrc.ec.europa.eu/televisions/stakeholders.html

For each of the criteria, boxes are provided with the current criteria (grey), the first proposal (yellow) and a second proposal (green) for revised criteria. After each box a discussion of the rationale for the proposed change (or not) to the criterion is made, based on the stakeholder feedback and further research. Proposals for *new* criteria have also been made together with the rationale behind each proposal.
This second version of the technical report will bring together the scientific arguments for the proposed new criteria document to provide input for another stakeholder discussion at the second AHWG meeting taking place in May 2014, before finally being voted upon by the EU Ecolabelling Board.

The current scope of the EU Ecolabel criteria document for Televisions

As stated in the previous technical reports Task 1 (scope) and Task 4 (improvement potential) of the revision process for the development of EU Ecolabel criteria for televisions, there is a functionality overlap between television sets and computer monitors placed on the EU market. Television sets are increasingly enabled for web browsing and computer monitors are being used to watch content normally only viewed on televisions. Thus, it is becoming more and more difficult to distinguish between the two product categories. In the current review process of the EU Ecodesign and Energy Labelling Regulations for televisions, the discussion paper proposed to change the scope from solely “televisions” to “electronic displays”, including television sets, television monitors, and external computer displays (EU Ecodesign Review TVs 2012). Considering the general desire for harmonised approaches and coherent product policy, the following criteria proposals include this approach using synergies where appropriate.
Currently, two separate sets of EU Ecolabel criteria exist for televisions (Commission Decision 2009/300/EC) and for external computer displays as part of the criteria set for personal computers (Commission Decision 2011/337/EU) and. They consist of twelve (seven for televisions, respectively) criteria which are listed in Table 1.

Table 1: Current EU ecolabel criteria for external computer displays and televisions according to Commission Decisions 2011/337/EU and 2009/300/EC

Current EU ecolabel criteria for *Displays*	Current EU ecolabel criteria for *Televisions*
Criterion 1 – Energy savings (specific for displays)	Criterion 1 – Energy savings
Criterion 2 – Power management	---
~~Criterion 3 – Internal power supplies~~	---
Criterion 4 – Mercury in fluorescent lamps	Criterion 2 – Mercury Content of Fluorescent Lamps
Criterion 5 – Hazardous substances and mixtures	Criterion 5 – Heavy Metals and Flame Retardants
Criterion 6 – Substances listed in accordance with Art. 59(1) of Regulation (EC) No 1907/2006	---
Criterion 7 – Plastic parts	---
~~Criterion 8 – Noise~~	---
Criterion 9 – Recycled content	---
Criterion 10 – User instructions	Criterion 6 – User instructions
Criterion 11 – User repairability	---
Criterion 12 – Design for disassembly	Criterion 4 – Design for disassembly
~~Criterion 13 – Lifetime extension~~	Criterion 3 – Life-time extension
Criterion 14 – Packaging	---
Criterion 15 – Information appearing on the Ecolabel	Criterion 7 – Information appearing on the Ecolabel

Crossed out lines: EU ecolabel criteria for personal computers, explicitly not applied to displays

The revised Ecolabel criteria document is proposed to cover both product groups; thus common criteria for both televisions and external computer displays will be developed, differentiating between technical product characteristics where necessary.

The key environmental impacts associated with the product group

Based on the LCA review presented in the Task 3 report the overall findings indicate that the production phase and the use phase are associated with the most significant environmental impacts during the life cycle of computer products.

Within the manufacturing phase of televisions, specific environmental 'hot spots' identified are the assembly process of the LCD module, the used amount of chrome steel in the housing and the Printed Circuit Boards used.

One of the reasons is that critical raw materials are concentrated in these components, whose extraction and processing is associated with major material requirements, appropriation of land and consumption of energy, and causes severe environmental impacts: silver, gold and palladium in the motherboard and other Printed Circuit Boards, or indium and gallium in the display and background illumination.

The direct influence of ecolabel criteria on the production of single components of televisions or computer displays is rather limited. However, by improving design (e.g. design for dismantling and recycling) or indirectly by extending the lifetime or by reusing parts, the impacts of the manufacturing phase can be reduced as secondary resources from recycling or extended lifetime can avoid primary production. Thus, the allocation of benefits from re-use and recycling is an area specifically highlighted in Task 4 (improvement potential) and the criteria development.

A number of issues are currently not addressed by the EU Ecolabel criteria although evidence exists for the potential environmental and / or social impacts (e.g. fluorinated greenhouse gases, use of conflict-free metals). Proposals to include them in the revised criteria are provided in this technical report.

The proposed framework for the revision

The following table provides a proposal for a new systematic to cluster and allocate the existing as well as new criteria to certain thematic fields following the identified hotspots for televisions and external computer displays:

Table 2: New proposed criteria cluster and allocation of sub-criteria for the revision of the Ecolabel criteria for televisions and displays

New proposed criteria cluster	Proposed allocation of sub-criteria
1 Energy consumption	Criterion 1.1 – Energy savings
	Criterion 1.2 – Power management
2 Environmentally hazardous substances	Research and evidence presented in a separate document
3 Life time extension	Criterion 3.1 – Commercial guarantee
	Criterion 3.2 – Repairability
	Criterion 3.3 – Upgradeability
4 End-of-life management: Design and material selection	Criterion 4.1 – Material selection and material information
	Criterion 4.2 – Design for dismantling and recycling
	Criterion 4.3 – Packaging
5 Corporate production / supply chain management	Criterion 5.1 – Social labour conditions during manufacture
	Criterion 5.3 – Use of "conflict-free minerals" during production
6 Further criteria	Criterion 6.1 – Ergonomics
	Criterion 6.2 – Emission of fluorinated GHG during LCD production
7 Information	Criterion 7.1 – User instructions
	Criterion 7.2 – Information appearing on the Ecolabel

The following sections and criteria proposals are provided according to the proposed criteria cluster. Note: The final numeration of the single criteria might change in the course of discussions with stakeholders and the final decisions on the criteria.

2. PRODUCT GROUP DEFINITION

Present scope, Decisions 2009/300 and 2011/337
The product group 'televisions' shall comprise: 'Mains powered electronic equipment, the primary purpose and function of which is to receive, decode and display TV transmission signals.'
The product group 'personal computers' shall comprise: desktop computers, integrated desktop computers, thin clients, displays and keyboards (as a stand-alone item) as defined in Article 2. Notebook computers, small-scale servers, workstations, gaming consoles and digital picture frames shall not be considered personal computers for the purpose of this Decision.

Major proposed changes (first proposal)

Proposed scope (first proposal)
The product group 'electronic displays' shall comprise: television sets, television monitors, dual-function TV/monitors and external computer displays that can be connected to the mains power source either directly or via an external power supply. Internal computer displays, tablet PCs, smart phones, gaming consoles, digital photo frames, projectors, signage products and displays intended for and only available to medical and professional markets and providing specified features required by those markets shall not be considered as 'electronic displays' for the purpose of this Decision.

- External computer displays are proposed to be removed from the revised scope of the EU ecolabel for computers to a revised scope of Ecolabel criteria for TVs, combining them under a new title "Electronic Displays", subsuming TV sets, TV monitors, dual-function TV/monitors and external computer displays.
- The new product scope is basically aligned to the proposals provided in the 'Discussion paper on the review of the Ecodesign and Energy Labelling Regulations for televisions and on the draft Regulation on electronic displays, including computer monitors' from August 2012.
- Especially those products excluded from the scope of the discussed Ecodesign and Energy Labelling Regulations for electronic displays are also not included in the scope of the EU Ecolabel for electronic displays as this would otherwise require separate calculation, measurement and verification procedures.
- Deviating from the scope of the discussed Ecodesign and Energy Labelling Regulations for electronic displays, digital photo frames and signage products are proposed to be excluded from the EU Ecolabel for electronic displays.

For more details cf. Task 1 report ("Scope and Definitions").

Stakeholder feedback on product scope and definition

According to written stakeholder feedback following the AHWG meeting, the proposed broadening of the scope to external computer displays is welcomed explicitly by one of the stakeholders.

Further evidence and research

The draft Commission Regulation with regard to ecodesign requirements for electronic displays (not published yet) provides the following definitions:

- '**Electronic display**' means an electronic product with a display screen and associated electronics, that is primarily intended for use in a household and/or in an office, that as its primary function displays visual information and that is connected to a mains power source for its intended continuous use, either directly or via an external power supply; Electronic displays include, but are not limited to, the following products:
  - (a) '**Television**' means an electronic display that is manufactured with a television tuner, and that is capable of displaying dynamic visual information from wired or wireless sources including but not limited to:
    - (i) broadcast and similar services for terrestrial, cable, satellite, and/or broadband transmission of analogue and/or digital signals;
    - (ii) display-specific connections, such as VGA, DVI, HDMI, DisplayPort;
    - (iii) media storage devices such as a USB flash drive, a memory card, or a DVD/BRD; or
    - (iv) network connections, usually using Internet Protocol, typically carried over Ethernet or WiFi.
  - (b) '**Computer monitor**' means an electronic display that displays a computer's user interface and open programs, allowing the end-user to interact with the computer, typically using a keyboard and mouse;
  - (c) '**Digital photo frame**' means an electronic display, whose primary function is to display digital images. It may also feature a programmable timer, occupancy sensor, audio, video, or Bluetooth or wireless connectivity.

- For the following product groups, further definitions are provided, however, the Commission Regulation will not or only partly apply to them:
  - Public displays (also known as commercial signage displays), medical monitors and other medical devices, high performance displays, broadcast monitors, all-in-one video conference systems; security monitors; projectors; displays in notebook computers; displays in integrated desktop computers; mobile computing and communication devices; displays in game consoles; and status displays.

Second proposal for the product scope of the EU Ecolabel

It is proposed to align the scope of the EU Ecolabel further to the product groups and their proposed definitions of the draft EU Commission Regulation on ecodesign requirements for electronic displays.

Proposed scope (second proposal)
The product group 'electronic displays' shall comprise: televisions and external computer displays that is connected to a mains power source for its intended continuous use, either directly or via an external power supply. Internal computer displays (i.e. displays in notebook computers; displays in integrated desktop computers; mobile computing and communication devices); displays in game consoles, digital photo frames, projectors, all-in-one video conference systems as well as public displays (also known as commercial signage displays), medical monitors, high performance displays, broadcast monitors, security monitors, and status displays shall not be considered as 'electronic displays' for the purpose of this Decision.

Stakeholder feedback following AHWG2 and further evidence

Discussions at the second AHWG meeting and written stakeholder feedback revealed that there was support on aligning TVs and computer monitor definitions to draft Ecodesign proposal. Concern on possible changes on the definitions was raised by manufacturers. However DG Energy expressed that definitions are likely to remain unchanged but scope will probably be widened to other electronic displays.

From NGO was proposed not to exclude digital photo frames from the scope, as they belong to the category of displays and are covered by the Ecodesign

Revised proposal for the product scope of the EU Ecolabel

It is proposed to maintain the scope and definitions aligned to the draft EU Commission Regulation on ecodesign requirements for electronic displays.

Proposed revised definition
The product group 'electronic displays' shall comprise: televisions and computer monitors that is connected to a mains power source for its intended continuous use, either directly or via an external power supply. Internal computer displays (i.e. displays in notebook computers; displays in integrated desktop computers; mobile computing and communication devices); displays in game consoles, digital photo frames, projectors, all-in-one video conference systems as well as public displays (also known as commercial signage displays), medical monitors, high performance displays, broadcast monitors, security monitors, and status displays shall not be considered as 'electronic displays' for the purpose of this Decision.

3. CURRENT ECOLABEL CRITERIA AND PROPOSED CHANGES

3.1 Cluster 1 – Energy consumption

3.1.1 Criterion 1.1 – Energy savings

Present criteria,
Decisions 2009/300 and 2011/337

Energy savings for televisions

(a) Passive Standby

(i) The passive standby consumption of the television shall be ≤ 0.30 W except where the condition in part ii is fulfilled.

(ii) For televisions with an easily visible hard off-switch, such that when the switch is operated to the off position, the television's energy consumption is < 0.01 W, the passive standby consumption of the television shall be ≤ 0.50 W.

(b) *Maximum energy consumption:* TVs shall have energy consumption in on-mode of ≤ 200 W.

(c) Energy Efficiency

Until 31 December 2010, televisions placed on the market bearing the Ecolabel shall have an on-mode power consumption equal to or lower than $0{,}64 \cdot (20\ W + A \cdot 4{,}3224\ W/dm^2)$.

From 1 January 2011, until 31 December 2012 televisions placed on the market bearing the Ecolabel shall have an on mode power consumption equal to or lower than $0{,}51 \cdot (20\ W + A \cdot 4.3224\ W/dm^2)$.

From 1 January 2013, televisions placed on the market bearing the Ecolabel shall have an on-mode power consumption equal to or lower than $0{,}41 \cdot (20\ W + A \cdot 4{,}3224\ W/dm^2)$.

Where A is the visible screen area ([1]) expressed in dm^2.

<u>*Assessment and verification*</u>: (points a) to c)): The television shall be tested for its on-mode power consumption in its condition as delivered to the customer, according to the revised IEC62087 standard, using the dynamic broadcast video signal (Methods of Measurement for the Power Consumption of Audio, Video and Related Equipment). If the television has a forced menu upon initial start-up, the default shall be the setting which is recommended by the manufacturer for normal home use. A test report shall be provided by the applicant to the awarding competent body demonstrating that the television meets the requirements set out in points a) to c).

For meeting the conditions of a) ii), the applicant shall declare that their television complies with the requirement and provide photographic evidence regarding the hard off-switch.

For meeting the conditions of c), the applicant shall demonstrate that any of their Ecolabelled televisions when first placed on the market after the dates shown in the criterion will meet the appropriate energy efficiency criterion. If this cannot be demonstrated the competent body will only issue the Ecolabel licence for the period for which compliance can be demonstrated.

([1]) Screen Area: This is the area of the screen in dm^2. It is equal to [screen size × screen size × 0,480] for a standard screen (4:3 aspect ratio) and [screen size × screen size × 0,427] for a wide screen (16:9 aspect ratio).

Energy savings for computer displays

(i) The computer display's energy efficiency performance in active mode shall exceed the energy efficiency requirements set out in Energy Star v5.0 by at least 30%;

(ii) Computer display sleep mode power must not exceed 1 W;

(iii) Computer displays shall have an energy consumption in on-mode of ≤ 100 W measured when set to maximum brightness;

(iv) Computer monitor off mode power shall not exceed 0.5 W.

<u>*Assessment and verification*</u>: The applicant shall declare compliance of the product with these requirements to the competent body.

3.1.1.1 Major proposed changes (first proposal)

Proposed revised criteria (first proposal)

Energy Efficiency

The electronic display's energy efficiency performance in active mode shall meet the following energy efficiency requirements set out in Regulation [1062/2010/EU][2]:

(a) Televisions:

(i) Energy efficiency class A for appliances with a visible screen diagonal of up to and including 70 cm (or 27.5 inches);
(ii) Energy efficiency class A+ for appliances with a visible screen diagonal of 70 cm (or 27.5 inches) to 119 cm (or 47 inches);
(iii) Energy efficiency class A++ for appliances with a visible screen diagonal of equal or more than 120 cm (or 47.5 inches).

(b) External computer displays: Energy efficiency class # (to be discussed)

Standby

(i) The power consumption of the electronic display 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 0.5 W.
(ii) The power consumption of an electronic display 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 W.

Passive Standby

(i) The power consumption of an electronic display in any off-mode condition shall not exceed 0.3 W, unless the condition in part ii is fulfilled
(ii) For electronic displays with an easily visible switch, which puts the electronic display in a condition with power consumption not exceeding 0.01 W when operated to the off position, the power consumption of any other off-mode condition of the electronic display shall not exceed 0.50 W.

Networked Standby

(i) If a networked electronic display has the ability to connect to a wireless network, it shall offer the possibility for the user to deactivate the wireless network connection(s). This requirement does not apply to products which rely on a single wireless network connection for intended use and have no wired network connection.
(ii) A networked electronic display that has one or more standby modes shall comply with the requirements for these standby mode(s) when all network ports are disconnected or, for wireless network ports, the network ports are deactivated.
(iii) Power consumption in a condition providing networked standby:
- The power consumption of electronic display with HiNA functionality, in a condition providing networked standby into which the equipment is switched by the power management function, or a similar function, shall not exceed 8 W.
- The power consumption of electronic display without HiNA functionality in a condition of networked standby into which the equipment is switched by the power management function, or a similar function, shall not exceed 3 W.

Maximum energy consumption

(a) *Televisions:* Televisions shall have maximum power in active mode of ≤ 64 W.
(b) *External computer displays:* tbd.

- The criteria for energy savings, both for TVs and external computer displays, are proposed to be aligned to the future EU Ecodesign and Energy Labelling Regulations for 'electronic displays' being currently under development.

[2] Shall be adapted to the final revised Energy Labelling Regulation on electronic displays.

- Energy efficiency
  - Televisions: depending on the final version of the revised EU Ecodesign and Energy Labelling Regulations for 'electronic displays', it is proposed to apply a progressive approach, developing less strict requirements for small and medium-sized TVs but stricter ones for large TVs[3]. The proposed benchmarks are derived from the selection criteria for TVs of topten.eu[4].
  - External computer displays: So far, external computer displays are not covered by any EU energy labelling regulation but are proposed to be included in the new ecodesign and energy labelling requirements for 'electronic displays'. First proposals how to calculate the energy efficiency index (EEI) have been developed[5], however being disagreed by stakeholders requiring different calculation formulae for televisions and computer displays due to different components, utility and energy efficiency (for details, cf. Task 4 report). Depending on the final version of the revised EU Ecodesign and Energy Labelling Regulations for 'electronic displays' currently being under development, and the resulting expected market distribution of energy efficiency classes for external computer displays, the EU ecolabel criteria should set an ambitious benchmark (e.g. class A or better if applicable) to address the 10-20 percent most energy efficient computer displays on the market.
- Standby / Passive standby: These criteria might become obsolete if they will be covered by the final revised EU Ecodesign Regulation for 'electronic displays' being currently under development[6].

[3] The current EEI formula and Labelling classification scale allow large TVs to reach a good Energy Efficiency class despite consuming more energy than smaller TVs which can get a worse classification.

[4] Cf. http://www.topten.eu/english/criteria/selection_criteria_television_sets.html&fromid=

[5] See the 'Discussion paper on the review of the Ecodesign and Energy Labelling Regulations for televisions and on the draft Regulation on electronic displays, including computer monitors' presented and discussed at the Consultation Forum meeting at 8 October 2012

[6] Currently included in the draft proposal of the new ecodesign and energy labelling requirements for diplays, see www.ebpg.bam.de/de/ebpg_medien/tren5/005_workd_12-08_revision.pdf, Annex B.

- Networked standby: These criteria are derived from the draft proposal of the new EU Ecodesign Regulation for 'electronic displays' being currently under development. They refer to the Tier 2 requirements to be regulatory introduced as of 1 January 2017.
- Maximum energy consumption:
  - Televisions: The benchmark is taken from the selection criteria for televisions of topten.eu, taking into account the rapid market innovations and energy efficiency gains of the past years (for comparison: the Blue Angel ecolabel for Televisions (2012) requires that the maximum power consumption in active mode shall not exceed 100 W).
  - External computer displays: Depending on the final version of the revised EU Ecodesign and Energy Labelling Regulations for 'electronic displays', additional maximum values for on mode power might be discussed. For example, the selection criteria for computer monitors of topten.eu[7] apply the following maximum on-mode power values:

Diagonal (inches)	**Max. On mode power**
15 ≤ d < 17	13 W
17 ≤ d < 20	18 W
20 ≤ d < 22	20 W
d ≥ 22 inches	22 W

For more details cf. Task 4 report "Improvement Potential", section 4.2.1.1 "energy efficiency".

[7] http://www.topten.eu/english/criteria/selection_criteria_computer_monitors.html&fromid=

Consultation questions
• Should the criterion on energy savings include a dynamic approach to better react on future market developments with regard to energy efficiency gains? (i) Variant: No later than 2 years after the criteria for EU Ecolabel for televisions and external computer displays have entered into force, the Commission shall evaluate the market penetration of these devices meeting the criteria on energy efficiency and, if justified, present to the EUEB and Regulatory Committee an amendment of this criterion. (ii) Variant: "The energy-efficiency performance of televisions and external computer displays shall meet and exceed the appropriate energy-efficiency requirements set out in the Energy Labelling Regulation for electronic displays as follows: - At the date of adoption of the Decision: energy efficiency class # - Two years from the date of adoption of the Decision: energy efficiency class # minus 20% (tbd)" • Depending on the final version of the revised EU Ecodesign and Energy Labelling Regulations for 'electronic displays' currently being under development, for external computer displays (i) The benchmark to energy efficiency class A, and (ii) Additional maximum on mode power values might be discussed, see above. • Assessment and verification procedure: It shall be discussed if the on-mode should be measured at a predefined peak luminance value (indicated as lumen, not percentage) which better reflects 'real-life' brightness settings[8].

3.1.1.2 Stakeholder feedback and further evidence

Written stakeholder feedback following the AHWG meeting, states that regarding the definition of the energy consumption criteria, it is supported in general to follow the approach for the revised Ecodesign Regulation in order to ensure a clear level playing field for the different types of devices under the different regulatory instruments.

Dynamic approach

- Feedback from one of the stakeholders indicates support for a progressive approach (setting higher efficiency criteria for larger devices combined with a maximum cap for the energy use) in order to set clearly market incentives connected with the overall environmental targets.

[8] According to topten.eu, 'power depends on setting; a TV test in 2012 showed that changing settings such as brightness or contrast can lead to a power increase by 30% compared to the test settings. TVs are measured and declared the way they are shipped, which in most cases combines the settings ensuring the lowest possible power in on-mode. Often the brightness is rather low in these factory settings, close to the minimum of 65% of the maximum brightness which is stipulated by the Ecodesign Regulation for Televisions. Still, for many viewers the factory settings will be considered suboptimal, and all changes will most probably lead to an increase in power.' See http://www.topten.eu/uploads/File/TV_market_2007–2012_Topten.pdf

- One of the stakeholders explicitly agrees on a dynamic approach, preferring option (i), meaning that no later than 2 years after the criteria for EU Ecolabel for televisions and external computer displays have entered into force, the Commission shall evaluate the market penetration of these devices meeting the criteria on energy efficiency and, if justified, to present to the EUEB and Regulatory Committee an amendment of this criterion.
- Another stakeholder proposes that the level of the EU Ecolabel should be 10-20% below any valid EcoDesign criteria from the beginning.
- In this respect, more than one of the stakeholders stressed the urgent need for up-to-date market data allowing aligning currently available data on TV sets (and efficiency of monitors) with the possible new proposal defining the energy efficiency. A thorough investigation should be done to take into account possible market evolutions. If this is not possible another solution should be provided, e.g. foreseeing a fast revision or flexible criteria that will follow the evolutions within the market.
- Emerging technologies:
  - Opening clauses for emerging technics (like OELD backlights) are not considered as appropriate according to written feedback of a stakeholder, due to the mostly unclear timelines for acceleration of the efficiency of these technologies
  - On the other hand, another stakeholder asks that the current proposal for energy efficiency criterion should include some consideration for upcoming technologies (like UHDTV and OLED) that are inherently less efficient for now. Considering the market trend and additional features provided by such technologies, they should be allowed to qualify for the Ecolabel, through the introduction of some specific factor to the calculation.

Strictness of energy savings criteria

- One of the stakeholders indicates that at present EU Ecolabel televisions with only an energy label class B are on the market which should be avoided with the next set of criteria. The proposed criteria are seen as ambitious except for the stand-by energy use.
- Further information provided by a stakeholder gives an overview of some parameters of televisions that were available on the Belgian market in May 2013. These data, coming from the energy label of these products, are based on more than 570 models. These numbers indicate that the proposed standby requirements are not strict enough.

Table 3: available televisions on the Belgian market in May 2013

Belgian Data	
Number of models	573
Average Energy consumption (W) when on	83.7
Max Energy consumption (W) when on	570.0
Min Energy consumption (W) when on	16.0
<= 64 W	Largest display that could fulfill this requirement is 55 INCH. In total 287 models could fulfill the requirement
Stand-by consumption	0.33 (without 1 outlier that had a value of 23 W)
Standby use < = 0.5	525 models (91% models passed)
Top 20 Percentile energy consumption	42 W
Top 20 Percentile stand-by	0.15 W

- Also another stakeholder requires that standby limits should be lower than mandatory 0.5 W.
- One of the stakeholders understands the need to set Network Standby requirements that go beyond the mandatory Eco-design requirements. However the level of ambition is assessed to be too high, by halving the LoNA requirement to 3 Watt (from 6 Watt at ErP). Therefore it is requested that this requirement is set at a higher threshold.

Power cap

- One of the stakeholders proposes to have a general Energy Cap for energy consumption – independent of screen size.
- On the other hand, another stakeholder informed that power is generally needed
  - for the basic functionalities like tuner, decoder,
  - for features like frame rate up-conversion, 3D, 4K,
  - for the luminance (cd/m2) of the display (W/m2);

  so that low power limits could limit features and a power cap could exclude bigger screen sizes.
- This requirement is seen as too ambitious by another stakeholder as well having a big impact on larger displays. The current power cap criterion will mean that no TV over 57" will be able to qualify for the Ecolabel, even if it has A++ Energy Class. These larger size displays should not be excluded from the Ecolabel by such a criterion as for example most of R&D investment goes into larger screen products, therefore if newer technologies are not able to meet Ecolabel criteria, this will impact the commitment to the Ecolabel scheme.

Further energy savings criteria proposed by written stakeholder feedback

- Visible on-/off-switch
  - Regarding (Passive Standby/Off-mode) a visible on/off switch is considered still as an important element by one of the stakeholders.
  - On the other hand, another stakeholder provides additional information There are safety and mechanical stability concerns with power switched carrying mains voltages:
    - The power limit of 0.01 Watts when operated to the off position requires that such a switch must carry mains and must consequently meet the related safety requirements. A minimum pole separation must be allowed in order to avoid arcing/sparking. Physical dimensions of mains

switch design is not expected to reduce due to the safety requirements, while flat panel TV design is trending toward ever thinner designs.

- The mechanical stability of modern, light, flat panel designs could be compromised by the inclusion of a mechanically operated mains switch. TV sets must be designed in such a way that equipment shall not tip over when used (e.g. when operating such a switch).

– Further, the CENELEC TC206 TV harmonised standard working group have produced a “White Paper” for the Commission, meeting the latter’s requirement for a definition of “an easily Visible” TV off-switch. In the white paper, they qualify the practicality of such a switch in the context of current “thin” displays and show that the potential energy saving of such a switch is minimal. This is due to the remarkable downturn in the standby power requirement of the majority of TVs sold in Europe (The white paper shows that Off- switch energy saving, is very small compared with total on-mode energy even if the switch was used on 100% of the installed TVs in Europe. The energy saving is shown to be smaller than the measurement error of the on-mode power testing standard, used for the TV Regulation conformance declaration).

- Finally, one of the stakeholders recommends a criterion not allowing any “fast start” mode, as this feature can consume much more than the usual standby.

Further research / evidence

Power demand in on-mode

At the Consultation Forum meeting in October 2012, the EU Commission presented a first 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. The Ecodesign proposal included equations for the calculation of the Energy Efficiency Index (EEI) of all electronic displays, distinguishing between smaller and larger displays and basing the EEI of larger displays on a logarithmic regression line so preventing to favour largest displays with high total energy demand.

Table 4: Ecodesign: Proposed Calculation of Energy Efficiency Index for Displays (2012)

$EEI = \frac{Pm}{(0.88*A+2.71)*2.10}$	for screen areas where A ≤ 16.5 dm^2
$EEI = \frac{Pm}{(60.645*\ln(A)-152.64)*2.10}$	for screen areas where A > 16.5 dm^2

Where

- P_m = power demand (W) in on-mode, measured according to the accepted test methodology of determining the average power required by the electronic display when displaying a standardised dynamic broadcast content moving picture test sequence
- A = the visible area of the display screen (dm^2)

On the other hand, the existing calculation of EEI within the current Energy Label for televisions is different, not distinguishing between display sizes and based on a linear regression line, i.e. indirectly favouring larger displays.

Table 5: Current Energy Label: Calculation of Energy Efficiency Index for Televisions (2009)

$EEI = \frac{Pm}{(4.3224*A+20)}$	for all screen areas

Table 6: Current Energy Label: Energy Efficiency Classes for Displays (2009)

A+++	EEI < 0.10
A++	0.10 ≤ EEI < 0.16
A+	0.16 ≤ EEI < 0.23
A	0.23 ≤ EEI < 0.30
B	0.30 ≤ EEI < 0.42
C	0.42 ≤ EEI < 0.60
D	0.60 ≤ EEI < 0.80
E	0,80 ≤ EEI < 0,90
F	0,90 ≤ EEI < 1,00

Based on feedback from stakeholders, the Commission revised the proposals for calculation of EEI for Ecodesign and Energy Label and the related Energy Efficiency Classes.

For the **Energy Label**, the discussion paper on the review of the Ecodesign and Energy Labelling Regulation for TVs proposed to apply the different calculations according to display size also to the setting of labelling classes.
However, in order to avoid a full re-classification of displays on the market, for the Energy Label only the EEI values associated with the energy classes from A+ upwards have been adapted and not the underlying equations used to calculate the EEI, see Table 7[9]. This also means that the Energy Labelling classes will still be based on a linear regression line in the future.

Table 7: Proposed Energy Label: Energy Efficiency Classes for Displays (2014)

A+++	EEI < 0.05
A++	0.05 ≤ EEI < 0.13
A+	0.13 ≤ EEI < 0.23
A	0.23 ≤ EEI < 0.30
B	0.30 ≤ EEI < 0.42
C	0.42 ≤ EEI < 0.60
D	0.60 ≤ EEI

For **Ecodesign requirements**, the calculations of EEI have been changed compared to the first proposal as follows[10]:

Table 8: Ecodesign: Proposed Calculation of Energy Efficiency Index for Displays (2014)

$EEI = \frac{Pm}{(1.10 * A + 9.11) * 2.10}$	for screen areas where A ≤ 15.9 dm^2
$EEI = \frac{Pm}{(42.66 * \ln(A) - 90.68) * 2.10}$	for screen areas where A > 15.9 dm^2

The screen area has been lowered slightly to distinguish from smaller and larger display sizes. However, the effect seems negligible[11]. The change in the equations shall reflect stakeholders' feedback to the first proposal that the requirements for

[9] Draft Version of Commission Regulation with regard to Energy labelling of electronic displays; not published yet
[10] Source: Draft Version of Commission Regulation with regard to Ecodesign requirements for electronic displays; not published yet
[11] For comparison: screen diagonal 24 inch = 15.88 dm^2 screen area; 25'' = 17.23 dm²

displays with smaller screens should be relaxed due to their low total energy consumption. The logarithmic regression line (compared to the linear lines in the existing Ecodesign and Energy labelling Regulations on TVs) prevents to favour large displays.

Against this background, the study team proposes to align the EU Ecolabel criteria to the Ecodesign requirements, reflecting less strict requirements for small and medium-sized electronic displays but stricter ones for larger displays. If the EU Ecolabel would be aligned to certain Energy efficiency classes of the Energy Label (e.g. A+ or better), this so called "progressive approach" would not implemented as they are still derived on a linear approach.

The draft version of Commission Regulation with regard to Ecodesign requirements for electronic displays (not published yet) proposes the following tiers for on-mode power demand:

Table 9: Proposed Ecodesign Requirements and timetable for On-mode power demand (2014)

Tier	Timetable (after publication of the Regulation)	EEI
I	12 months	≤ 0.60
II	36 months	≤ 0.40
III	60 months	≤ 0.20

Note: The EEI of Ecodesign requirements is not directly comparable and adoptable to the EEI values of the Energy Efficiency Label due to different underlying equations.

The accompanying Explanatory Memorandum to the Commission Regulation with regard to Ecodesign requirements for electronic displays (not yet published) reflects these EEI values against a market dataset of 882 models of televisions (794 models) and computer monitors (88 models) made available to consumers in 2012/2013, representing both small and large screen displays.

The following Table 10 provides an overview about the pass/compliance rate of 775 LED models with the Tier 1 to Tier 3 on-mode power demand requirements laid down in the proposed measure.

Table 10: Percentages of compliant small, large and all screens with regard to the proposed Ecodesign Requirements for On-mode power demand (2014, not yet published)

%	Tier 1	Tier 2	Tier 3
Max EEI	**≤ 0.60**	**≤ 0.40**	**≤ 0.20**
Small	71.12%	18.41%	0%
Large	81.53%	44.98%	0%
Total	**77.81%**	**35.48%**	**0%**

As the EU Ecolabel claims to cover the 20% best appliances being on the market, the study team proposes to

a) align the Ecolabel requirements at least to the EEI values of Ecodesign Tier 2 as the compliance rate of Tier 1 is already quite too high and would become mandatory within the validity period of the EU Ecolabel;

b) to differentiate Ecolabel requirements between small and large displays as the compliance rate of larger displays seems to be higher;

c) to include a dynamic approach for taking into consideration future innovations within the four years period of the EU Ecolabel (above data are based on 2012/2013 market data).

Power demand in standby mode and off mode: Stakeholder feedback indicated that the firstly proposed requirements for power demand in standby mode were not strict enough for the EU Ecolabel. The proposed values correspond to half of the limit values as applied in the current EU Ecodesign Regulation and would be equivalent to the values of the upcoming proposed revision of the Ecodesign Regulation becoming mandatory 12 months after the publication of the Regulation.

Stakeholder feedback as well as own market research at www.topten.eu show that the power demand of energy efficient computer or television displays in sleep mode or standby mode varies between 0.1 and 0.5 Watts, thus reducing the limit value could be possible in general.

However, the following Table 11 provides an indication about the overall relevance of setting stricter requirements for power demand in standby mode.

Table 11: Estimation of annual power consumption in standby mode per electronic display

Power demand in standby mode [W]	Annual power consumption in standby mode [kWh/year] (PCs: approx. 3 hours per day)	Annual power consumption in standby mode [kWh/year] (TVs: approx. 20 hours per day)
0.1 W	0.11	0.73
0.3 W	0.33	2.19
0.5 W	0.55	3.65
1.0 W	3.37	7.30

Assuming that computer displays are in standby mode on average 3 hours per day and televisions 20 hours per day, the overall annual power consumption would result in a range between 0.1 and 7.3 kWh per year. Further reducing the Ecolabel requirements from 0.5 W to 0.3 W, for example, would result in total energy savings of around 0.2 to 1.5 kWh per year and device which seems to be negligible.

Against this background, the study team proposes not to set own EU Ecolabel criteria on power demand in standby mode and off mode at all as the upcoming Ecodesign requirements becoming mandatory 12 months after publication of the Regulation will already halving the permitted power demand (further, for power demand in off mode, the current Ecodesign requirement of 1.0 Watt will be reduced to 0.3 Watt).

3.1.1.3 Second proposal for energy savings criteria

Proposed revised criteria (second proposal)

Energy savings

Power demand in on-mode

The on-mode power demand of an electronic display shall not exceed the following Energy Efficiency Index (EEI) determinations in accordance to the equations as set out in Annex II of the *Commission Regulation (EU) No. ## of ## implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for electronic displays*[12]:

(a) For electronic displays with a visible area of the screen ≤ 15.9 dm^2:
  (i) At the date of adoption of the Decision: EEI ≤ 0.40
  (ii) Two years from the date of adoption of the Decision: EEI ≤ 0.30

(b) For electronic displays with a visible area of the screen > 15.9 dm^2:
  (i) At the date of adoption of the Decision: EEI ≤ 0.30
  (ii) Two years from the date of adoption of the Decision: EEI ≤ 0.20

Power demand in a condition providing networked standby

(a) The power demand of electronic display with HiNA functionality, in a condition providing

[12] Not yet published.

networked standby shall not exceed 8 W.

(b) The power demand of electronic displays without HiNA functionality in a condition providing networked standby shall not exceed 4 W.

Assessment and verification

The electronic display must be tested according to the measurement methods indicated in Annex III of the *Commission Regulation (EU) No. ## of ## implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for electronic displays*. The test report shall be submitted to the Competent Body with the application.

Major proposed changes

- The requirements on power demand in on-mode have been aligned to the EEI equations of the proposed revised Ecodesign regulation.
- The firstly proposed EU Ecolabel requirements on power demand in standby mode and off mode have been deleted as becoming legally binding 12 months after publication of the revised Ecodesign regulation on electronic displays; the impact of further reducing the requirements seems to be negligible.
- Networked standby:
  - The requirement on offering the possibility for the user to deactivate the wireless network connection(s) has been deleted as these will become legally binding 12 months after publication of proposed revised Ecodesign Regulation on Electronic Displays.
  - The requirements for power demand in a condition providing networked standby have been slightly relaxed for displays without HiNA functionality due to stakeholder feedback (2/3 instead of ½ of the 6 Watts becoming legally binding 12 months after publication of proposed revised Ecodesign Regulation on Electronic Displays).
- Power cap: The initial requirement for an absolute power cap has been deleted as due to the logarithmic regression line for the calculation of the EEI of larger displays the energy efficiency requirements are felt to be strict enough also for quite large displays.

Justification for requirements on power demand in on-mode:

The following tables provide an overview of the calculated EEI values of current computer and television display models listed at www.topten.eu[14].

Topten already lists best products currently being available on the market. The following indicative calculations shall assess if there are any products at all which would fulfil the proposed requirements of Ecodesign Tier 2 and beyond today. If more than one model of a certain screen size was listed at topten.eu, the calculations where only made for the products with each the least and the highest power demand in on-mode to show the possible range.

The overview shows that the proposed requirement of EEI ≤ 0.4 for smaller displays, as well as EEI ≤ 0.3 for larger displays would be applicable.

Table 12: Overview of EEI values of computer displays

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Screen diagonal [inch]	15	17	19	19	22	22	23	23	24	24	27
Screen area A [dm²]	6,2	7,97	9,95	9,95	13,34	13,34	14,58	14,58	15,88	15,88	20,1
Power demand on-mode P_m [W]	13	16	13	18	12	22	14	22	15	21	20
EEI (Ecodesign)	0,39	0,43	0,31	0,43	0,24	0,44	0,27	0,42	0,27	0,38	0,26
EEI (Energy Label)	0,28	0,29	0,21	0,29	0,15	0,28	0,17	0,26	0,17	0,24	0,19
Energy Label classification	A	A	A	A	A+	A	A+	A	A+	A	A+

Table 13: Overview of EEI values of television displays ≤ 15.9 dm² (EEI limit ≤ 0.4)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Screen diagonal [inch]	19	20	22	22	24	24	24	24
Screen area A [dm²]	9,95	11,03	13,34	13,34	15,88	15,88	15,88	15,88
Power demand on-mode P_m [W]	17	18	20	22	19	21	23	25
EEI (Ecodesign)	0,40	0,40	0,40	0,44	0,34	0,38	0,41	0,45
EEI (Energy Label)	0,27	0,27	0,26	0,28	0,21	0,24	0,26	0,28
Energy Label classification	A	A	A	A	A+	A	A	A

[13] Topten is a consumer-oriented online search tool, which presents the best appliances in various product categories. Because only the best-performing products are listed, the selection is much narrower than typical labelling systems, making it easier for consumers to choose from among the thousands of products available. The selection is based on existing regulations and international energy measurement standards.

[14] Topten is a consumer-oriented online search tool, which presents the best appliances in various product categories. Because only the best-performing products are listed, the selection is much narrower than typical labelling systems, making it easier for consumers to choose from among the thousands of products available. The selection is based on existing regulations and international energy measurement standards.

Table 14: Overview of EEI values of television displays > 15.9 dm² (EEI limit ≤ 0.3)

	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16
Screen diagonal [inch]	26	26	28	32	32	39	39	40
Screen area A [dm²]	18,4	18,64	21,61	28,23	28,23	41,93	41,93	44,11
Power demand on-mode P_m [W]	28	30	25	30	34	34	48	40
EEI (Ecodesign)	0,40	0,42	0,29	0,28	0,31	0,24	0,33	0,27
EEI (Energy Label)	0,28	0,30	0,22	0,21	0,24	0,17	0,24	0,19
Energy Label classification	A	A	A+	A+	A	A+	A	A+

	Model 17	Model 18	Model 19	Model 20	Model 21	Model 22	Model 23	Model 24
Screen diagonal [inch]	40	42	42	46	46	50	55	55
Screen area A [dm²]	44,11	48,63	48,63	58,34	58,34	68,93	83,4	83,4
Power demand on-mode P_m [W]	51	43	56	44	64	53	52	64
EEI (Ecodesign)	0,34	0,27	0,36	0,25	0,37	0,28	0,25	0,31
EEI (Energy Label)	0,24	0,19	0,24	0,16	0,24	0,17	0,14	0,17
Energy Label classification	A	A+	A	A+	A	A+	A+	A+

3.1.1.4 Stakeholder feedback following AHWG2 and further evidence

- *Ecodesign/Energy labelling alignment and progressive approach*

Discussions at the second AHWG meeting and written stakeholder feedback revealed that especially stakeholders from Member States and environmental / consumer organisations might prefer to stick to the Energy labelling as basis for EU Ecolabel requirements.

In spite of several manufacturers expressed their support to the harmonization of this criterion with Ecodesign Tier 2, the majority of stakeholders argue that the Energy labelling classes are better to communicate to consumers.

Furthermore several comments revealed the concern related to the fact that EEI formulas revision is not finalised yet and there may still be changes after the next round of stakeholder and inter-service consultations.

One manufacturer claims their support to the use of the logarithm equation (based on the Ecodesign draft proposal) and suggests the adaptation of the EEI formulae in case it is changed at next round of Ecodesign consultation.

Furthermore, concerning the progressive approach, a stakeholder representing consumer oriented online search tool, which presents the best appliances supports the proposal to base on the progressive EEI formula which is proposed for the Ecodesign regulation. They mentioned the importance of a progressive approach

because the average screen size keeps increasing – a trend which runs contrary to the aim to lowering energy consumption. They welcomed the proposal to apply more stringent EEI requirements for larger displays.

It was remarked that TVs with energy labels below *A* class shall not acceptable for an Ecolabel display. Whilst it is recognised that the EU Ecolabel is based on multi criteria, energy use is the most significant environmental impact for this product group, therefore it will be difficult to justify and communicate anything less than *A* class to consumers.

A stakeholder expressed the need to link to Energy Star for computer monitors. This issue is seen especially important in respect of GPP because of the requirement under the Energy Efficiency Directive to ensure that public procurement meets at least Energy Star requirements.

- *Proposals from stakeholders*

Several stakeholders suggested modifications at the proposal.
From consumers organisation side is suggested to continue using the existing Energy labelling equations and class thresholds for televisions as a basis for the Ecolabel. They claimed that the criteria could be set as such:

- Between 0 and 35 inches: A+ class

- Between 35 and 50 inches: A++ class

- Beyond 50 inches: A+++ class (to ensure that only extremely efficient products can qualify in the largest screen categories)

One manufacturer expressed that the limit for "> 15.9 dm2" is too ambitious and suggested one of the following alternatives:

1) In b) (ii), a transition period of more than three years, instead of two years, or

2) Same EEI limit for all screen area sizes as bellow:

Tier 1 ≤ 0.40

Tier 2 (two years after) ≤ 0.30"

- *Dynamic approach*

One stakeholder expresses their concern about what happens after the 4 years validity. They claimed that at the moment most criteria documents are prolonged. In order to prevent the criteria to be outdated in relation to energy they proposed to have an extra tier or at least an evaluation of the energy requirement as for PCs in case the document is prolonged.

- *Power cap*

From consumer organisation side it is expressed that they would like to have maximum level of energy consumption limit reintroduced. They expressed that consumers are still asking for larger screens and an extra pressure for energy efficiency for such products would be preferred.
As the progressive EEI formula is only modestly more ambitious for large and especially medium sized displays, they suggested a power cap at e.g. 64W for all displays.

- *Networked Standby*

A stakeholder from consumer organisation side expressed their concern related to the networked standby requirement. They expressed that Ecodesign requirements enter into force in 2017 and by January 2017 (about only two years after being adopted) the Ecolabel criteria would be less stringent than the minimum legal requirements on the market. They proposed that Ecolabel criteria should be at minimum at the 2017 Ecodesign levels, that is 8 W in HiNA and 3 W in non-HiNA. Slightly more demanding levels, e.g. 6 W in HiNA and 2 W in non-HiNA, would even be more adequate.
One stakeholder claimed that the HiNA functionality could hardly be found on TV and suggest deleting the requirement of power demand of electronic display with HiNA functionality.

Further research and evidence

As previously detailed at point 3.1.1.2, the discussion paper on the *review of the Ecodesign and Energy Labelling Regulation for TVs* proposed to apply different calculations according to display size to the setting of labelling classes. However, in order to avoid a full re-classification of displays on the market, for the Energy Label only the EEI values associated with the energy classes from *A*+ upwards have been adapted and not the underlying equations used to calculate the EEI, see Table 7[15]. This also means that the Energy Labelling classes will still be based on a linear regression line in the future.

The explanatory memorandum which accompanies the draft version of Commission Regulation with regard to Energy labelling of electronic displays analyses the distribution of all 882 displays models among the energy labelling classes laid down in the proposed regulation. Table 15: Display models against the energy labelling classesTable 15 reveals that 18% of 2012 and 2013 televisions and computer monitors (based on the dataset established by the EC) will be labelled as class *A*+ products while 37% will be labelled as class *A* product. Not a single product recorded in the dataset will be labelled as *A*++ or *A*+++ product.

Table 15: Display models against the energy labelling classes

TVs and Monitors		
	%	Nb. models
A+++	0%	0
A++	0%	0
A+	18%	158
A	37%	326
B	25%	217
C	18%	163
D	2%	18
Total	100%	882

Topten selected best appliances on the market have been analysed in order to explore the proportion on new Energy labelling classes on the market. 258 television

[15] Draft Version of Commission Regulation with regard to Energy labelling of electronic displays; not published yet

models and 64 computer monitors have been compiled from Topten website[16]. These models are compliant with the selection criteria used by Topten (Table 16) and in the case of televisions, the organization estimates that their selection represents approximately the 30 % of the sales share in 2013 in Europe.

Table 16: Selection criteria for Topten best Televisions.

<70cm	A
70-120cm	A+
>120cm	A++
plus max. 64W	

Energy labelling classes have been calculated using the EEI equation and threshold proposed at the draft Regulation. The following figures represent the results of the calculations of Topten appliances (see Annex I. Calculations of Energy labelling classes (draft Regulation) of best appliances selected by Topten (updated database 21/05/2014).). Figure 1 revealed that more than 70% of best products are compliant are A+ while the uptake of A++ is still very low.

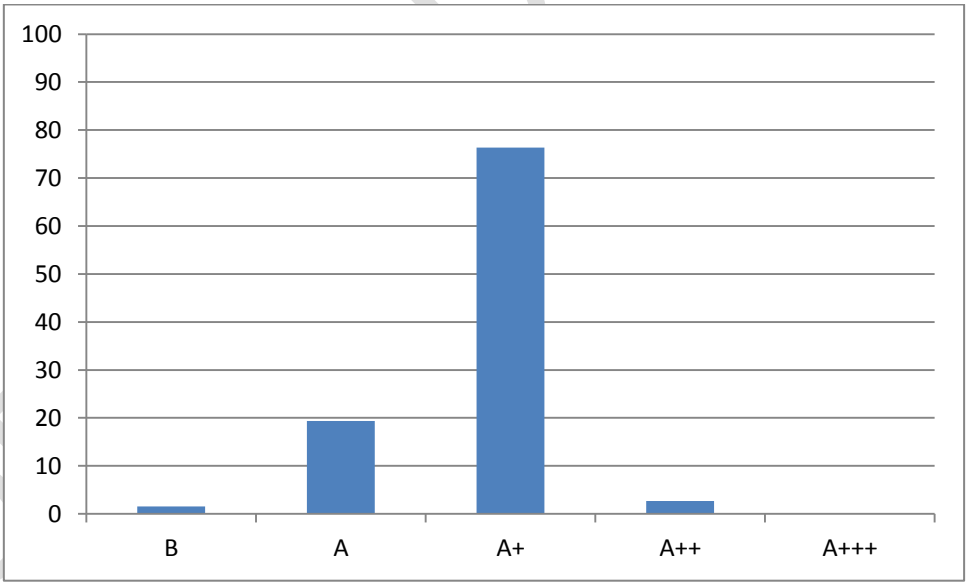

Figure 1: Energy labelling classes (draft regulation) of 258 TV models from Topten.

[16] See: http://topten.eu/

The data have been represented against three size ranges in order to see the distribution of Energy classes. Figure 2 reveals that only best big screens are able to reach A++ class while small displays are still presenting low Energy classes.

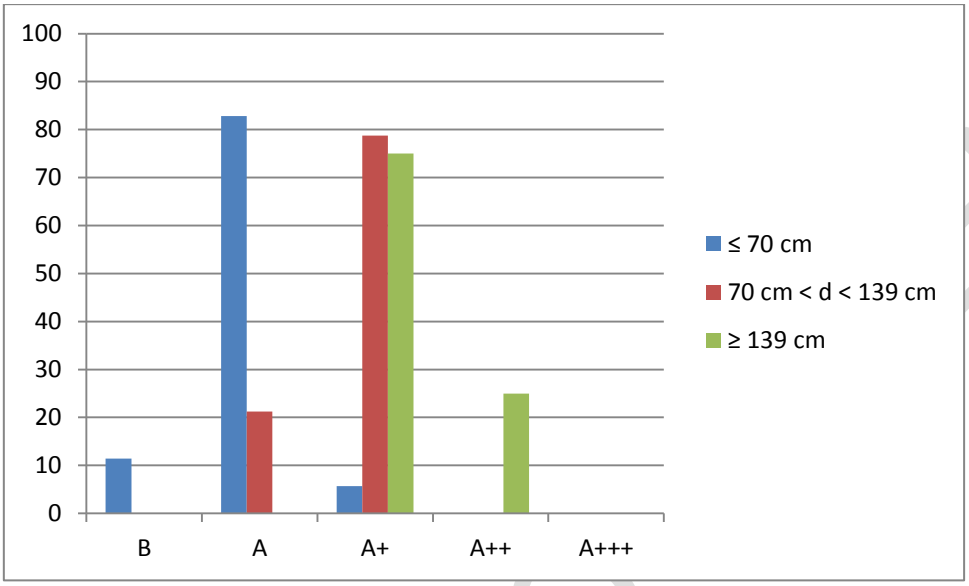

Figure 2: Percentage of Energy labelling classes (draft regulation) of 258 TV models from Topten against size ranges.

However for computer monitors (see Figure 3) the energy efficiency is higher compare to TVs. The distribution of energy classes is rather equally distributed along the different screen sizes (see Annex I. Calculations of Energy labelling classes (draft Regulation) of best appliances selected by Topten (updated database 21/05/2014).). More than 50 % of best appliances selected by Topten showed an *A*++ energy class.

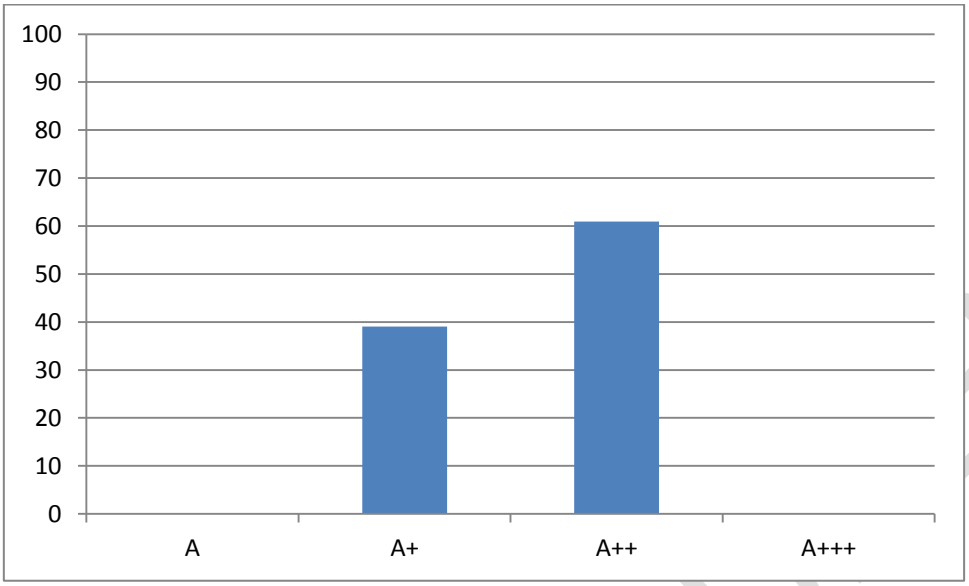

Figure 3: Energy labelling classes (draft regulation) of 64 computer monitor models from Topten.

With regard to the energy cap in on mode, previously provided data from Belgian market (see Table 3) gives an overview of some parameters of televisions that were available on the Belgian market in May 2013. These data, coming from the energy label of these products, are based on more than 570 models. These numbers indicate that 287 models could fulfil the requirement of a maximum on-mode power of ≤ 64 W. Furthermore, 64W maximum energy consumption is one of the selection criteria of Topten best appliances and selected TVs products represented the 30 % of the sales share in 2013 in Europe. Largest display that could fulfil this requirement is 55 inch. However, last Topten report on *European TV market 2007- 2013*[17] revealed that more than the 90% (93%) of TV sales in Europe in 2013 were below 50" (See Figure 4).

[17] *European TV market 2007- 2013*[17]*. Energy efficiency before and during the implementation of the Ecodesign and Energy Labelling regulations (July 2014)*

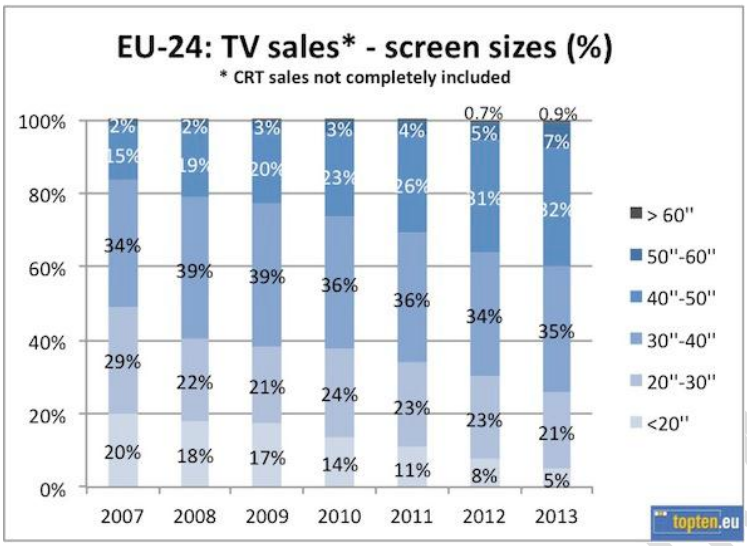

Figure 4: TV sales in the EU-24: percentage of different screen size categories (Data source: GfK)

Concerning the alignment with Energy Star for computer, all relevant ecolabel (EU Ecolabel, Nordic Ecolabelling, TCO, Blue Angel, and EPEAT) refer to a specific version or, more generally, the most recently published Energy Star program requirements for displays.

Unlike televisions, external computer displays are included in the Agreement between the Government of the US and the European Community (EU) to co-ordinate the energy labelling, thus Energy Star criteria on displays are also valid in Europe[18].

The Energy Star Program Requirements for Displays (Version 5.1)[19] have been the most established benchmark for the energy requirements of computer displays. In 2011, on average 85 % of all new computer displays sold in the USA were already certified according to this specification. In general, the experience shows that

[18] Commission Decision of 26 October 2009 determining the Community position for a decision of the management entities under the Agreement between the Government of the United States of America and the European Community on the coordination of energy-efficiency labelling programmes for office equipment on the revision of the computer monitor specifications in Annex C, part II, to the Agreement (Text with EEA relevance) (2009/789/EC)

[19] See https://energystar.gov/products/specs/sites/products/files/Version_5.1_ENERGY_STAR_Displays_Program_Requirements_Post-Clarification.pdf

approximately two years after a new Energy Star version becomes effective, a large proportion of devices fulfils the energy requirements, especially when they build the basis for Green Public Procurement (e.g. computer displays).

The new Energy Star Program Requirements for Displays, Version 6.0 became effective from June 2013 (Energy Star Displays 2013[20]).
The Version 6.0 specification establishes new On Mode power consumption requirements for displays with a viewable diagonal screen size from 12 to 30 inches and for computer displays greater than 30 inches. It also establishes a new maximum Sleep Mode power requirement of 0.5 watts for all displays, and a power management requirement that all computer displays 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.

3.1.1.5 Revised proposal for energy savings criteria

Proposed revised criteria
Energy savings **(a) Energy efficiency performance in on mode** The electronic display's energy efficiency performance in on mode shall meet the following energy efficiency requirements set out in *Commission Regulation (EU) No. ## of ##*

20 http://energystar.gov/products/specs/sites/products/files/Final_Version_6%200_Displays_Program_Requirements.pdf?8a38-1944

supplementing Directive 2010/30/EC of the European Parliament and of the Council with regard to energy labelling of electronic displays[21]:

Computer monitors

For computer monitors: energy efficiency class ≥ A++

Televisions

(i) Energy efficiency class ≥ A for appliances with a visible screen diagonal ≤ 70cm (or 28.5 inches);
(ii) Energy efficiency class ≥ A+ for appliances with a visible screen diagonal 70cm < d < 139cm
(iii) Energy efficiency class ≥ A++ for appliances with a visible screen diagonal ≥ 139 cm (or 45.7 inches).

Assessment and verification: The applicant shall submit a test report for the electronic display model(s) carried out according to the measurement methods indicated in Annex IX of the Commission Regulation (EU) No. ## of ## supplementing Directive 2010/30/EC of the European Parliament and of the Council with regard to energy labelling of electronic displays[21].

See also the proposed accompanying text in the Commission statement

No later than 2 years after the criteria for EU Ecolabel for electronic displays have entered into force, the Commission shall evaluate the market penetration of displays meeting the criterion on "Energy efficiency performance in on mode" and, if justified, present to the EUEB and Regulatory Committee an amendment of this criterion.

(b) On Mode power requirements

(i) Televisions shall have maximum power consumption in on mode of ≤ 64 W.
(ii) Computer monitors shall meet the appropriate on mode power requirements set out in the Energy Star v6.0 standard for displays.

Assessment and verification: The applicant shall submit a test report for the television model(s) carried out according to the measurement indicated in Annex III of the Commission Regulation (EU) No. ## of ## implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for electronic displays[22].

The applicant shall submit a test report for the computer monitors model(s) carried out according to the Energy Star v6.0 test methods for displays which are specified in the Eligibility Criteria.

(c) Sleep mode and off mode power requirements for computer monitors

(i) Computer monitors shall meet the appropriate sleep mode and off mode power requirements set out in the Energy Star v6.0 standard for displays.

Assessment and verification: The applicant shall submit a test report for the computer monitors model(s) carried out according to the Energy Star v6.0 test methods for displays which are specified in the Eligibility Criteria.

(d) Networked Standby power requirements for televisions

(i) The power demand of televisions without HiNA functionality in a condition providing

[21] Not yet published.
[22] Not yet published

networked standby shall not exceed 3 W.

Assessment and verification: The applicant shall submit a test report for the television model(s) carried out according to the measurement indicated in Annex III of the Commission Regulation (EU) No. ## of ## implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for electronic displays[23].

Major proposed changes

- Alignment to Energy Efficiency classes of the revised Energy labelling Regulation.
- Distribution of Energy classes revealed higher efficiency for computer monitors. Thus different requirements have been established for different display type.
- Different stringency requirements for small and larger televisions; attending to the distribution of classes described in Figure 2 which represent best products on the market. A and A+ classes represent the 80-90% of best appliances for small and medium screens respectively. (Note that best appliances selected represent approximately the 30 % of the sales share in 2013 in Europe). More stringent requirement has been proposed for larger televisions (only the 25 % of best appliances compliant with class A++).
- The reinsertion of initially proposed power cap for televisions as on mode power requirement is considered appropriate as Energy Labelling classes will still be based on a linear regression line.
- On mode, sleep mode and off mode power requirements for computer monitors have been aligned to Energy Star v6.0 for displays. This aspect is seen especially important in respect of GPP because of the requirement under the Energy Efficiency Directive to ensure that public procurement meets at least Energy Star requirements
- Networked Standby power requirements have been only addressed to Television to not create additional burden to computer monitors (aligned to energy star). Requirement on power demand of electronic display with HiNA

[23] Not yet published

functionality has been deleted as HiNA functionality could hardly be found on TV.

- A dynamic approach aligned to EU Ecolabel for computers has been included to provide the possibility to adjust and tighten them during the validity period of the EU Ecolabel in the face of a fast developing market.

3.1.2 Criterion 1.2 – Power management

Present criteria, only Decision 2011/337
Display sleep: Power management settings for display sleep shall be 10 minutes to screen off. *Assessment and verification*: the applicant shall provide the competent body with a declaration to certify that the computer has been shipped in the power management settings stated above or better.

3.1.2.1 Major proposed changes (first proposal)

Proposed revised criteria (first proposal)
Power management (a) *Manual Brightness Control*: The electronic display shall allow the user to manually control the backlight intensity. (b) *Automatic Brightness Control*: The electronic display shall have a light sensor that automatically adjusts the picture brightness to the ambient light conditions (Automatic Brightness Control, ABC). The ABC shall be enabled by default. In active mode at an ambient light level of 0 Lux the power consumption shall be at least 20 percent lower than in active mode at an ambient light level of 300 Lux. With ABC enabled, the minimum brightness should preferably be manually adjustable. (c) For external computer displays: The display shall be shipped with a default setting that automatically puts the device into a low-power mode (sleep or off mode) after an extended period of user inactivity (10 minutes at the most). *Assessment and verification*: The applicant shall provide the competent body with a declaration to certify that the appliance has been shipped in the power management settings stated above or better. The applicant shall submit a measurement protocol on the power consumption measured according to IEC 62087 at ambient light levels of 0 Lux and 300 Lux as well as their ratio to each other.

- It is proposed to include power management requirements into the revised EU Ecolabel criteria for electronic displays. The proposals are aligned to the current ecolabel criteria of Blue Angel RAL-UZ 145 for Television Sets from July 2012.

For more details cf. Task 4 report “Improvement Potential”, section 4.2.1.2 “power management”.

3.1.2.2 Stakeholder feedback and further evidence

According to written stakeholder feedback following the first AHWG meeting, the proposals for power management are explicitly supported by one of the stakeholders. Another stakeholder welcomes making ABC mandatory in the criteria, but the need for manual adjustment of minimum brightness should be clarified.

Regarding power management for computer displays, the need is seen but this should be driven by the computer whenever connected. Therefore it should not be a requirement for the product during connection but should only apply whenever the display is disconnected from the computer. It would be preferred if this requirement is aligned with Energy Star criteria, which define power down in 15 minutes.
One of the stakeholders informs that regardless of current legislation, "0 lux" (not even one photon?) is an impractical level to quote as it cannot be reasonably verified. The IEC 62087 revision is quoting "≤ 1 lux" for on-mode power measurements and "≤ 5 lux" for peak luminance measurements. Further, it is asked that "EN" should be referenced for a European label.

Further research and evidence

According to the proposed draft Ecodesign Regulation for electronic displays,

- For an electronic display without forced menu, the peak luminance of on-mode condition of the display as delivered by the manufacturer (home mode/standard mode) shall not be less than 65% of the peak luminance of the brightest on mode condition provided by the electronic display using the picture settings for the brightest on-mode condition declared by the manufacturer.
- For an electronic display with forced menu, the peak luminance of the home mode/standard mode condition shall not be less than 65% of the peak luminance of the brightest on mode condition, in a manufacturer pre-set mode, provided by the electronic display

Such settings are however recommended by the manufacturer and hence leave room for variations. For instance, a display where the manufacturer declares a lower maximum brightness would lead to a darker picture in the home-mode as well, i.e. lower power demand in on mode. However, if a consumer manually adjusts the settings to get a better picture, energy consumption increases due to increasing brightness, which would actually correspond to a higher power demand in on mode. Therefore, a measurement system based on maximum settings defined and declared by the manufacturer might lead to a systematic variation of measurements of On-Mode power consumption, and might lead to displays being classified under better

energy efficiency classes than they would be under real use conditions (see notably tests carried out by Stiftung Warentest (2011)[24]. For this reason, it is recommended conducting On-Mode measurements under a fixed luminance level. An important task would be to analyse the usability of measurement standard IEC 62087 Ed.3 2011 for measuring the On-mode power consumption of televisions considering the measurement at a fixed, predefined luminance level, and not under manufacture-defined settings. This issue is less problematic for computer monitors.

3.1.2.3 Second proposal for power management criteria

Proposed revised criteria (second proposal)
Power management (a) *Manual Brightness Control*: The electronic display shall allow the user to manually adjust the backlight intensity. (b) *Automatic Brightness Control*: The electronic display shall have a light sensor that automatically adjusts the picture brightness to the ambient light conditions (Automatic Brightness Control, ABC). The ABC shall be enabled by default. In on mode at an ambient light level of ≤ 1 Lux the power consumption shall be at least 20 percent lower than in on mode at an ambient light level of 300 Lux. With ABC enabled, the minimum brightness should preferably be manually adjustable. *Assessment and verification*: The applicant shall provide the competent body with a declaration to certify that the appliance has been shipped in the power management settings stated above. The applicant shall submit a test protocol on the on mode power consumption measured according to EN 62087 at ambient light levels of ≤ 1 Lux and 300 Lux as well as their ratio to each other.

Major proposed changes

- The requirement on power management for external computer displays (putting the computer display into a low-power mode after 10 minutes of inactivity) has been deleted as this will become mandatory 12 months after publication of proposed revised Ecodesign Regulation on Electronic Displays.
- The term ‘active mode’ has been adapted to the definition ‘on mode’ as used in the proposed revised Ecodesign Regulation on Electronic Displays
- The reference for the measurement method has been changed from IEC norm to the according EN norm. The lower ambient light level has been adapted.

[24] In this test, only 3 of 20 televisions provided good picture quality in the pre-set mode.

3.1.2.4 Stakeholder feedback following AHWG2 and further evidence

Discussions at the second AHWG meeting and written stakeholder feedback revealed that concerning the criteria on power management there was a divided opinion on the added value of the criteria. An estimation of the power savings of power management criteria and verification of the test cost was requested by one stakeholder. An industry stakeholder claimed that ABC technology is not present in TVs below 30 inches. From NGOs side it was claimed that it is essential that ecolabelled products fully respect the spirit of the standby/networked standby regulations and do not provide alternative operating modes such as 'fast start' modes that can lead to substantial energy waste if selected by the user (some of these modes have been reported to consume more than 20 W). Following text is suggested to be added: *'When not in on mode, the electronic display shall not provide any condition exceeding the applicable power consumption requirements for conditions providing standby and/or networked standby.'*

Further research and evidence

With regard to the Automatic Brightness Control (ABC) bibliography was consulted in order to estimate the environmental value of the criteria. A recent article on ambient light levels during Television viewing[25] analysed the ambient light levels during television viewing in 60 homes over seven days. The study revealed that the vast majority of viewing (79.5%) occurred at illuminance levels below 50 lux, while very little viewing (3.6%) occurred at illuminance levels greater than 300 lux. The authors of the study referenced the Energy Star Program Requirements for Televisions Version 5 test procedures for Automatic Brightness Control (ABC) enabled

[25] Invited Paper: Ambient Light Levels During Television Viewing. Kyle Sills, Konstantinos Papamichael, Keith Graeber, My Ton and Chris Wold (2014 Society for Information Display, SID Symposium Digest of Technical Papers, San Diego, CA, June 1–6, 2014, Volume 45, Issue 1, pages 599–602, June 2014)

televisions' which requires power measurements at 0 Lux and 300 Lux. They concluded that 0 lux illuminance is unnecessary and that other illuminance levels (10, 50, and 100 lux) should be considered for power measurements, to better reflect actual illuminance levels during TV viewing in residential applications.

Figure 3, a study of TVs on the market today, shows that many TVs fail to take advantage of an opportunity to save power at low room light conditions of between 10 and 100 lux.[26]

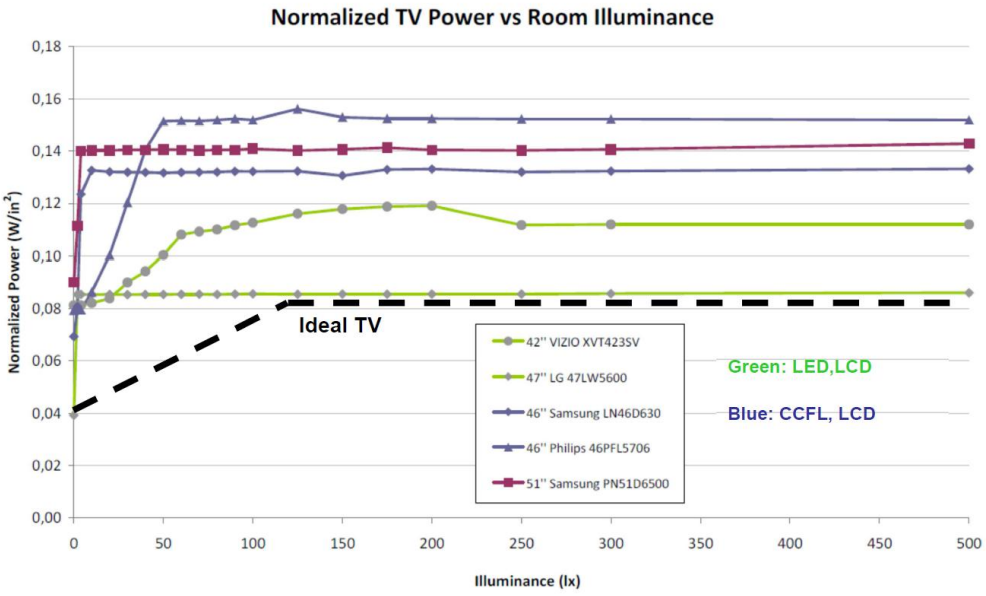

Figure 5: Power consumption of TVs at measured ambient light conditions. As the TVs are similar but not identical in size, the diagram shows power consumption normalised by measuring Watts per square inch. (Source: *Technical Article How to comply with the Energy Star 6.0 standard for LED TVs: a demonstration of reduced power consumption with improved picture quality. Markus Luidolt and David Gamperl*)

Current Energy Star v.6.0 for Televisions requires power measurements to be taken at three different luminance levels: 10, 50, 100 lux. Average power measured at 10

[26] Technical Article How to comply with the Energy Star 6.0 standard for LED TVs: a demonstration of reduced power consumption with improved picture quality. Markus Luidolt and David Gamperl

lux must be 5% lower than at 50lux, and the average power at 50lux must be 5% lower than at 100lux.

In order to estimate potential energy savings by using ABS the Energy Star database was consulted. From 1697 TV units certified models on Energy Start 556 are ABC enabled.

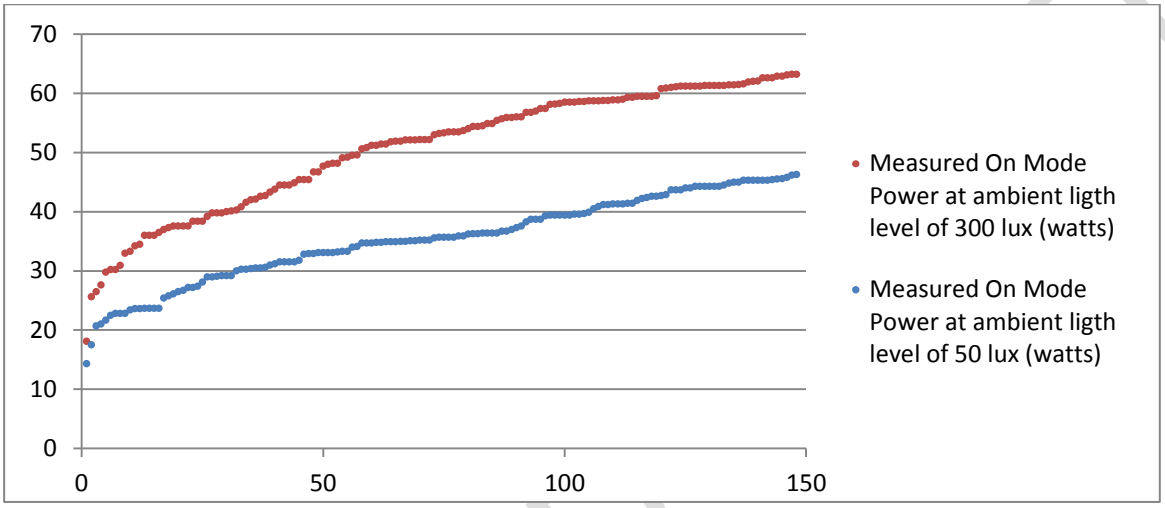

Figure 6: Measured on mode power at ambient light at 300lux and 50 lux for Energy star TV models below 64W maximum power demand.

As it is proposed to establish a power cap at 64W for EU Ecolabel, the models below that power cap were selected. 150 Energy star models presented a maximum on mode power demand of 64 Watt and enabled ABC. Measured on mode power at ambient light at 300lux and 50 lux (majority of viewing occurs at illuminance levels below 50 lux) have been depicted (see Figure 6). The graph shows an average 25% lower consumption at 50 lux compared to the measured power at 300 lux.

With regards to the "Quick Start" functionality a report created by Defra's Market Transformation Programme in 2011[27] in Televisions revealed that in November 2010 this functionality was only present in the high end models of three manufacturers.

[27] BNCE TV07: Power Impacts of "Quick Start" Standby Functionality in Televisions

High end products could be estimated to represent around 10% of their total market. However, this feature could become much more prevalent in televisions of screen diagonal size greater than 32 inches in future.

The report showed that there appear to be two current means of achieving the “quick start” function:

i) Through maintaining power to the picture and digital tuner processors prior to product switch on

ii) Through provision of additional non volatile random access memory (NVRAM) to store the active configuration of the picture and tuner

Where power is maintained to the processor, additional power consumption requirements (above the 1W regulatory level) may be around 11 to 12 W, but could be as high as 30 to 38W for high specification products. However where additional memory (NVRAM) is provided, the additional power consumption can be negligible (fractions of a watt).

The report provides the following data from a literature review and testing exercise upon a small sample of products on the market with this functionality:

Table 17: Sample televisions with quick start functionality (*source: BNCE TV07: Power Impacts of "Quick Start" Standby Functionality in Televisions*)

Brand	Product model	"Quick Start" technical solution	"normal" standby power demand	"Quick Start" standby power demand	"normal" start-up delay time	"quick" start-up delay time	Setting config	Reference
Sony	40EX1 and 40ZX1 (very high specification with separate media receiver)	Processor power up	Media receiver 3.35 W Monitor 0.45W	38. W (19 W monitor + 19 W media receiver)	12 secs	4 secs	Restricted to set time periods (user configured)	Manual, pages 30 and 33.
Sony	KDL - 40EX713 and others with larger screens in this series	Processor power up	0.2 W	11.8W.	11 secs	3 secs	Restricted to set time periods (user configured and on similar newer models with self – learning option)	MTP testing November 2010
Sony	KDL-55EX503	Processor power-up	0.2 W	12.1 W	11 secs	3 secs	User configured Set time periods and self learning options.	MTP Testing December 2010
Samsung	LE40C 750R2 and larger screens in this series	Additional memory	0.1 W	0.3 W	10 secs	5 secs	User configured feature (on or off).	MTP testing November 2010
Sharp	LC-40 LE 821E	Processor power up	0.3 W	12.1W	11 secs	4 secs	Setting retained indefinitely once enabled (until user disables).	MTP testing November 2010
Sharp	LC-60LE 925E	Processor Power-up	0.2 W	30.9 W	11 secs	5 secs	Setting retained indefinitely once enabled (until user disables).	MTP Testing December 2010

There is not available representative data of the proportion of televisions that currently present such function and their power demand to establish a threshold. However the Japanese Eco Mark criteria for Televisions Version 1.0[28] require that appliances presenting such function have been set to the factory default as OFF.

[28] Eco Mark Product Category No. 152 "TelevisionVersion 1.0" Certification Criteria. (See at: http://www.ecomark.jp/english/pdf/152eC1.pdf)

Furthermore, Blue Angel RAL-UZ 145 for Television Sets from July 2012 presents the following requirements:

Quick Start (or Fast Start)

If the appliance supports the Quick Start (or Fast Start) feature:

- The quick start feature shall be disabled by default.

- After enabling the Quick Start feature the appliance shall automatically switch back to passive standby or Off mode 4 hours (default setting) after the last user activity at the latest.

- When enabling the Quick Start feature a clear written warning shall appear to inform the user that this feature will increase the appliance's power consumption (e.g. warning appears on the menu when activating the Quick Start feature).

- The Quick Start feature and the warning of additional power consumption shall be explained in the product documentation.

Compliance Verification

The applicant shall declare compliance with the requirement and submit the relevant pages of the product documentation as well as a screen photo documenting the warning.

3.1.2.5 Revised proposal for power management criteria

Proposed revised criteria
Power management for Televisions **(a) Manual Brightness Control**: The Television shall allow the user to manually adjust the backlight intensity. ***Assessment and verification***: The applicant shall provide the competent body with a declaration to certify that the appliance has been shipped in the power management settings stated above. **(b) Automatic Brightness Control**: The Television shall automatically adjust the picture brightness to the ambient light conditions. This Automatic Brightness Control (ABC) function shall be installed as the default setting. The ABC shall be validated according to the following test procedure: Test i) $(\frac{P_{50}-P_{10}}{P_{10}}) \geq 5$ Test ii) $(\frac{P_{100}-P_{50}}{P_{50}}) \geq 5$ Test iii) $P_{300} \geq P_{100}$ Where Pn is the Power consumed for On Mode with ABC enabled at n lux with a direct light source.

Assessment and verification: The applicant shall submit a test report for the appliance showing compliance with the specified validation procedure.

(c) Quick Start functionality: If the appliance supports the Quick Start feature:

(i) The quick start feature shall not increase the appliance's power consumption more than 5% of the on-mode power consumption.

(ii) The quick start feature shall be disabled by default.

(iii) After enabling the Quick Start feature the appliance shall automatically switch back to standby or Off mode as a default setting 4 hours after the last user activity at the latest.

(iv) When enabling the Quick Start feature a clear written warning shall appear to inform the user that this feature will increase the appliance's power consumption (e.g. warning appears on the menu when activating the Quick Start feature).

(v) The Quick Start feature and the warning of additional power consumption shall be explained in the product documentation.

Assessment and verification: The applicant shall provide the competent body with a declaration to certify that the appliance has been shipped in the power management settings stated above.

The applicant shall submit the relevant pages of the product documentation as well as a screen photo documenting the warning.

Major proposed changes

- Advanced Brightness Control is a feature which, if calibrated correctly to reflect the real-life lighting conditions that users may experience, has been estimated to have the potential to save 20-30% of display energy use. ABC requirements have been aligned to Energy Star v.6.0 for Televisions.
- A new requirements to disable 'quick star' functionality by default for televisions offering such function and to clearly advertise its major power demand have been introduced aligned with the Japanese Eco Mark criteria for Televisions Version 1.0 and the Blue Angel RAL-UZ 145 for Television Sets. Furthermore, a requirement on its power consumption (it shall not increase the appliance's power consumption more than 5% of the on-mode power consumption) has been introduced. This threshold should allow appliances providing the functionality through provision of additional non-volatile random access memory

(see Table 17). In case the functionality is provided through maintaining power to the picture and digital tuner processors prior to product switch on, low power consumption respect to the on mode power consumption has to be achieved.

- The criterion has been focused on televisions as power management is covered at Energy star for displays that is already addressed at energy saving criteria for computer monitors.

3.2 Cluster 2 – Environmentally hazardous substances

3.2.1 Criterion 2 – Hazardous substances

The research results from the background paper on hazardous substances in computers, displays and televisions has highlighted the need for an interpretation of Articles 6(6) and 6(7) of the Ecolabel Regulation (EC) 66/2010 that is workable for such complex products. These two Articles place restrictions on the presence of hazardous substances in ecolabelled products, using REACH and CLP as their main reference points.

The requirements of the Ecolabel Regulation have up until now been interpreted by a standard legal text addressing 'hazardous substances and mixtures' which has, since 2010, been added as a criteria for each product group. This can be seen in Criteria 5 of Decision 2011/337/EU for personal computers and Criteria 4 of Decision 2011/330/EU for portable computers (see below). This requirement has not yet been integrated into the television criteria.

Defining television as complex articles

A computer or television comprises a number of different articles, or components. For example, a desktop computer would include a monitor, keyboard, hard drive, DVD reader/writer and power cable. In accordance with the Ecolabel Regulation it could therefore be considered to be a 'complex article' (i.e. an article composed of many individual articles). A definition is suggested as being:

> *'An object composed of an assembly of different articles which during production is given a special shape, design, structure and component configuration which determine its function to a greater degree than does its chemical composition or its constituent articles'*

The Ecolabel Regulation also refers to homogenous parts of a complex article which could be interpreted to homogenous plastic and metals components. Whilst no specific definition can be found in REACH of CLP, the RoHS Directive 2011/65/EU defines a homogenous material as:

'one material of uniform composition throughout or a material, consisting of a combination of materials, that cannot be disjointed or separated into different materials by mechanical actions such as unscrewing, cutting, crushing, grinding and abrasive processes'

Components or homogenous parts of a complex article may also be treated with or incorporate chemical mixtures or additives that impart specific functions to the sub-component or the product. For example:

- circuit boards and plastic housings may be required to have flame retardant properties;
- Plastic housings may contain colorants such as pigments;
- Power cables may contain plasticizers such as phthalates;
- Solder may contain metals such antimony and beryllium;
- Lithium ion batteries contain hazardous electrolyte but are fundamental in achieving long notebook and tablet battery lives.

This distinguishment between articles, complex articles and chemical mixtures is important because it will influence how hazards within a display product are assessed and verified.

Proposed approach to hazard screening and criteria development for displays

Subject to discussion with stakeholders it is proposed to apply a new approach to the computer and displays product groups. This would follow an adapted version of the proposed approach developed by JRC-IPTS for the EU Ecolabel's Horizontal Task Force on Chemicals.

An initial screening has been carried out of the bill of components/materials (see section 2.4 of the Hazardous Substances paper) followed by an initial identification of substance groups by their function (see also section 2.5). This reflects the broad approach outlined in the box below.

Case studies and restricted substance listings have been collated that will then enable the state-of-the-art in hazard substitution to be defined for these substance groups.

Additional input will also be required from stakeholders in order to identify substitutions that have been made and also, if required, to identify derogations that may also be required if substitutions are not currently possible for technical reasons. According to the Ecolabel Regulation derogations are only to be granted

> *"in the event that it is not technically feasible to substitute them as such, or via the use of alternative materials or designs, or in the case of products which have a significantly higher overall environment performance compared with other goods of the same category,"*

And furthermore, additional rules apply to Substances of Very High Concern:

> *"No derogation shall be given concerning substances that meet the criteria of Article 57 of Regulation (EC) No 1907/2006 and that are identified according to the procedure described in Article 59(1) of that Regulation, present in mixtures, in an article or in any homogeneous part of a complex article in concentrations higher than 0,1 % (weight by weight)."*

Substitution proposal and derogation request forms will be circulated to stakeholders following the first Ad-Hoc Working Group meeting on the 10th October 2013.

Proposed approach to the hazard screening of complex articles (first proposal)
• Identification of the main homogenous materials within the bill of materials i.e. metals, alloys, polymers, glass, ceramics; • Alloys and polymers to which no potentially hazardous additives, coatings or treatments have been applied are proposed for exemption, with reference to Article 23 of Regulation (EC) No 1272/2008 and Annex I point 1.3.4; • Identification of functional additives, coatings and treatments that are related to components of the complex article. These should then be screened for hazards and/or risk of potential release; • Separate screening of hazards associated with the chemistry of batteries; • The identification of relevant Candidate List and Article 57 substances by reference to industry declaration lists, European Commission initiatives (e.g. Endocrine disruptors) and Member State intentions; • Check that the alloys and/or polymers to which hazardous additives or treatments have been applied would pass design for recycling/dismantling requirements (see the Cluster 4 criteria proposals).

Screening and identifying substances and hazards

As a starting point for an investigation on the functional level the table below presents a preliminary overview of display substance groups by function, and gives example substances for each of them. *Feedback is required from stakeholders in order to complete their identification and where in the product they may arise.*

Substance groups	**Where in product?** *To be completed by means of stakeholder input*	**Substances (examples)**
Flame retardants	e.g. PWB, plastic casing, housing, connectors	• TBBP-A • Hexabromocyklododekan (HBCDD), • tris(2-chloroethyl)phosphate (TCEP) • Short and medium chain chlorinated paraffins (SCCP and MCCP)
Colorants / dye / pigments	e.g. Plastic casing	• Antimony and its compounds; • Lead/lead compounds • Azo dyes • Lead chromate molybdate sulfate red (C.I. Pigment Red 104) • Lead sulfochromate yellow (C.I. Pigment Yellow 34)
Solder		• Antimony or bismuth and its compounds • Cadmium/cadmium compounds
Catalysts : a) flame retardant catalyst b) curing catalyst for silicone resin and urethane resin		a) • Antimony or beryllium and its compounds b) • Dibutyltin (DBT) • Dioctyltin (DOT)
Plasticizer		• Phthalates (including DEHP, BBP, DINP, DIDP, DNOP, DHNUP, DIHP) • Short Chain Chlorinated Paraffins (SCCPs)
Additives (e.g. in metal, glass and plastics)		• Phthalates (plasticizers in plastics) • Arsenic compounds (in glass)
Adhesives		• Phthalates
Anti-corrosion surface treatments		• Cadmium/cadmium compounds
Lubricants / Surfactant		• Phthalates • Nonylphenol • Nonylphenolethoxylates
Anti-microbial agents/coatings		• Selenium and its compounds, • Triclosan • Organotins Tributyl tin oxide (TBTO) Dibutyltin dichloride (DBTC) Dibutyltin (DBT) Dioctyltin (DOT)
Ceramics		• Beryllium oxide (BeO)
Electrolytes (in batteries)		• Bis(2-methoxyethyl) ether

Substance groups	Where in product? *To be completed by means of stakeholder input*	Substances (examples)
Stabilizer		• Cadmium/cadmium compounds • Lead/lead compounds • Dibutyltin (DBT) for PVC • Dioctyltin (DOT) for PVC
Surface finish/treatment: Ink, paint, plating[29]; anti-corrosion layer		• Cadmium/cadmium compounds
Fluorescence		• Cadmium/cadmium compounds

Relevant substance restrictions arising from this exercise would then be entered into a restricted substance list. This list would be specified to reflect the state-of-the-art within industry and ecolabel substance restrictions. It is likely that in the process the list would remove a range of hazards from the display product, including Article 57 and 59 (Candidate List) SVHC's.

The list could be structured with reference to electronics industry declaration protocols such as the Joint Industry Guide (JIG) and IEC 62474. For example, the JIG establishes three criteria that determine whether substances shall be declared:

- Criteria 1 – R (Regulated)

  Substances that are subject to enacted legislation that (a) prohibits their use; or (b) restricts their use; or (c) requires reporting or results in other regulatory effects (e.g. RoHS).

- Criteria 2 – A (For Assessment Only)

  Substances that are likely to be subject to enacted legislation (e.g. Authorisation under REACH of SVHC's) but where the substance specific effective dates of the regulatory requirements are uncertain.

- Criteria 3 – I (For Information Only)

  Substances that are not regulated but where there is a recognised market requirement for reporting their content in display products (e.g. to be in compliance with ecolabel criteria).

[29] Surface covering in which a metal is deposited on a conductive surface

Substances used within displays would then need to be screened for the hazards listed in the table below. The preferred approach would be to screen at substance group level which, as illustrated by screening exercises in the background paper comparing flame retardants, allows for the comparison of substitutes. Given the complexity of the products existing studies will be used as far as possible.

Acute toxicity	
Category 1 and 2	**Category 3**
H300 Fatal if swallowed (R28)	H301 Toxic if swallowed (R25)
H310 Fatal in contact with skin (R27)	H311 Toxic in contact with skin (R24)
H330 Fatal if inhaled (R23/26)	H331 Toxic if inhaled (R23)
H304 May be fatal if swallowed and enters airways (R65)	EUH070 Toxic by eye contact (R39/41)
Specific target organ toxicity	
Category 1	**Category 2**
H370 Causes damage to organs (R39/23, R39/24, R39/25, R39/26, R39/27, R39/28)	H371 May cause damage to organs (R68/20, R68/21, R68/22)
H372 Causes damage to organs (R48/25, R48/24, R48/23)	H373 May cause damage to organs (R48/20, R48/21, R48/22)
Respiratory and skin sensitisation	
Category 1a	**Category 1b**
H317: May cause allergic skin reaction (R43)	H317: May cause allergic skin reaction (R43)
H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled (R42)	H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled (R42)
Carcinogenic, mutagenic or toxic for reproduction	
Category 1a and 1b	**Category 2**
H340 May cause genetic defects (R46)	H341 Suspected of causing genetic defects (R68)
H350 May cause cancer (R45)	H351 Suspected of causing cancer (R49)
H350i May cause cancer by inhalation (R49)	
H360F May damage fertility (R60)	H361f Suspected of damaging fertility (R62)
H360D May damage the unborn child (R61)	H361d Suspected of damaging the unborn child (R63)
H360FD May damage fertility. May damage the unborn child (R60, R60/61)	H361fd Suspected of damaging fertility. Suspected of damaging the unborn child (R62/63)
H360Fd May damage fertility. Suspected of damaging the unborn child (R60/63)	H362 May cause harm to breast fed children (R64)
H360Df May damage the unborn child. Suspected of damaging fertility (R61/62)	

Hazardous to the aquatic environment	
Category 1 and 2	**Category 3 and 4**
H400 Very toxic to aquatic life (R50)	H412 Harmful to aquatic life with long-lasting effects (R52/53)
H410 Very toxic to aquatic life with long-lasting effects (R50/53)	H413 May cause long-lasting effects to aquatic life (R53)
H411 Toxic to aquatic life with long-lasting effects (R51/53)	
Hazardous to the ozone layer	
EUH059 Hazardous to the ozone layer (R59)	

Assessment and verification

Assessment and verification procedures would then need to be specified. It is proposed that these should reflect the supply chain management practices of front runner manufacturers and selected ecolabels with experience in this area. Initial findings from industry and ecolabel case studies suggest that this could include declarations for specific sub-components obtained from tier 1 suppliers and random analytical testing for specific substances or chemistries.

Present criteria, Decisions 2011/337 and 2011/330
"Hazardous substances and mixtures" In accordance with Article 6(6) of Regulation (EC) No 66/2010 the product or any part of it shall not contain substances referred to in Article 57 of Regulation (EC) No 1907/2006 nor substances or mixtures meeting the criteria for classification in the following hazard classes or categories in accordance with Regulation (EC) No 1272/2008 of the European Parliament and of the Council. List of hazard statements and risk phrases: *see equivalent listing above* The use of substances or mixtures which change their properties upon processing (e.g. become no longer bioavailable, undergo chemical modification) so that the identified hazard no longer applies is exempted from the above requirement. Concentration limits for substances or mixtures meeting the criteria for classification in the hazard classes or categories listed in the table above, and for substances meeting the criteria of Article 57(a), (b) or (c) of Regulation (EC) No 1907/2006, shall not exceed the generic or specific concentration limits determined in accordance with Article 10 of Regulation (EC) No 1272/2008. Where specific concentration limits are determined, they should prevail over the generic ones. Concentration limits for substances meeting criteria of Article 57(d), (e) or (f) of Regulation (EC) No 1907/2006 shall not exceed 0,1 % weight by weight. The following substances/uses of substances are specifically derogated from this requirement: Homogenous parts with weight below 10 g: Nickel in stainless steel *Assessment and verification:* for each part above 10 g the applicant shall provide a declaration of compliance with this criterion, together with related documentation, such as declarations of compliance signed by the suppliers of substances and copies of relevant Safety Data Sheets in accordance with Annex II to Regulation (EC) No 1907/2006 for substances or mixtures. Concentration limits shall be specified in the Safety Data Sheets in accordance with Article 31 of Regulation (EC) No 1907/2006 for substances and mixtures.

"Substances listed in accordance with Article 59(1) of Regulation (EC) No 1907/2006"
No derogation from the exclusion in Article 6(6) may be given concerning substances identified as substances of very high concern and included in the list foreseen in Article 59 of Regulation (EC) No 1907/2006, present in mixtures, in an article or in any homogenous part of a complex article in concentrations higher than 0,1 %. Specific concentration limits determined in accordance with Article 10 of Regulation (EC) No 1272/2008 shall apply in case it is lower than 0,1 %.

Assessment and verification: the list of substances identified as substances of very high concern and included in the candidate list in accordance with Article 59 of Regulation (EC) No 1907/2006 can be found here:
http://echa.europa.eu/chem_data/authorisation_process/candidate_list_table_en.asp
Reference to the list shall be made on the date of application.
The applicant shall provide a declaration of compliance with this criterion, together with related documentation, such as declarations of compliance signed by the suppliers of substances and copies of relevant Safety Data Sheets in accordance with Annex II to Regulation (EC) No 1907/2006 for substances or mixtures. Concentration limits shall be specified in the Safety Data Sheets in accordance with Article 31 of Regulation (EC) No 1907/2006 for substances and mixtures.

Proposed structure for the revised criteria (first proposal)

"Substitution of hazardous substances and mixtures in displays"
The following structure is proposed for the criteria, which will also need to include the standard hazard listing and a legal reference to the requirements in the Ecolabel Regulation 66/2010:

(a) Restricted substances in displays: A list would be compiled based on best practice by manufacturers and, as far as possible,
- Article 57 substances that have already been/are in the process of being substituted by leading manufacturers.
- The listing would be appended as an appendix of the Ecolabel Decision. The listing would include the Article 6(6)/6(7) requirement to exclude Candidate List SVHC's and Article 57 substances.

(b) Derogation framework: If the need for derogations is identified then these will, as far as possible, be structured according to the function of the substance and/or the relationship of the substance to a specific sub-component within a display.
- Derogations will only be permitted for specific hazards if, after a screening of substance group substitutions, they are required.
- The hazards derogated would be defined by the hazard profile and market status of substitution options.
- Derogation conditions would be set that would be related to the point in the life cycle of the product where the hazard is most relevant.

(c) Assessment and verification: This would be specified for the restricted substance listing and for the derogation framework (if required).
- It is to be discussed if a restriction list could be verified by random analytical testing and if so the frequency of this testing.
- It is to be discussed the level at which verification of the classification/non-classification of substance groups within products could be workable. One possibility is for declarations to be obtained from tier 1 component suppliers.

Consultation questions

- Could the overall approach, combining a substance list and a substance group approach to hazard screening and substitution/derogation, be workable for this product group?
- Are there other screening studies and/or examples of (implemented) substitution projects that we have not covered in the background report?
- What can be learnt from the experience of applicants/competent bodies for other ecolabels which have similar criteria? e.g. EPEAT, TCO
- Based on the experience of industry and existing ecolabels could the approach to assessment and verification be workable? Are there other examples of how this can work in a way that provides a high level of assurance?

3.2.1.1 Stakeholder feedback and further evidence

The main points arising from the 1st AHWG meetings for Computers and Televisions were as follows:

- Stakeholders understood that the criteria has to be ambitious, but the level of ambition has to stay within the limits of possibility. Even the present, less ambitious Television criteria, are difficult to realise.
- A critical point was the transparency of the supply chain. A computer or a TV is a complex article. Manufacturers are not used to verifying based on hazards but on specific substances.
- Care needs to be taken in looking to other Ecolabels' criteria as they have copied each other 'bad' criteria which are not necessarily implementable or scientific. Verification was also highlighted as an important area to strengthen. Third party verification of the hazardous substance criteria for the US EPA DFE programme and for Green Screen assessments were cited as good models.
- An approach focused on a prioritisation of the main components and functions related to the product was generally supported. Flame retardants and plasticisers, for example, should not be treated in a group but should be studied separately. Safety standards which include the use of FR, such as those for TV housings, have to be considered. Clear guidance would be needed for Competent Bodies on which components they would need to verify.
- Concern was expressed that the Ecolabel Regulation's Article 6(6) and 6(7) has a very broad scope and the scope for flexibility was questioned. For example, there could be over 700 pigments used to colour plastic. DG ENV highlighted the need to consult during the revision process on what is legally possible. Early feedback from Member States indicates a willingness to adopt a more flexible approach for electrical products.
- Substitution is expensive. Leading manufacturers therefore seek to anticipate future regulatory restrictions so as to minimise costs. However, substitutes should have a better hazard profile than those they substitute. The US Design for the Environment (DFE) programme, for example, has evaluated 32 flame

retardants, including halogenated and non-halogenated. Other studies and evaluations could also be referred to.

- Stakeholders highlighted the need to cover not only a black list of restricted substances but also a white list of substances which are substituting black substances, which could be a living dynamic list.

The main points arising from written stakeholder feedback received between September and November 2013 were as follows:

- There was concern that fundamentally the approach would not work because manufacturers have not implemented hazard-based restrictions. Concern was raised that Ecolabels have led manufacturers to make 'regrettable substitutions' for which there are major data gaps in their hazard profile.
- From 2011 onwards a major TV manufacturer could not apply for the Ecolabel because it was not possible to use main the flame retardant used in the plastic housings based on hazard restrictions.
- The industry manages well the absence of regulated substances and those of concern but has limited information on all substances in parts e.g. plastics additives and colorants. The scope of the criteria therefore needs to be limited in order to make progress.
- Restricting the use of SVHC in Ecolabel products makes sense. The SVHC restriction should be applicable to component level rather than homogeneous material level. To make the SVHC criteria workable, it is necessary to limit the scope of the 'homogenous' part to a manageable range (e.g. plastic parts over 25 grams, metal parts, etc.). A clear distinction is required between substances in mixtures, and substances in articles/complex articles.
- More information is needed on the inventory of hazardous substances included in TVs/computers. This information is the basis for any debate about substitution possibilities and barriers and respective needs for derogations.

Sources such as ENFIRO, Green Screen, SubSport and the US DfE project were highlighted as being important references.

- Green Screen in particular was highlighted as a means of evaluating, benchmarking and comparing the hazard profile of potential substitutes. Verification should be strengthened, moving away from self-declarations by OEM's to third party verified hazard evaluations and test reports for defined hazard end-points.
- There is the need to avoid the use of substances that will case health and environmental impacts during the End of Life phase of these products e.g. in third world countries where the goods may be processed in dangerous conditions, harming the health of local people and damaging the environment. An EEA report on the issue was highlighted.

One formal derogation has been received to date - nickel in stainless steel, submitted by Eurofer - together with supporting technical information relating to the use of Antimony, Beryllium and non-halogenated flame retardants. A compilation of information and assessments relating to the Green Screen assessment tool was also provided.

Further research and evidence:

In order to analyse and gather further evidence related to hazards that may be present within the product, as well as substitutions and restrictions made by the industry, a sub-group was established as mandated at the first AHWG and two matrices were established as a means of compiling and structuring the information that will underpin the criteria proposal.

Establishment of the sub-group

An invitation to take part in the sub-group was sent out to registered stakeholders and EUEB members in November. The aim of the hazardous sub-group was defined as being to:

- Steer the overall approach to be taken with regards to the Ecolabel Regulation and the substitution potential of the best performing products on the market;
- Assist in developing a better understanding of the substitution potential for the product group;
- Review substitution information and derogation requests;
- Advise on how verification could work.

Based on the responses to the invitation the sub-group was structured to ensure a balanced representation from product manufacturers, industry specialists, EU member states and NGO's. The sub-group members are listed in Table 18. A first telephone meeting of the sub-group took place on the 26th February 2014 with full attendance and a further meeting is anticipated following the second AHWG. *For transparency the minutes have been made available to stakeholders.*

Table 18: Computers and Display hazardous substance sub-group members

Markus Stutz	Dell
Hans Wendschlag	Hewlett Packard
Claudia Albuquerque	LG
Steven Clayton	Samsung
Lein Tange	ICL-IP
Claus Ruediger	Bayer
Dr. Johanna Wurbs	UBA (Germany)
Søren Mørch Andersen	Danish EPA
Dirk Jepsen	Oekopol
Lauren Heine	Clean Production Action (USA)

Participation as observers:

Blanca Morales	EEB/BEUC
Bernd Kappenberg	CEFIC
Susanne Stark	VKI (Austria)

Screening and evaluation of the comments and evidence base

In order to screen and evaluate the existing evidence compiled in the September 2013 background document on hazardous substances and new evidence submitted by stakeholders subsequent to this two matrices have been setup:

1. Candidate List and RoHS screening matrix: The IEC 62474 Declarable substance list for electrotechnical products [30] was used as the starting point for identifying substances from the most current ECHA Candidate List that may be relevant to computers and displays. The list is frequently updated by a dedicated team and is therefore understood to be accurate as well as assisting in screening the list. Substances of potential relevance were flagged and colour coded before being circulated to sub-group members to obtain further feedback on their use/non-use in products. The codings were as follows:

    i. Substances that are already understood to have been eliminated from production;
    ii. RoHS exemptions that may be relevant to the product group but their current/post-sunset date relevance is to be confirmed;
    iii. Substances on which little is known about their potential relevance to the product group
    iv. Substances not deemed relevant to the product group based on the available information.

2. Bill of materials and hazardous substance screening matrix: The evidence gathered to date was structured, firstly, according to substance groups, which can generally be seen to related to functions associated with components of the product, and secondly according to the components/sub-components where hazardous substances are/may be found. A summary of the evidence

[30] International Electrotechnical Commission, *IEC 62474 - Material Declaration for Products of and for the Electrotechnical Industry,* http://std.iec.ch/iec62474

used to compile the matrix can be found in Table 19. This evidence is supplemented by feedback from product group stakeholders and sub-group members, including OEM's. An overview of how the matrix is structured and how it works is summarised in Table 20.

Table 19: Main evidence base used to compile the screening matrix

Screening	Evidence base
RoHS (recast) Directive	• Relevance of exemptions identified from OEM restriction lists
RoHS ATP	• Oeko-Institut and Austrian EPA reports with recommendations on extended RoHS scope
ECHA Candidate List	• Substances of relevance to the product group using IEC 62474 Declaration List (see colour coded version appended) • ECHA and Member State risk assessments and dossiers (e.g. German BFR - PAHs)
Substitution analysis	• EU ENFIRO study of environment-compatible flame retardants • US EPA Printed Circuit Board and decaBDE evaluations • Green Screen assessments for TV enclosures and plasticisers • COWI and the Danish Technological Institute compilation for plastics
Industry substitutions and restrictions	• OEM chemical restriction lists (with a focus on SG members HP, Samsung, Dell, LG) • International Electronics Manufacturing Initiative (iNEMI) • EFRA and PINFA guides to flame retardant applications in electronic equipment • SubSport Case Story substitution database • OEM product and component specifications

The analysis carried out using the matrix was used to derive the following outputs which form the basis for the scope and ambition level of first criteria proposal:

- Current hazard benchmarks: *Substances that are currently used or were used until recently in mainstream products*. For each substance the CAS number and, as far as possible, their hazard profile have been identified for comparative purposes.
- Proposed substitution benchmarks: *Substitutes for hazardous substances currently used in mainstream products that have been implemented, or are proposed for implementation, by leading manufacturers*. For each substance the CAS number and, as far as possible, hazard profile have been identified for comparative purposes.

- Proposed restrictions: *Substance or substance group restrictions that have been identified from OEM restriction lists or from risk assessment exercises by the European Commission, Member State or Intergovernmental bodies*. Where a restriction is proposed:
  - The specific substances, how they relate to the product and, where appropriate, a concentration limit are identified.
  - The potential to specify analytical testing of component parts to strengthen verification is flagged for follow-up and, if agreed to be appropriate in terms of the available test methods and burden for applicants, specification.
  - For some special cases possible derogation conditions are briefly flagged.

These outputs from the screening can be found in *'Functional need and substances currently used'* and *'best practices identified'* columns in the main screening matrix.

Table 20: Indicative schema for the hazardous substance screening matrix

Component or sub-component	Functional need and substances currently used	Best practice identified	Summary evaluation of evidence to support substitution or restrictions	Questions and information gaps
Substance group x				
Generally supply chain tier 2 or 3 components	Description of the function and its need as well as identification of the substances typically used. Substances are also identified which may be used as the hazard profile benchmarks for current practices against which the improvement potential of substitutes may be compared.	Substitutions made by industry and/or mandatory and voluntary restrictions that have been implemented in leading products available on the market. Substances are also identified which may be used as the substitution hazard profile benchmarks to set 'white list' derogations, as well as possible restrictions on specific hazardous substances.	Discussion of background evidence relating to different options for achieving the same function. Comparative evidence relating to substances and substance groups is summarised, in some cases with reference to US EPA and Green Screen assessments.. This evidence may be used to support criteria proposals to derogate the use of substances (*the hazard white list*) and/or restrict the use of substances (*the hazard black list)*.	For follow-up with stakeholders in order to address information gaps

Grouping of the EU Ecolabel hazard list

At the March meeting of the EU Ecolabel Board a final version of the Chemicals Horizontal Task Force approach to implementation of the hazardous substance criteria was tabled[31]. The approach was informally mandated for use in product groups.

Importantly the approach included a grouping of the hazard list which forms a reference for the criteria. This grouping is intended to better reflect the different levels of hazard as defined in the CLP classification rules. The Groups have also been designed to facilitate a better read across from the results of US EPA and Green Screen hazard assessments, which form part of the evidence base in the screening matrix.

The Groups are accompanied by a set of rules for the derogation of hazards, with Group 1 being the strictest and Group 3 being the most flexible. These rules can be found in the Horizontal Task Force approach paper. In all cases the emphasis is on the need to demonstrate the functional need for the use of a substance and the availability of substitutes.

For reference the three groups are listed below:

Group 1: Hazards subject to complete restriction

Substances present in mixtures, in an article or in any homogeneous part of a complex article that meet the criteria of Article 57 of Regulation (EC) No 1907/2006 or that are identified according to the procedure described in Article 59(1) of that Regulation. This shall include the hazards listed below, as well as endocrine disruptors, neurotoxins and sensitisers of equivalent concern.

[31] JRC-IPTS, *Findings of the EU Ecolabel Chemicals Horizontal Task Force – Proposed approach to hazardous substance criteria development*, 24th February 2014

Carcinogenic, mutagenic or toxic for reproduction	
CLP Category 1A and 1B	
H340 May cause genetic defects (R46)	
H350 May cause cancer (R45)	
H350i May cause cancer by inhalation (R49)	
H360F May damage fertility (R60)	
H360D May damage the unborn child (R61)	
H360FD May damage fertility. May damage the unborn child (R60, R60/61)	
H360Fd May damage fertility. Suspected of damaging the unborn child (R60/63)	
H360Df May damage the unborn child. Suspected of damaging fertility (R61/62)	

Group 2: Priority hazards for restriction to which strict conditions shall apply

Combinations of these hazards that also result in the substance being PBT (Persistent, Bioaccumulative and Toxic), or persistent or bioaccumulative, according to the definitions provided in Annex XIII of the REACH Regulation, shall be treated as Group 1 substances.

Carcinogenic, mutagenic or toxic for reproduction	
	CLP Category 2
	H341 Suspected of causing genetic defects (R68)
	H351 Suspected of causing cancer (R49)
	H361f Suspected of damaging fertility (R62)
	H361d Suspected of damaging the unborn child (R63)
	H361fd Suspected of damaging fertility. Suspected of damaging the unborn child (R62/63)
	H362 May cause harm to breast fed children (R64)

Acute toxicity	
CLP Category 1 and 2	
H300 Fatal if swallowed (R28)	
H310 Fatal in contact with skin (R27)	
H330 Fatal if inhaled (R23/26)	
H304 May be fatal if swallowed and enters airways (R65)	

Specific target organ toxicity (STOT)	
CLP Category 1	
H370 Causes damage to organs (R39/23, R39/24, R39/25, R39/26, R39/27, R39/28)	
H372 Causes damage to organs (R48/25, R48/24, R48/23)	

Hazardous to the aquatic environment	
CLP Category 1 and 2	
H400 Very toxic to aquatic life (R50)	
H410 Very toxic to aquatic life with long-lasting effects (R50/53)	
H411 Toxic to aquatic life with long-lasting effects (R51/53)	
Hazardous to the ozone layer	
H420 Hazardous to the ozone layer (R59)	

Respiratory and skin sensitisation (*not proposed for general application to this product group, with limited exceptions*)	
CLP Category 1	
H317: May cause allergic skin reaction (R43)	
H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled (R42)	

Group 3: Hazards to which greater flexibility may be applied in derogations

Acute toxicity	
	CLP Category 3
	H301 Toxic if swallowed (R25)
	H311 Toxic in contact with skin (R24)
	H331 Toxic if inhaled (R23)
	EUH070 Toxic by eye contact (R39/41)
Specific target organ toxicity (STOT)	
	CLP Category 2
	H371 May cause damage to organs (R68/20, R68/21, R68/22)
	H373 May cause damage to organs (R48/20, R48/21, R48/22)

Hazardous to the aquatic environment *	
	CLP Category 3 and 4
	H412 Harmful to aquatic life with long-lasting effects (R52/53)
	H413 May cause long-lasting effects to aquatic life (R53)

** flexibility may be applied only if the fate of the product is not in the aquatic environment*

3.2.1.2 First proposal for hazardous substances criteria

First criteria proposal (draft v2 140429)

Substitution of hazardous substances used in the main electronic displays components

The final product shall not contain hazardous substances in accordance with the rules set out in the following sub-criteria which apply to:

- Substances of Very High Concern (SVHC's)
- Restrictions based on hazard classifications
- Restrictions on substances in specified component parts

Applicants are required to verify that the final product and specified component parts complies with these sub-criteria.

2(a) Substances of Very High Concern (SVHC's)

The product shall not, unless specifically derogated, contain substances that:

(i) Meet the criteria in Article 57 of Regulation (EC) No 1907/2006,

(ii) Have been identified according to the procedure described in Article 59(1) of Regulation (EC) No 1907/2006 which establishes the candidate list for substances of very high concern.

No derogation shall be given to substances that meet either of these two conditions, and which are present in an article or in any homogeneous part of a complex article in concentrations greater than 0,10 % (weight by weight). For the purpose of this criterion verification shall be provided, as a minimum, for the component parts identified in 2(b).

Assessment and verification

Substances that are present in the final product shall be screened against the version of the candidate list published by ECHA at the time of the application for a license. The applicant shall compile declarations of compliance from, as a minimum, suppliers of the component parts specified in 2(b). Where a derogation has been granted then the applicant shall show that use of the substance is in compliance with the stated derogation conditions and verification requirements.

2(b) Restrictions based on hazard classifications

2(b)(i) Overall rules applying to specified components and substance groups

Substances that, in accordance with Regulation (EC) No 1272/2008 of the European Parliament ('the CLP Regulation') and of the Council32 or Council Directive 67/548/EC33,

[32] 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 (OJ L 353, 31.12.2008, p. 1).

First criteria proposal (draft v2 140429)

meet the criteria for classification with the hazard classes or risk phrases listed in table 2.1 shall not be present in the specified component parts of a display at or above a concentration limit of 0.10% unless they have been specifically derogated. Specific concentration limits identified in the CLP Regulation, and any subsequent Adaptations to Technical Progress (ATP's), shall take precedence over this generic concentration limit.

For the purpose of this criterion the main component parts of an electronic display are defined as comprising:

Circuitry and connectors

- Printed Circuit Boards >10 cm^2
- Electrical contacts
- Electrical and data connections (internal and external)

External elements

- External cables
- External housing and enclosure materials
- External casing and surfaces of peripheral devices

Displays

- Display screen glass
- Liquid Crystal Display unit
- Screen LED backlights

Homogeneous parts with a weight of below 25 g and the metal chassis of the product are excluded from the scope of this criterion.

The hazard classifications in Table 2.1 generally refer to substances. However, if information on substances cannot be obtained, the classification rules for mixtures apply. The most recent classification rules adopted by the European Union shall take precedence over the listed hazard classifications or risk phrases.

The use of substances or mixtures which change their properties upon processing (e.g., become no longer bioavailable, undergo chemical modification) so that the identified hazard no longer applies are exempted from the above requirements. This shall include polymers that have been modified to incorporate a function and additives which become covalently bonded with polymers.

Table 2.1: Restricted hazard classifications and risk phrases and their CLP categorisation

Acute toxicity	
Category 1 and 2	**Category 3**

[33] Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances (OJ 196, 16.8.1967, p. 1).

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H300 Fatal if swallowed (R28)	H301 Toxic if swallowed (R25)
H310 Fatal in contact with skin (R27)	H311 Toxic in contact with skin (R24)
H330 Fatal if inhaled (R23/26)	H331 Toxic if inhaled (R23)
H304 May be fatal if swallowed and enters airways (R65)	EUH070 Toxic by eye contact (R39/41)

Specific target organ toxicity	
Category 1	**Category 2**
H370 Causes damage to organs (R39/23, R39/24, R39/25, R39/26, R39/27, R39/28)	H371 May cause damage to organs (R68/20, R68/21, R68/22)
H372 Causes damage to organs (R48/25, R48/24, R48/23)	H373 May cause damage to organs (R48/20, R48/21, R48/22)

Carcinogenic, mutagenic or toxic for reproduction	
Category 1A and 1B	**Category 2**
H340 May cause genetic defects (R46)	H341 Suspected of causing genetic defects (R68)
H350 May cause cancer (R45)	H351 Suspected of causing cancer (R40)
H350i May cause cancer by inhalation (R49)	
H360F May damage fertility (R60)	H361f Suspected of damaging fertility (R62)
H360D May damage the unborn child (R61)	H361d Suspected of damaging the unborn child (R63)
H360FD May damage fertility. May damage the unborn child (R60, R60/61)	H361fd Suspected of damaging fertility. Suspected of damaging the unborn child (R62/63)
H360Fd May damage fertility. Suspected of damaging the unborn child (R60/63)	H362 May cause harm to breast fed children (R64)
H360Df May damage the unborn child. Suspected of damaging fertility (R61/62)	

Hazardous to the aquatic environment	
Category 1 and 2	**Category 3 and 4**
H400 Very toxic to aquatic life	H412 Harmful to aquatic life with long-lasting

(R50)	effects (R52/53)
H410 Very toxic to aquatic life with long-lasting effects (R50/53)	H413 May cause long-lasting effects to aquatic life (R53)
H411 Toxic to aquatic life with long-lasting effects (R51/53)	

Hazardous to the ozone layer	
EUH059 Hazardous to the ozone layer (R59)	

2(b)(ii) Derogations applying to substances with a favourable hazard profile and those required for the function of the product

In accordance with Article 6(7) of Regulation (EC) No 66/2010 the substance groups in table 2.2 are specifically derogated from the requirements set out in Article 2(b)(i) and in accordance with the derogation conditions stipulated.

Table 2.2. Derogation of substance groups by hazard classification

Substance group	**Sub-components**	**Hazard derogations**	**Derogation conditions**
1. Reflecting substitutes with an improved hazard profile			
1.1 Flame retardants	Printed Circuit Boards	*H412, H413*	- *Control of hazardous reaction products.*
	Internal connectors and switches	*H413*	-
	Plastic enclosures and casings	*H412, H413*	- *Control of PFOA emissions from PTFE production*
	Recycled plastic in enclosures and casings	*FR's (H412, H413) and their synergists (H351) that are not REACH restricted or identified as SVHC's*	- *Declaration of FR and synergist by the component supplier.*
1.2 Plasticisers	External cables	*H413*	-

	Recycled content (all components)	*Substances present in recycle that that are not REACH restricted or identified as SVHC's*	- *Declaration of the plasticiser by the component supplier.*
2. Substances required for the function of the product			
2.1 LED doping	Chip and diode	*H301, H331, H400, H410*	- *Control of workforce exposure during manufacturing* - *LED specification to minimise chip thickness*

Assessment and verification:
The applicant shall obtain declarations of compliance from, as a minimum suppliers of the specified component parts. This shall declare that, where present in the specified component parts*, the following substances do not meet the criteria for classification with one or more of the hazard classifications or risk phrases listed in table 2.1:*

- *Flame retardants in PCB's, electrical/data connectors and display casings*
- *Plasticisers in cables and wiring*
- *Plastic stabilisers in external cables*
- *Plastic colorants in external casings*
- *Biocides in plastic and rubber parts of peripheral devices and external cables*
- *Electrical contacts on PWB and connecting internal devices*
- *Thermal conductors in PCBs*
- *Screen glass fining agents*
- *Liquid crystals in TFT display units*
- *LED doping and luminescent materials*

Where substances are derogated in 2(b)(ii) *then the declaration shall specifically identify those derogated substances and provide supporting evidence showing how the derogation conditions are to be met.*
The following technical information shall be provided to support the declaration of classification or non-classification for each substance identified as being used:

(i) For substances that have not been registered under Regulation (EC) No 1907/2006 or which do not yet have a harmonised CLP classification: Information meeting the requirements listed in Annex VII to that Regulation;

(ii) For substances that have been registered under Regulation (EC) No 1907/2006

and which do not meet the requirements for CLP classification: Information based on the REACH registration dossier confirming the non-classified status of the substance;

(iii) For substances that have a harmonised classification or are self-classified: SDS where available. If these are not available or the substance is self-classified then information shall be provided relevant to the substances hazard classification according to Annex II to Regulation (EC) No 1907/2006;

Where self-classifications are made the robustness of the evidence on which they are based shall be independently verified by a third party toxicologist or by reference to Governmental or third party verified evidence studies. Evidence from the use of third party verified screening tools which are equivalent, or can be read across, to the hazard list in table 2.1 shall be accepted.

Where SDS are provided they shall be completed in accordance with the guidance in Section 2,3,9,10, 11 and 12 of Annex II to Regulation (EC) 1907/2006 (requirements for the compilation of SDS).

2(c) Restriction of substances in specified component parts

The final product and, where stipulated, specified component parts shall not contain the hazardous substances listed in table 2.3 at greater than the specified concentration limits and/or shall comply with the specified restrictions. The restrictions in the Table 2.3 take precedence over any derogations listed in Criterion 2(b)(ii).
Verification requirements are specified in table 2.3. Laboratory testing, where required, shall be carried out for each production model. Testing shall be carried out annually during the license period in order to demonstrate ongoing compliance..

Table 2.3. Restriction of substances in component parts

Substance group	**Restriction**	**Concentration limit**	**Verification**
1. Plasticisers	DEHP, BBP, DBP, DIBP, DMEP, DIPP, DPP, DnPP and DnHP shall not be used in external cables and power packs.	Sum total concentration limit of 0.1%	*Test method to be specified*
	Medium Chained Chlorinated Paraffins (MCCP's) Alkanes C14-17 shall not be used in external cables and power packs.	Sum total concentration limit of 0.1%	*Test method to be specified*
2. Plastic stabilisers	Lead shall not be intentionally present in external cables, wires and connecting cords.	Concentration limit of 0.03%.	*IEC 62321-3-1*

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3. Plastic colourants	Colourants containing lead, chromium VI and cadmium, including the specific compounds included in the Candidate List, shall not be used.	*Not applicable*	*The potential to specify testing is to be discussed.*
	Pigments and dyes used to colour ABS shall be colour fast.	*Not applicable*	*A migration test is proposed.*
4. Biocides	Biocides intended to provide a hygiene (anti-bacterial) function shall not be added to keyboards and peripherals.		*Self-declaration from component suppliers.*
5. Plastic contaminants	The 18 listed Polycyclic Aromatic Hydrocarbons (PAHs) shall not be present at or greater than the individual and sum total concentration limits in the external surfaces of remote control and external power cables.	Individual concentrations for the eight REACH restricted PAHs shall be 1 ppm The sum total concentration of the 18 listed PAHs shall not be greater than 10 ppm	*ISO 21461 for rubber parts* *ZEK 01.4-08 for plastic parts*
6. Electrical contacts	RoHS exemption 8b for the use of cadmium shall not be granted to Ecolabelled electronic displays	*Not applicable*	*Declaration by the manufacture detailing the alternative contact material specified.*
7. Thermal conductors	Beryllium and its compounds shall not be present in the specified parts unless it is in a ceramic form.	Concentration limit 0.1%	*Self-declaration from component suppliers.*
8. External steel parts	Nickel migration from in stainless steel shall be restricted where any external part will be in close contact with the skin.	Migration from metal surfaces of >0.5 ug/cm2/week	*EN 1811 with detection using GC-ICP-MS*

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Assessment and verification: *The applicant shall provide a declaration of compliance with the restriction list in table 2.3 supported by the verification evidence requested for the substances relevant to the final product. Testing, where required, shall be carried out upon application for each production model licensed and once a year thereafter, with results then to be communicated to the relevant competent body.* *Failure of a test result during a license period shall result in retesting for the specific model. If the second test fails then the license shall be suspended for the specific product line. Remedial action will then be required in order to re-instate the license.*

Summary of the how the proposal is formulated:

- The scope of the criteria has been set in order to ensure that it can be complied with the best products on the market, reflects the practical potential for the substitution of hazards and can be verified with a high level of assurance.
- The scope is proposed to be narrowed to specific named components and substance groups that have been identified as being of high concern and which have been addressed by substitution initiatives.
- A lower cut-off limit of 0.1% is set for the consideration of hazards in *components parts*. In-line with the practice within all other ecolabelling and reporting schemes for display products a general weight-based cut-off for the scope of the criterion is proposed at 25g.
  - The defined components – mainly understood to be manufactured by Tier 2 or 3 suppliers - are proposed to be recognised as *homogenous parts* for the purpose of applying the 0.1% cut-off limit for hazardous substances, such that verification shall be required for the part as whole in the case that specific restrictions or concentration limits are defined.
- In-line with Articles 6(6) and 6(7) of the Ecolabel Regulation (EC) 66/2010 a restriction is placed on the presence of substances placed on ECHA's Candidate List for authorisation (Substances of Very High Concern) being present in any component of the final product.

  - Provision is only made for the derogation of SVHC's under strict conditions and where a substance is present at concentrations less than 0.1%. It is understood that some OEM's may submit derogations. A strict deadline for derogations to be submitted shall be set at the AHWG2.

- A set of substance restrictions – *a black list* - have been identified from the hazard restriction lists of the leading OEM's that seek to limit or avoid the presence of substances of concern. The aim is to create a clear and visible control of these substances presented in a form that is familiar to OEM's and their suppliers. Functions that are not essential are also excluded where possible e.g. biocidal treatment of keyboards.
  - These restrictions are proposed to be verified for specific identified components. In some cases the restriction relates to possible exposure of the consumer to hazards. Where limit values are proposed then verification shall be according to laboratory testing using standardised IEC, EN or ISO test methods.
  - Reflecting the practices of leading OEM's random laboratory testing is proposed for selected Candidate List substances (to be identified from the IEC 62474 Declaration List) and/or the Ecolabel's restriction list. This shall take place once a year during the license period.
- The initial findings from an analysis of substitutions made by leading manufacturers in order to minimise hazards present in their products has been used to establish a *'white list' hazard derogation framework*. The aim of the framework is to identify from the EU Ecolabel hazard list those hazards that should be derogated in order to permit the hazard profile of the best products on the market to comply with the criterion.
- The framework is structured according to common substance groups that carry out specific and required functions in the product.

3.2.1.3 Stakeholder feedback following AHWG2 and further evidence

The main points arising from the 2nd AHWG meetings for Computers and Televisions were as follows:

- High number of stakeholders agreed that for 2a and 2b the scope can be limited to the listed components parts and that this can also be taken to mean 'homogenous parts'. The 25g threshold was not felt to be needed if the components parts listing are comprehensive, these parts should then be verified.

- One stakeholder queried as to what % of the product is addressed by the component part list.
- Some concern was raised about the proposal for third party certification of hazard profiles.

- The paragraph in 2a relating to the exemption of substances or mixtures that change their properties upon processing was queried – this may prevent issues along the life cycle being addressed. The potential for breakdown products should be better addressed and evaluated in the evidence base – assumptions are being made about stability over time

- The proposal for further testing after the license has been granted was felt to create potentially too much of a burden for Competent Bodies

- NGO discussed the issue of bioavailibility and raised their concern that there is no explanation how this shall be demonstrated. They had special concerns in cases where substances remain existing in a matrix and molecules are not modified (covanlent bound of an additive in a polymer not given). This should be reflected in the criteria, because there was agreement among the stakeholders that just physical inclusion in a matrix is not sufficient to prove this.

The main points arising from written comments received after the 2nd AHWG meetings for Computers and Televisions were as follows:

A Member State queried the implied definition of an article – could it be flexibly applied to specific components or the whole product? Their understanding was that it was a case of 'once an article, always an article'. Moreover, a definition of 'homogenous parts' was requested and it was clarified by JRC-IPTS that this had no legal definition in EU legislation and that 'component parts' had the same intended meaning for the purpose of this proposal.

Defining the main components

In general the linking of 2(a) and 2(b) to a defined list of main components was supported by stakeholders who commented. It was requested that the list be repeated in 2(a) for clarity and it was also queried why the 25g threshold was needed if the components were already defined. For some stakeholders this would not be acceptable because it was not clear what would be covered by such an exemption. The scientific argument for 25g was also felt to be lacking.

A Member State requested to know what would be the proportion of the product that would be covered by the components defined in 2(b)? This would then define the coverage and the acceptability of the criterion.

Screening for SVHCS's

In the criterion text it is unclear whether the intention is to screen SVHC meeting the criteria of article 57 or REACH (i) and/or SVHC in the candidate list (ii). This requires clarification. Candidate List substances should be screened not only in the main components listed but also for the entire article. With this proposed solution it would be ensured that the level of ambition remains high for listed components while at the same time the entire final product as sold is addressed as a safety net. For clarity the component list should be included within 2(a).

Verification of hazard profiles

The proposal for third party verification of hazard profiles was the subject of many comments. In other products there is an almost complete reliance on self-declarations – why should this product group be different? What value would this add, how would it work and in what situation? Good arguments would be needed to introduce this additional new step.

Asking for verification or documentation for the classification is going further that CLP and will add an extra burden on manufacturers, but only for those applying for the Ecolabel. A Member State felt that this was neither fair to applicants nor increased the environmental benefit.

Clarification was additionally requested that a parallel system to REACH and CLP was not being created. A proposal was made that joint submission dossiers in the ECHA C&L Inventory be taken as being more authoritative than single notifications or aggregated notifications. An industry stakeholder highlighted the need for decisions to be made based on the best available scientific data. It was commented that Green Screen assessments could be used to fill gaps.

Exemption of substances which changes their properties

Concern was raised by one stakeholder regarding that criterion text which exempts substances where they change their properties so as to no longer be bioavailable. It was queried what evidence this would need to be based on (e.g. EU risk assessment reports) and it was felt that the burden of proof should be on the manufacturer to demonstrate that it would not be bioavailable along the products lifecycle.

This exemption was felt to preclude addressing the lifecycle of the product and certain substances and, moreover, would give a freedom to use any substances bonded to polymers. On this basis brominated flame retardants and PVC may not be addressed, whereas at the very least consumers should be informed if they are used. One stakeholder proposed that instead all additives (e.g. FRs, plasticisers) should be treated as bioavailable unless proven stable over time.

A related concern was expressed for the need for a stronger focus on breakdown products which may arise. Assumptions are currently being made about the stability of substances over time which require reviewing.

Substance-specific issues raised

A Member State was opposed to there being a restriction and declaration for mercury backlights. With LED's understood to be mercury free anyway and Ecodesign proposals for mandatory labelling of displays this could cause confustion for consumers. Another stakeholder disagreed, citing the potential for mercury backlit LCD's to still be on the market. The requirement would therefore serve as a safety net.

A specific point was raised in relation to testing for nickel in stainless steel. This will require reviewing because the approach to migration testing is under review. It was also considered that stainless steel casings are specialised so may not be relevant to the product group. For chrome coatings the same approach should be considered as for solders under RoHS where self-declarations are used.

Another specific point was raised in relation to power cables. Can the restriction proposed for plasticisers actually be verified? It was cited by a Member State that problems had arisen with this before.

With regard to the use of beryllium in computer/television products it was stated that it was not used in connectors and that the use of beryllium oxide as a heat sink was too expensive for the applications covered by the product group.

An industry representative highlighted the different ways in which substances such as flame retardants may be incorporated into components. In some cases they are reacted and so should be exempted. It was queried whether the evidence base was being put together to reflect what industry wanted or what the scientific evidence showed.

Addressing improper WEEE disposal

Substandard and improper treatment technologies were of concern to one stakeholder. A report by the European Environmental Agency was cited as evidence

that considerable amounts of electronic products end up outside the EU. The report estimates this trade to be at least 250 000 tonnes every year, possibly much more. 'These goods may subsequently be processed in dangerous and inefficient conditions, harming the health of local people and damaging the environment'.

The main concerns related to brominated flame retardants and PVC cables. Whether or not the EU Ecolabel excludes use of PVC and halogenated FRs, it should allow manufacturers who succeed in making halogen-free substances to make such claims in association with the label.

Approach to testing

With regards to the proposal for product testing during the license period a Member State felt that this went too far towards market surveillance rather than compliance and wasn't necessary.

Further research and evidence

Follow-up research to finalise the criteria proposal for hazardous substances were steered by the comments from the AHWG2 and a second meeting of the sub-group (SG), which took place on the 11th July 2014. Minutes of the SG meeting were published in the BATIS on-line consultation system.

Should declarations for Candidate List substances be required at product, component or material level?

In further discussions within the SG there was a general agreement on setting a threshold of 0.10% the non-presence of Candidate List substances. This is the threshold for notification under the REACH Regulation and, moreover, manufacturers and their suppliers are familiar with having to provide declarations at or above this threshold. Manufacturer's experience was that there are very limited substances on the Candidate List that may be present above 0.1% at the article level (usually only plasticisers).

Further investigation of how this threshold works in practice highlighted that if a declaration was to be requested without a threshold (i.e. below 0.10%) then this would go beyond current practices, with the exception of where manufacturers have implemented very specific restrictions that can be verified with laboratory testing. For example, those required under RoHS.

A more significant issue raised by manufacturers was whether the threshold should be applied at 'complex article' (the whole product), sub-assembly, component or material level. The first criterion proposal was worded to be verified at a component level. This is stricter than current practice because many products are imported as a finished article. Some manufacturers do not assemble their final products, having decided to outsource their design and assembly.

However, a key distinction was identified that could be used to introduce selectivity into the criterion. *Some manufacturers request declarations of compliance at what is termed 'sub-assembly' level* e.g. populated motherboard or HDD unit as supplied for final assembly. A stakeholder highlighted that a sub-assembly such as a HDD may be sold in the EU as an article itself, so it seems reasonable to ask for verification at a level equivalent to a sub-assembly that a consumer might be able to obtain themselves as a spare/replacement part.

A definition of the main subassemblies that might typically be verified has been created with the feedback of a manufacturer of the SG. Table 21shows the definitions of sub-assemblies and main components. The manufacturer stated that for the level described in Table 21 they might be able to comply with the non-presence of Candidate List substances above 0.10%.

Table 21: Proposed definition of sub-assembly and main components

Current list on Criteria 2(b)	Modified components	Definitions
Printed Circuit Boards >10 cm^2	Printed Circuit Boards >10 cm^2	Populated motherboard, power board (power supply unit), module board and other PCBs Assembly above 10 cm^2
Electrical solder and metal contacts	----	Not easy to define and localize. Proposed to be removed. Solders form part of cables/wiring or PCBs (will be addressed at these components).
Electrical and data connections (internal and external)	Electrical wiring/cables (aggregated)	All this parts are very light in separate form. It could be proposed to address them in aggregated form.

	----	Data connectors: Tuner, HDMI, USB and Data storage device (HDD, SSD) if present. (Normally embedded on PCBs).
External cables	External cables	Power cable or cord, (modem cable and LAN cable if applicable), HDMI cable, RCA cable.
External housing and enclosure materials	External housing	Back cover, Front cover (Bezel decoration) and stands.
External casing and surfaces of remote control	External housing of remote control	Housing of remote control.
Display screen glass	-----	The screen glass is normally integrated at the LCD panel. Proposed to be removed as a separate component.
Liquid Crystal Display unit	Liquid Crystal Display panel	Crystal black panel (cell)
Screen LED backlights	LED backlights	LED arrays

Pre-screening of the Candidate List for relevance to display products

It was noted in SG discussions that there are Candidate List substances that are not relevant for electronics. Use of the IEC 62474 substance declaration list [34] was highlighted as a tool to pre-screen the Candidate List for relevance. This is then provided to suppliers who must then provide declarations down to concentration limit of 0.1%.

The IEC 62474 declaration list includes notes on what functions substances serve and in which products and/or components they may be present. In general it was felt by SG members to be relevant and reasonable to carry out such a pre-screen. It was highlighted that the use of pre-screening can be seen in the published restriction lists of manufacturers, where SVHC's of relevance are listed alongside substances restricted by, for example, RoHS.

Defining the scope of substances and components addressed by the criterion

The background research by IPTS has highlighted that a complete picture of hazards that may be present in a display product is not available. Instead information must

[34] International Electrotechnical Commission, *IEC 62474 - Material Declaration for Products of and for the Electrotechnical Industry,* http://std.iec.ch/iec62474

be pieced together from different sources, as summarised in Table 19. In the April 2014 (v1) criteria proposal a substance group and components list was defined based on the evidence of progress made by leading manufacturers to address hazardous substances in displays.

This evidence has been brought together into a Display evidence matrix (see Appendix 1) that identifies the following activities by industry that in turn form the basis for the criterion proposal:

- Restriction of hazards by communicating to suppliers *substances that shall not be used* e.g. PAHs in plastic and man-made rubber;
- Substitution of hazards by *benchmarking and assessment of alternatives* e.g. flame retardants, plasticisers;
- Precautionary substitution of substances that cause exposure to hazards either at *manufacturing sites* or during the *improper disposal of waste electrical equipment* e.g. brominated flame retardants in motherboards, PVC in power cables;
- Early compliance with *RoHS derogations that may sunset* e.g. lead solder in servers, cadmium in metal contacts;

Based on further analysis and stakeholder feedback the v1 proposal for criterion 2(b) was too open in its scope to be implementable. This is because currently only some of the substance groups can be verified for the hazard classifications under 2b (i.e. flame retardants and plasticisers) whereas most are currently verified for substance restrictions of the kind in 2c (e.g. colourants, screen glass).

Flame retardants and plasticisers have been the main focus for planned substitutions of hazardous substances by leading manufacturers. These substance groups are also notable for being the first examples of substitutions by manufacturers where hazard classifications have been a consideration. This process has been supported by research programmes of the US EPA and assessments using Green Screen.

Further discussions within the SG emphasised that for certain substance groups identified in the Display evidence matrix, industry has not been able to obtain further information or influence suppliers. A cited example was colourants in plastics, which it was claimed had received attention but that no progress had been made because

of confidentiality in the supply chain. Suppliers are also often given flexibility as to how they meet certain specifications e.g. plastic colour.

The most common approach is, instead, to use CAS numbers to identify specific substances that should not be present in the product or sub-assemblies. For example, several colourants of concern are identified in the IEC 62474 declaration list. Whilst the CAS numbers of colourants that may be used in different types of plastic can be identified from the catalogues of, for example, Clariant [35] and BASF [36] an overview of the hazard profile of different colourants and their comparative improvement potential is not currently available.

How much of the product is addressed by the criterion proposal?

The proposed approach is based on a narrowing of the scope to focus instead on specific groups of substances and the 'sub-assemblies' (or components) in which they may be found. In order to answer the question, which was posed by a number of Member States, A bill of materials for an example LCD monitor from a study by Teehan and Kandlikar (2013) was analysed. The sub-assemblies and components were colour coded according to which are addressed by the different elements of the draft criteria:

- Restriction on Substances of Very High Concern (2a);
- Hazard derogations that reflect substitute flame retardants and plasticisers (Appendix 1a)
- Restrictions applying to substances that may be present in the final product (1b)
- Derogations applying to specific substances or groups of substances (1c)

The indicative results for a monitor are presented in Table 22, supported by the full analysis in *Annex 2.Bill of materials of a LCD monitor (source: Teehan and Kandlikar (2013))*, demonstrate that a large proportion of each product is addressed, in some

[35] Clariant (2007) *The coloration of plastics and rubber*, Pigments & Additives Division.
[36] BASF *Housing applications*, Accessed 2014, http://www.plasticadditives.basf.com/ev/internet/plastic-additives/en_GB/content/plastic-additives/Industries/Electrical_Electronics/electrical_electronics_applications

cases by several elements of the criterion proposal. Large parts of each product are accounted for by homogenous metal components, for example the steel chassis and capacitor coils in a desktop, which are derogated by the proposed approach.

Table 22: Indicative coverage of a LCD monitor BOM (Bill of Materials)

Criteria coverage sub-totals	***% of total product mass***
C2(a) SVHC	96.2%
A1(a) Substitutes	30.6%
A1(b) Substance restrictions	76.2%
A1(c) Specific derogations	46.8%

Determining the hazard classification of substitutes

Background research and dialogue with stakeholders has enabled a range of substitute flame retardants and plasticisers to be identified that are used in different components. However, in seeking to decide which should be derogated for use in the EU Ecolabel, and what form this derogation should take, a problem emerges in that a complete picture of a substances hazard classification may not be readily available.

Based on follow-up discussions with ECHA it has been identified that this may be the case because of a number of factors:

- Substances are progressively being registered under REACH and so a substance may not be registered yet ;
- Data gaps may exist in the hazard classifications for a substance and these may only be filled once testing proposals have been evaluated and agreed by ECHA;
- Where a substance has not been registered there may only be self-classifications to use as a reference point. These can be divergent depending on the state/form of the substance and, moreover, depending on the knowledge/expertise of the notifier they may not correspond to the final EU classification;
- Joint submissions and entries in the REACH registration database tend to provide greater confidence in the hazard classification because, as is encouraged by the REACH system, test data is shared by manufacturers;

- Harmonised classifications are only made where Member States or stakeholders make a proposal, as a result harmonisation may only focus on specific hazards associated with a substance.
- Adaptations to Technical Progress (ATPs) have resulted in changes to the classification rules, which may mean that self-classifications are incorrect.
- Data for low tonnage bands may more limited so, for example, there is the potential for gaps for hazards such as CMR which require longer term test data.

Because of these factors it may not therefore be possible to make a clear decision on a substances classification. It was therefore decided that, with input from ECHA, a decision making tool should be developed in order support the process. The resulting decision tree is presented in Figure 7. This tool was then used to determine hazard classifications for the substitute flame retardants and plasticisers identified. The results are compiled in *Annex 3. Determination of hazard profiles for substitute flame retardants and plasticisers.*

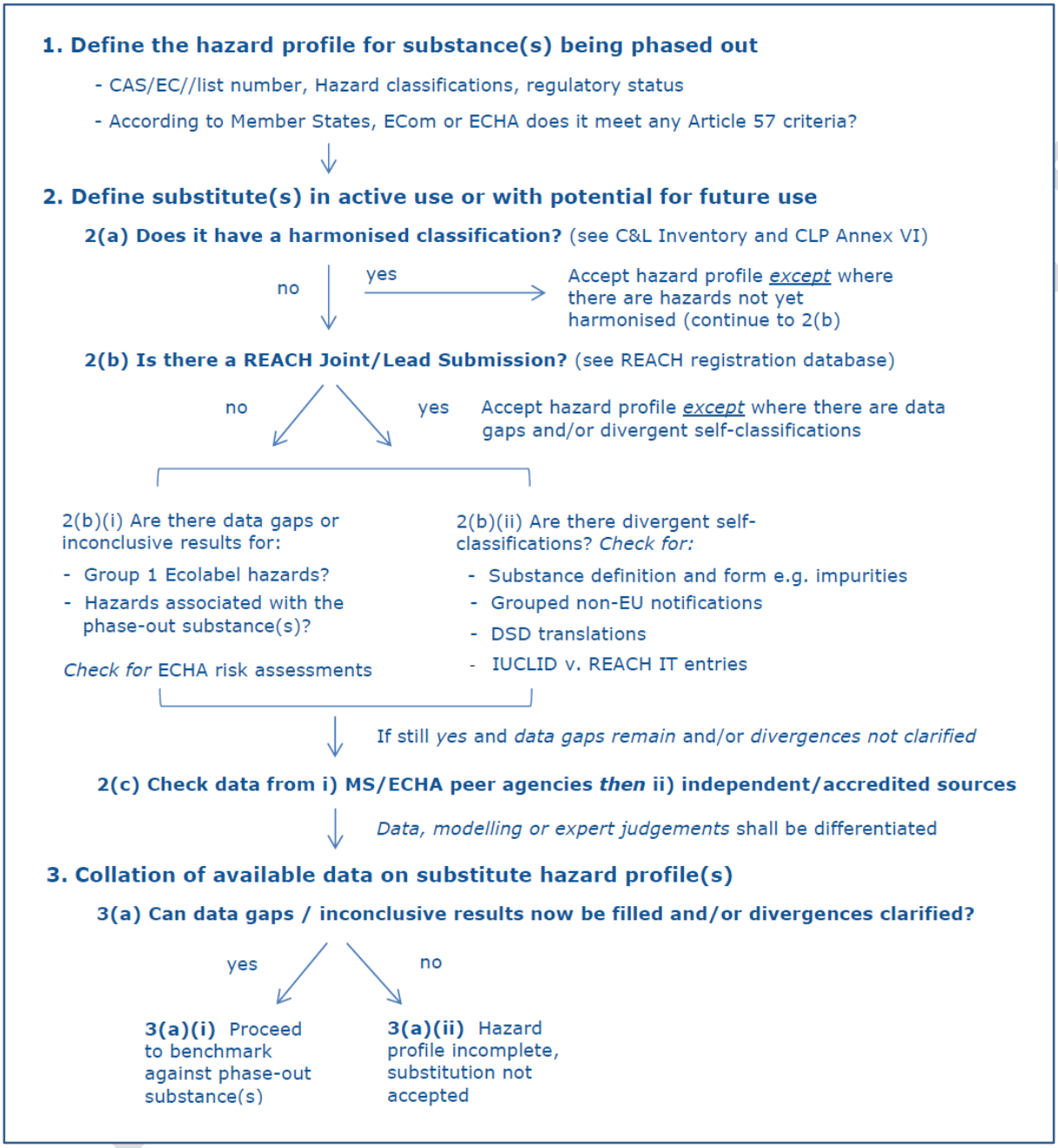

Figure 7: JRC-IPTS decision tree used to determine hazard classifications

An example of application of the decision tree to a flame retardant substitute is provided in Box 1. This example highlights a situation in which there are data gaps for a major substitute. Whilst the option exists to accept the self-classifications made, cross checking a hazard assessment by an ECHA peer agency provides a

potential means of filling the classification gaps and also highlights potential discrepancies in the self-classification for certain end-points.

Box 1. Application of the decision tree to a substitute flame retardant

Dihydrooxaphosphaphenanthrene (DOPO) CAS No 35948-25-5

Description: DOPO is a reactive flame retardant used in Printed Circuit Boards. It is the main substitute for TBBPA used by industry (CAS No 35948-25-5).

EU status: 74 notifications in C&L Inventory, including one REACH Joint Entry, which suggests that it is not classified but upon checking the REACH registration database it can be seen that data gaps exist for Acute Toxicity and CMR hazards.

Peer agency and independent data check: Cross checking with a US EPA study on PCB's we find that it is generally classify as a 'low' hazard (EU Ecolabel = no hazard) with the exception of 'medium' aquatic toxicity (EU Ecolabel = Group 3). It may therefore be classified with H412 and H413.

Options:

1. Accept that it is not classified according to the C&L Inventory if this is the finding for the Joint Entry for its use as a Flame Retardant.
2. Require further evidence that it is not classified as an acute toxin or CMR hazard, but this raises the issue of verification.
3. Use the US EPA's assessment to fill the gaps and cross-check the hazard profile, which suggests low acute toxicity and carcinogenicity but suggests medium aquatic toxicity (H412 and H413).

Using other hazard assessment tools and methodologies to fill classification gaps

Tools have been developed in the USA to address similar challenges when seeking to make decisions on the hazard profile of substances. The US EPA developed a hazard classification matrix for its design for the environment programme which it has applied to a range of different flame retardants. The matrix consists of a series of hazard end-points that mainly correspond to the EU Ecolabel hazard list. When the matrix is completed data gaps in GHS hazard classifications are clearly identified and can be filled based on expert judgement using evidence from computer modelling, read across and scientific literature.

The US Green Screen assessment tool has been developed by an NGO and broadly follows the approach of the US EPA [37]. At least one major computer manufacturer is now using Green Screen assessment tool to make decisions on investment in substitutions. A substances hazard profile is benchmarked based on combinations of GHS classifications and clearly defined characteristics, such as persistence or bioaccumulation, for which there is ready equivalence in REACH and CLP.

Discussions and feedback from the AHWG2 and the SG supported the use of information from governmental sources such as the US EPA (a peer agency for ECHA) or independent schemes such as Green Screen. Concern was, however, expressed that Green Screen as a system should not be used as the verification route for the EU Ecolabel. Instead it should be used alongside other sources of information in order to determine hazard profiles. This concern is reflected in the design of the decision tree in Figure 7, which emphasises the need to check data from ECHA peer agencies before resorting to independent schemes.

How shall substitutes be derogated?

The v1 proposal for substitute derogation made in April 2014 was considered to require further justification. Moreover, comparison with proposals for hazard benchmark levels in the TCO label suggested that important substitutes would not be permitted.

Three options for how substitutes could be derogated were discussed further within the Sub-group. The options were as follows:

1. *Derogate the white list based on hazards*: A white list of likely substitutes is finalised their associated hazards shall then be derogated.

   Background to the option: Whilst this option reflects the current approach in EU Ecolabel product groups it might be inflexible if other substitutes are introduced with different hazard profiles or if the classifications for important substitutes change in the future.

[37] Clean Production Action (2013) *Green Screen chemical hazard assessment procedure v1.2*

2. *Derogate/restrict based on hazard groups or benchmarks*: The electronic product ecolabel TCO will permit substances that are Green Screen benchmark level 2,3 or 4.

   Background to the option: Equivalence between the Green Screen benchmark levels and the EU Ecolabel hazard list can be established using the hazard groups 1-3. This option would give more flexibility for other substitutes to be brought forward. It would also allow for equivalence to be established with Green Screen and TCO.

3. *Provide a white list of substances that are accepted*: This option was proposed at the first AHWG but concern was raised in written comments about maintenance of such a list.

   Background to the option: This option relies on the white list substances having an acceptable/improved hazard profile, which is not clear in all cases. If a new substance is brought forward an applicant would need to proof that it has the same/improved hazard profile. This would reflect current practice in the EU Ecolabel, but verification of hazard classifications is considered to require strengthening.

Sub group members had divided views on the options. From the manufacturers side, one suggested either to derogate the hazard (Option 1) or describe a benchmark level from Green Screen in terms of hazards (Option 2). Another manufacturer showed a preference for Option 3 because they restrict using CAS No's and it would be clearer upon publication of the criteria. However, if needed they would be able to verify on the basis of hazards, with a preference: for Option 2. A third manufacturer wanted to target/exclude substances instead of hazards (Option 3). They considered the scope too open ended with hazards. From the NGO and MS side 1 *or* 2 were supported.

An industry stakeholder highlighted the need to take a broader view that just the hazard classifications. Referring to the example in Box 1 some FR's such as TBBPA

are reactive. A life cycle perspective is required as DOPO has a worse carbon footprint. From the NGO and MS side the need was highlighted to consider degradation products - as is done within Green Screen - and emissions from improper WEEE disposal were highlighted by another stakeholder.

No objections were raised when Option 2 was then proposed as a preferred option, being based on hazards but also allowing for flexibility and equivalence. It was agreed that degradation products and end-of-life environmental impacts would be explored, but only for targeted components of concern, given the need to minimise the complexity of the proposal.

Proposed decisions on derogation requests

Table 23. Derogation requests received and proposed decision

Substance	**Function within the product**	**Hazard profile and concentrations**	**Proposed decision**
Diantimony trioxide CAS 1309-64-4	Synergist for flame retardants used in casings and cables.	H351 (harmonised) *Typical concentrations:* PVC 3.5 – 20% Non-PVC 1 – 10%	Derogation not granted. *Reasoning:* Analysis of substitutes suggests that the flame retardants used in combination with ATO would not be derogated for use in EU Ecolabelled displays.

Tetrabromobisphenol (TBBPA) CAS 79-94-7 *Note: Several derogations request for TBBPA resins have been received.* *It is proposed to extend the scope of the derogation of TBBPA to include its reaction products. Details of these substances are entered in the hazardous substance evidence matrix.*	Flame retardant	Group 2: H400, H410 Registered, conclusive with no data gaps *Typical concentrations:* 1~2 % in Bare PWB.	Derogation granted in specific Printed Wiring Board (To be specified) *Reasoning: Manufacturers stated that TBBPA is being replaced with halogen free FRs. However, due to cost and reliability issues TBBPA is still needed for bare PWB board in specific TV parts.* *Reliability issues:* *1) hardness: Halogen free PWB is harder that PWB using halogens; this means that is easily broken.* *2) smell test: quality assessment smell test for PWB assemble fails when using halogen free PCB board.*
Nickel in stainless steel CAS No 7440-02-0	Nickel is used in stainless steel alloys in order to provide corrosion resistance Stainless steel casings may be required in locations where hygiene is a consideration e.g. hospitals, food production facilities.	H351, H373 and H412 Typical concentration: 8-13%	Derogation granted. Reasoning: Steel is a standard material used in casings, bolts, nuts, screws and brackets. Evidence submitted demonstrated the limited potential for migration where used in locations without frequent skin contact.
Beryllium oxide	Beryllium oxide is used as a thermal	H301, H330, H350i, H372 (harmonised	Derogation not granted.

CAS No 1304-56-9	conductor in high reliability electronic circuits e.g. military or space applications.	classifications) Typical concentration: <0.1% in an article.	Reasoning: Beryllium oxide ceramic is rarely used in consumer electrical and electronic equipment due to its higher relative cost. It is not therefore considered necessary to grant a derogation given the existing use of safer alternatives.
Beryllium copper alloy CAS No 7440-41-7	Beryllium alloys are used to increase electrical and thermal conductivity, enhance the reliability of connectors and facilitate miniaturisation of components. It enables resistance to be minimised whilst retaining strength at higher temperatures.	H301, H330, H350i, H372 (harmonised classifications) Typical concentration: <0.0050% in connectors and springs	Derogation not granted. Reasoning: No current use could be identified in televisions. Given the concentrations would be below the 0.1% threshold and the existing use of safer alternatives it is not therefore considered necessary to grant a derogation.
Doping and luminescence substances	Doping substances used in the chip and diode of LED lamps.	Substances classified with H301, H331, H400, H410, H411, H412 *Typical concentration:* n/a	Derogation granted. Reasoning: Evidence submitted demonstrated that there are not alternative substances for this function.
	Luminescent substances classified used in OLED screen	Substances classified with H350, H351, H361f, H372 and	Derogation granted. Reasoning: Evidence submitted demonstrated that there are not

	units.	H373 *Typical concentration:* n/a	alternative substances for this function.
Note: Additional derogations have been requested by several manufacturers on a confidential basis. These have not been considered further for derogation as some of them are permitted by the proposed criterion and for some others it was not possible to obtain further evidence or a complete enough picture of their specific function to consider a derogation. Details of these substances are entered in the hazardous substance evidence matrix.			

Addressing toxic emissions from improper WEEE disposal routes

The environmental impacts associated with the improper disposal of WEEE were highlighted by LCA work package of the ENFIRO project [38] and are well documented. Informal recycling and treatment of, amongst other components, printed circuit boards and cables to recover precious metals and copper [39] has been analysed and shown to result in a range of toxic emissions, including species of dioxins and furans at much higher concentrations than can be found under more controlled forms of incineration [40]. These have led to the exposure of communities and the pollution of local environments[41].

In a recent report the European Environment Agency quantify the scale of illegal WEEE export to less developed countries where improper disposal and informal

[38] *Life Cycle Assessment of Environment-Compatible Flame Retardants (Prototypical Case Study),* WP8: D8.5 LCA report, January 2013

[39] Oeko-Institut, *Recycling critical raw materials from waste electronic equipment*, Commissioned by the North Rhine-Westphalia State Agency for Nature, Environment and Consumer Protection, 24th February 2012 *and* Oeko-Institut, *Informal e-waste management in Lagos, Nigeria – socio-economic impacts and feasibility of international recycling operations*, UNEP SBC project, June 2011

[40] Sepúlveda, A., Schluep, M., Renaud, F.G., Streicher, M., Kuehr, M., Hagelüken, C. and Gerecke, A.C., (2010) *A review of the environmental fate and effects of hazardous substances released from electrical and electronic equipments during recycling: Examples from China and India,* Environmental Impact Assessment Review 30, 28–41

[41] Gullett, B.K.; Linak, W.P.; Touati, A.; Wasson, S.J.; Gatica, S.; King, C.J *Characterisation of air emissions and residual ash from open burning of electronic wastes during simulated rudimentary recycling operations*, Journal of Material Cycles & Waste Management 9: 69-79, 2007

recycling may take place [42]. They estimate that 16-38% of the EU 's WEEE waste (between 550,000 and 1,300,000 tonnes) was exported in 2008. However, whilst illegal WEEE shipments are classified as hazardous waste under the Basel Convention and are the subject of new controls under the recast WEEE Directive, the EEA highlights that there are no restrictions on the export of goods for re-use, accounting for a significant proportion of WEEE waste collected in Europe.

The ENFIRO projects' LCA work package identified from literature the following scenarios and modelled the related emissions to the environment from the informal treatment of an exported notebook computer in China:

- Open burning of cables to retrieve copper wires (lead and cadmium, chlorinated dioxins)
- Open burning of circuit boards to retrieve precious metals (brominated dioxins from Brominated Flame Retardants)
- Desoldering of printed wiring boards by heating them on a stove (lead/tin emissions)
- Acid leaching of printed wiring boards to retrieve precious metals (acid emissions to air and water, cyanide emissions)
- Manual dismantling of flat panel display with mercury-containing lamps (mercury emissions)

Concern relating to the end-of-life phase of electrical products has driven action by manufacturers to phase-out those materials and flame retardants for which evidence exists of the potential for toxic emissions[43].

The ENFIRO LCA modelling and comparison of the potential emissions from improper disposal of WEEE (see Figure 8) illustrates the significance of dioxin and furan emissions to human toxicity mid and end-points for WEEE incorporating brominated and chlorinated flame retardants. Notably in the low dioxin scenario the contribution of non-halogenated flame retardants to human toxicity is of comparative

[42] European Environment Agency, *Movements of waste across the EU's internal and external borders*, Report No 7/2012

[43] Industry statement

significance to the halogenated flame retardants. This is understood to be the result of toxic emissions such as carcinogenic Polyaromatic Carbons (PAHs).

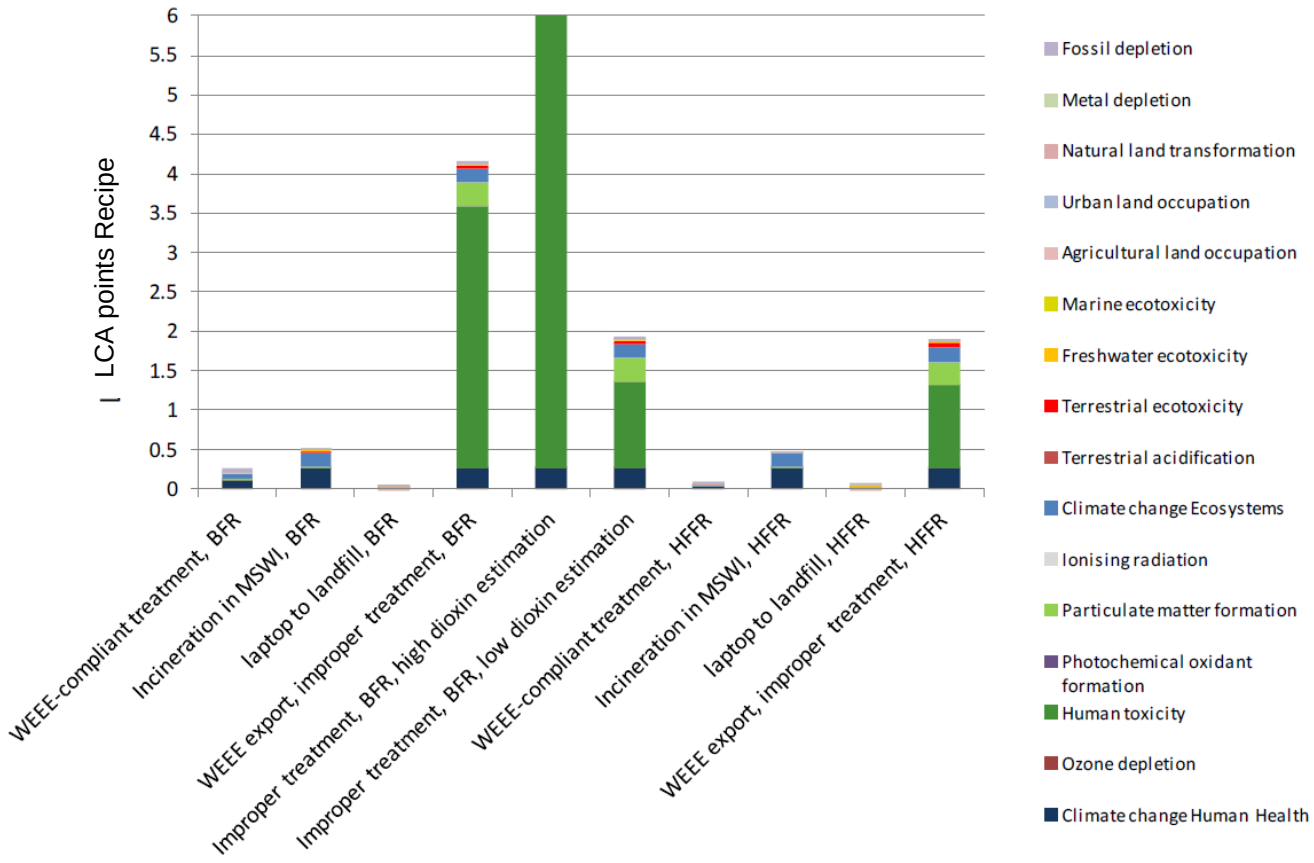

Figure 8: influence of dioxin formation during improper WEEE treatment on the total environmental impact of the waste treatment of one laptop.

Source: ENFIRO project (2013)

The testing of toxic emissions from the burning of printed circuit boards and cables has been carried out as part of the US EPA's Design for the Environment programme and ENFIRO work package 8, as well as studies by, amongst others Gullett et al (2007), Hull et al (2008) and Li et al (2009).

Simulation of the improper thermal treatment of WEEE waste can be approximated based on evidence of how this is carried out in different locations and by then using fire performance test methods and scenarios such as those described in ISO 19700

or IEC 60695-7-50, for which Hull et al (2008) suggests that the results are comparable with those from a large-scale fire model.

Simulation of the potential conditions for the formation of dioxins and furans, as well as their subsequent quantification, is understood to be more complex than for emissions such as chlorinated gases and PAHs. The US EPA and University of Dayton study characterised both dioxin and carcinogenic PAHs emissions from a range of flame retardant options [44]. The results, which are illustrated in Figure 9, show a variation in emissions based on the flame retardant chemistry. The emissions results are significantly higher than the 0.2 mg/kg sum total proposed by the German UBA for the control of PAHs.

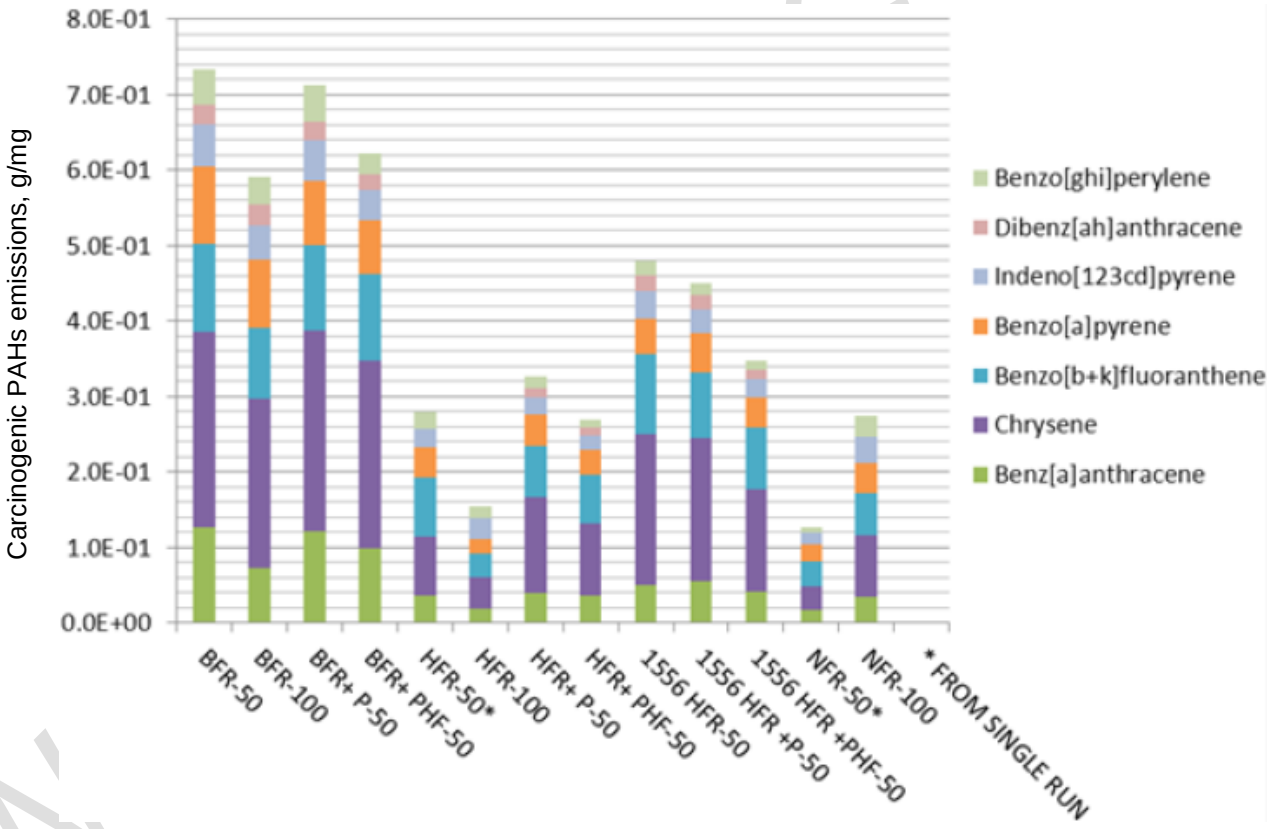

Figure 9: Carcinogenic PAHs emissions for three flame retardant resin chemistries

Source: US EPA (2013)

[44] US EPA and the University of Dayton, *Phase II of Circuit Board Emissions Project: Cone Calorimeter Testing and Emissions Analysis*, Presentation of findings 19th September 2013

3.2.1.4 Revised proposal for hazardous substances criteria

Proposed revised criteria
Restriction and substitution of hazardous substances in the product and its sub-assemblies and component parts ***Criterion 2(a) Restriction on Substances of Very High Concern (SVHC's)*** The product and its associated sub-assemblies and components as defined below shall not contain substances that have been identified according to the procedure described in Article 59(1) of Regulation (EC) No 1907/2006 (the 'REACH Regulation') which establishes the candidate list for substances of very high concern in concentrations of greater than 0.10% (weight by weight). The absence of the above referred to substances shall be declared for the product and, as a minimum, the following sub-assemblies: • Printed Wiring Boards • Internal electrical wiring • External cables • External plastic housing of the display • External plastic housing of the remote control • Liquid Crystal Display panel • LED backlighting • Metallic housing parts In communicating this requirement to suppliers of the listed sub-assemblies applicants may pre-screen the candidate list based on the relevance of substances to the product using the IEC 62474 declarable substance list. No derogation shall be given to the above referred to substances if they are present in an article ('the product') or in any homogeneous part of a complex article ('associated sub-assemblies') in concentrations greater than 0,10 % (weight by weight). ***Assessment and verification:*** *The applicant shall compile declarations of the non-presence of candidate list substances for the product and, as a minimum, the listed sub-assemblies. Where declarations are made based on a pre-screening of the candidate list using IEC 62474 the screened list given to sub-assembly suppliers shall also be provided by the applicant. Where a derogation has been granted then the applicant shall show that use of the substance is in compliance with the stated derogation conditions and verification requirements.*

Proposed revised criteria

Restriction and substitution of hazardous substances in the product and its sub-assemblies and component parts

***Criterion 2(b)* Restriction of CLP hazard classifications and Article 57 criteria**

Hazard classifications and criteria that shall apply

The product and its associated sub-assemblies and components shall not contain substances that meet the criteria for classification as toxic, hazardous to the environment, carcinogenic, mutagenic or toxic for reproduction (CMR), in accordance with Regulation (EC) No 1272/2008 ('the CLP Regulation') and Council Directive 67/548/EC ('the DSD Directive').

Substances that meet the aforementioned criteria shall not be present in the product and its associated sub-assemblies and components at concentrations greater than 0.10%. Specific concentration limits identified in Annex VI of the CLP Regulation or in sub-criterion 2(b)(ii) shall take precedence over this generic concentration limit.

The CLP hazard classifications and REACH Article 57 criteria that shall apply are listed in Table1. For the purpose of this product group the hazard classifications and Article 57 criteria are grouped based on their hazardous properties. Derogations shall be granted for individual hazard classifications or groups of hazards according to the requirements in *Appendix 1.*

Table 1. *CLP hazard classifications and REACH Article 57 criteria that apply to the product*

Group 1 hazards ***The following hazards, or combinations of hazards, identify a substance as being within group 1:*** ○ CMR Category 1A or 1B ○ PBT and vPvB substances ○ Endocrine disruptors, neurotoxins or sensitisers of equivalent concern. ○ vP or vB (REACH definitions) *in combination with* Category 1 hazards to the aquatic environment, Category 1 and 2 acute toxins or Category 1 STOT	
Carcinogenic, mutagenic or toxic for reproduction (CMR)	
CLP Category 1A and 1B	
H340 May cause genetic defects (R46)	
H350 May cause cancer (R45)	
H350i May cause cancer by inhalation (R49)	
H360F May damage fertility (R60)	
H360D May damage the unborn child (R61)	
H360FD May damage fertility. May damage the unborn child (R60, R60/61)	
H360Fd May damage fertility. Suspected of damaging the unborn child (R60/63)	
H360Df May damage the unborn child. Suspected of damaging fertility (R61/62)	

Hazardous to the aquatic environment	
CLP Category 1 and 2	
H400 Very toxic to aquatic life (R50)	
H410 Very toxic to aquatic life with long-lasting effects (R50/53)	
Acute toxicity	
CLP Category 1 and 2	
H300 Fatal if swallowed (R28)	
H310 Fatal in contact with skin (R27)	
H330 Fatal if inhaled (R23/26)	
H304 May be fatal if swallowed and enters airways (R65)	
Specific target organ toxicity (STOT)	
CLP Category 1	***CLP Category 2***
H370 Causes damage to organs (R39/23, R39/24, R39/25, R39/26, R39/27, R39/28)	H371 May cause damage to organs (R68/20, R68/21, R68/22)
H372 Causes damage to organs (R48/25, R48/24, R48/23)	H373 May cause damage to organs (R48/20, R48/21, R48/22)

Group 2 hazards

The following hazards or combinations of hazards identify a substance as being within group 2:

- Category 1 aquatic toxins
- Category 2 CMR, Category 1 and 2 acute toxins or Category 1 STOT
- P *and* B (REACH definitions)
- P *or* B (REACH definitions) *in combination with* Category 2 CMR, Category 2 and 3 hazards to the aquatic environment, Category 3 acute toxins or Category 2 STOT
- B *and* non-rapidly degradable (CLP definitions) *in combination* with Category 2 CMR, Category 3 acute toxins or Category 2 STOT

Carcinogenic, mutagenic or toxic for reproduction	
	CLP Category 2
	H341 Suspected of causing genetic defects (R68)
	H351 Suspected of causing cancer (R49)
	H361f Suspected of damaging fertility (R62)
	H361d Suspected of damaging the unborn child (R63)
	H361fd Suspected of damaging fertility. Suspected of damaging the unborn child (R62/63)
	H362 May cause harm to breast fed children (R64)
Hazardous to the aquatic environment	
CLP Category 2	***CLP Category 3 and 4***
H411 Toxic to aquatic life with long-lasting effects (R51/53)	H412 Harmful to aquatic life with long-lasting effects (R52/53)
	H413 May cause long-lasting effects to aquatic life (R53)
Acute toxicity	
	CLP Category 3
	H301 Toxic if swallowed (R25)

	H311 Toxic in contact with skin (R24)
	H331 Toxic if inhaled (R23)
	EUH070 Toxic by eye contact (R39/41)
Specific target organ toxicity (STOT)	
	CLP Category 2
	H371 May cause damage to organs (R68/20, R68/21, R68/22)
	H373 May cause damage to organs (R48/20, R48/21, R48/22)

Group 3 hazards	
Hazardous to the aquatic environment	
CLP Category 2	***CLP Category 3 and 4***
H411 Toxic to aquatic life with long-lasting effects (R51/53)	H412 Harmful to aquatic life with long-lasting effects (R52/53)
	H413 May cause long-lasting effects to aquatic life (R53)
Acute toxicity	
	CLP Category 3
	H301 Toxic if swallowed (R25)
	H311 Toxic in contact with skin (R24)
	H331 Toxic if inhaled (R23)
	EUH070 Toxic by eye contact (R39/41)
Specific target organ toxicity (STOT)	
	CLP Category 2
	H371 May cause damage to organs (R68/20, R68/21, R68/22)
	H373 May cause damage to organs (R48/20, R48/21, R48/22)

The hazard classifications in Table1 generally refer to substances. However, if information on substances cannot be obtained, the classification rules for mixtures apply. The most recent classification rules adopted by the European Union as Adaptations to Technical Progress (ATPs) shall take precedence when determining hazard classifications.

2(b)(i) The scope of restrictions that shall apply to the product

In accordance with the provision within Article 6(7) of Regulation (EC) No 66/2010 application of 2(b)(i) to the product as a whole shall be derogated and instead the scope of substance groups to which 2(b)(ii) shall apply, and the associated sub-assemblies and components for which verification shall be provided, shall be defined as those in Table 2.

The restrictions and derogations applying to the sub-assemblies and components identified in Table 2 are listed in *Appendix 1*. The sub-assemblies and components of product shall not contain the hazardous substances listed in *Appendix 1* at or above the specified concentration limits or according to the restrictions stipulated.

The restrictions contained in *Appendix 1* shall be communicated to suppliers and agents responsible for the manufacturing of the specified sub-assemblies and components. Verification and testing requirements are specified for sub-assemblies, components and production stages.

Table 2. *Substance groups to which hazard restrictions shall apply*

Substance group	**Sub-assemblies or components for which verification shall be provided**
Flame retardants	Printed Wiring Boards External cables External plastic housing of the display
Plasticisers	External cables Internal electrical wiring External plastic housing of the display
Polymer stabilisers	External cables Internal electrical wiring
Polymer colourants	External plastic housing of the display External cables
Polymer contaminants	External plastic housing of the remote control Rubber parts of the remote control External cables
Biocides	External plastic housing of the remote control Rubber parts of the remote control
Metal solder and contacts	Printed Wiring Boards Contacts between internal components
Metallic coatings	Metallic housing parts
Vapour discharge	LCD screen backlight units
Cleaning agents and degreasers	All internal components subject to treatment in the final assembly plant
Doping and luminescence	LED backlighting

Assessment and verification: *The applicant shall provide declarations of compliance with the requirements in Appendix 1. These shall be supported, where stipulated, by valid test reports and toxicological data confirming the hazard classification or the concentration of substances that are present.in the specified sub-assemblies or component parts of the product.*

Test reports, where required, shall be valid at the time of application for a production model. Applicants shall additionally identify where derogated substances are present in the product and provide supporting evidence showing how the derogation conditions have been met.

The following information shall be provided to support declarations of the hazard classification or non-classification for each substance identified as being used:

(i) The substance's CAS, EC or list number;
(ii) Harmonised CLP hazard classifications;
(iii) Self-classification entries in ECHA's REACH register.

Where a classification is recorded as 'data lacking' or 'inconclusive' according to ECHA's REACH register database, or where the substance has not yet been registered under the REACH system, toxicological data shall be provided that is sufficient to support conclusive self-classifications in accordance with Annex II of the CLP Regulation and ECHA's supporting guidance. In the above mentioned cases self-classifications shall be verified, with the following information sources being accepted:

(i) A Safety Data Sheet fully completed in accordance with Section 2,3,9,10, 11 and 12 of Annex II of the CLP Regulation;
(ii) Toxicological studies by ECHA Peer Agencies, Governmental regulatory bodies or Intergovernmental bodies;
(iii) An expert review of scientific literature and existing testing data, where necessary supported by results from new testing carried out by independent laboratories using methods approved by ECHA;
(iv) A report prepared by a toxicologist accredited to an independent hazard assessment scheme in accordance with the guidelines in Annexes I and II of ISO 17065. Schemes shall be based on the GHS or CLP hazard classification system.

Information on the hazardous properties of substances may be generated by means other than tests, for instance through the use of alternative methods such as in vitro methods, by quantitative structure activity models or by the use of grouping or read-across in accordance with Annex XI to Regulation (EC) No 1907/2006.

2(b)(ii) Substance declarations for sub-assemblies and components

Applicants shall request substance declarations for the associated sub-assemblies and components identified in Table 3. For each identified substance group the supplier, or suppliers, shall declare the CAS numbers for the substances used to fulfil the function.

***Table 3**. Substance groups for which CAS number declarations are required*

Substance group	**Sub-assemblies or components requiring declarations**
Colourants	External plastic housing of the display
Stabilisers	External cables Internal electrical wiring

***Assessment and verification:** The applicant shall compile supplier declarations listing the CAS numbers of the substances used in the specified sub-assemblies and components.*

Major proposed changes

Sub-criterion 2(a): SVHCs

- Manufacturers obtain declarations for the presence/non-presence of Candidate List substances to meet the legal obligation for notification at concentrations

>0.1% under the REACH system. This is generally obtained for the whole imported article as most electronic displays are assembled outside of the EU. However, some manufacturers additionally seek notifications for sub-assemblies and components.

- It is therefore proposed that in sub-criterion 2(a) SVHC declarations are required for the product as a whole and a defined set of 'sub-assemblies'. The additional declaration for sub-assemblies would introduce an additional level of strictness, differentiating those manufacturers who require more information from their suppliers,
- It is additionally proposed in sub-criterion 2(a) that, reflecting current practices, the process of screening the Candidate List for relevant substances is made easier for applicants by allowing use of the IEC 62474 declarable substance list.

Sub-criterion 2(b)(i): Hazard-based restrictions

- Leading manufacturers have started to identify, screen and request the substitution of hazardous flame retardants and plasticisers based on their hazard classifications. This is not yet the case for other types of hazardous substances that may be present in a display product, with manufacturers communicating to their suppliers restrictions for specified substances instead.
- It is therefore proposed that, based on the evidence gathered to date, the scope of 2(b) is defined based on the extent of leading manufacturers' activity to control hazardous substances in parts of a display. Moreover, to ensure that the approach is workable for the electronics sector, very specific restrictions shall be defined relating to substance groups and sub-assemblies where they are present.
- The evidence collected to date has been used to compile a list of hazard and substance based restrictions, together with derogations. Each restriction related to a specific sub-assembly or component. The list reflects best practice within the sector.

- Hazards have been restricted for flame retardants and plasticisers in a way that reflects substitutions of hazardous made by leading manufacturers. Safer substances have been identified and their hazard profile determined.

Sub-criterion 2(b)(ii): Substance declarations

- Some substances found within a product – for example, plastic colourants – have not yet been comprehensively addressed by even leading manufacturers. It is therefore proposed that a number of substance groups are identified for which manufacturers shall request basic information (in the form of CAS numbers). This would encourage further understanding and provide further information for the next criteria revision.
- The hazards addressed by the criterion have been grouped and combinations of additional hazards such as PBT and vPvB have been added. This approach provides the benefit of allowing a read across to the Green Screen scheme, which is now being used by leading manufacturers, and the new hazardous substance criterion to be adopted by successful electronics ecolabel TCO.

Revision of the approach to assessment and verification

- Reflecting discussions with ECHA it is proposed to revise the assessment and verification in order to better reflect the uncertainty associated with identifying hazard classifications, including gaps in data and classifications.
- In the absence of harmonised classifications or joint entry self-classifications in the REACH register, 'data lacking' or 'inconclusive' classifications could be filled using a number of verified sources, including approved testing, ECHA peer agencies (e.g. US EPA) and third party schemes (e.g. Green Screen).

3.3 Cluster 3 – Lifetime extension

The research results of Task 3 and Task 4 revealed that high attention should be paid to the extension of the lifetime of televisions and external computer displays to reduce the overall environmental impacts caused by ever shorter lifecycles and continually manufacturing of new products which increases the pressure on the environmentally and socially burdening primary extraction and to reduce the impacts caused by manufacturing processes.

In the current criteria documents, requirements affecting the lifetime of televisions and external computer displays are subsumed under different criteria titles (televisions: “lifetime extension”; external computer displays: “user repairability”).

Present criteria, Decisions 2009/300 and 2011/337
Televisions: “Lifetime extension” The manufacturer shall offer a commercial guarantee to ensure that the television will function for at least two years. This guarantee shall be valid from the date of delivery to the customer. The availability of compatible electronic replacement parts shall be guaranteed for seven years from the time that production ceases. *Assessment and verification*: The applicant shall declare the compliance of the product with these requirements.
External Computer Displays No explicit criterion on lifetime extension
Televisions No explicit criterion on user repairability
External Computer Displays: “User repairability”: The applicant shall provide clear instructions to the end-user in the form of a manual (in hard or soft copy) to enable basic repairs to be undertaken. The applicant shall also ensure that spare parts are available for at least five years from the end of production of the computer monitor. *Assessment and verification*: The applicant shall declare the product’s compliance with these requirements to the competent body together with a copy of the repair manual.

To illustrate the importance of lifetime extension for televisions and external computer displays, for the revision it is proposed to cluster the associated criteria, and complementing them by some new proposals.

3.3.1 Criterion 3.1 – Commercial guarantee

3.3.1.1 Major proposed changes (first proposal)

Proposed revised criteria (first proposal)
Commercial guarantee: The manufacturer shall offer a commercial guarantee to ensure that the television will function for at least two years. This guarantee shall be valid from the date of delivery to the customer. *Assessment and verification*: The applicant shall declare the compliance of the product with these requirements and additionally provide a copy of the guarantee document to the competent body.

- It is proposed to change the title “lifetime extension” of the criterion into “commercial guarantee” in case that there will be other sub-criteria to be subsumed under a cluster on “lifetime extension”.
- The availability of replacement parts has been shifted to the new and more elaborated sub-criterion “repairability” (see next section).
- For verification, the provision of a copy of the guarantee document has been added.

Consultation questions
• In general: does a commercial guarantee in case of products’ defects facilitate the repair, i.e. lifetime prolongation, or are the defect devices simply being exchanged by new products?

3.3.1.2 Stakeholder feedback and further evidence

According to written stakeholder feedback following the first AHWG meeting, besides an extended commercial guarantee, more criteria should be included addressing “performance quality “of the devices during their lifetime. This shall include maximum failure rates from respective life-time tests as well as avoiding a potential loss of brightness. These quality criteria are especially important for devices used very intensively like those addressed by GPP and other commercial clients.

One of the stakeholders is afraid that the proposed criterion misses the goal of the EU Ecolabel also ensuring that the products are of a good quality next to their environmental performance. There is not seen much added value of this criterion because the DIRECTIVE 1999/44/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 May 1999 on certain aspects of the sale of consumer goods and associated guarantees, gives a minimum guarantee of 2 year. With an additional

Ecolabel criterion, it is worried that we risk that consumers will buy a commercial guarantee with very limited benefits.

Instead, another approach should be considered to ensure that products have a long lifetime. For example a test on average lifetime (like is done for lamps), forbidding built-in obsolescence. The new criteria, such as proposed for the hard disk drive and the battery for desktop and notebook computers, could be more effective than a commercial guarantee.

Further research and evidence

Regarding longer product **guarantees**,

- WRAP research (HWP200-301)[45] conducted six qualitative focus groups and a nationally representative survey of 1,104 consumers of household electrical appliances in England and Wales; based on that, the study concluded that the provision of longer standard guarantees or warranties is likely to be central to maximising consumer pull for longer lifetimes. They are seen by consumers as a show of faith by the manufacturer in the lifetime of their product. However, participants in the qualitative focus groups of the study also expressed a strong preference for longer guarantees or warranties that would enable them to have the product in question replaced rather than repaired if it did break down.
- According to the WRAP "Buying Specification Guides for Durability and Repair – LCD Television"[46], manufacturer warranties are available for 3 years on some mid-cost televisions and 5 years on some high-cost models. However, warranty does not necessarily mean that products are repaired (as products can be disposed of and replaced during warranty). To encourage longer life, WRAP proposes that warranties should include parts and labour.
- The market research carried out within the revision process of the EU Ecolabel criteria[47] revealed that the existing TV being outdated or broken was a strong driver for TV replacement, but not one of the top reasons.

[45] Source: WRAP GB Report "Electrical and electronic product design: product lifetime"; January 2013; http://www.wrap.org.uk/sites/files/wrap/WRAP%20longer%20product%20lifetimes.pdf

[46] Cf. http://www.wrap.org.uk/sites/files/wrap/Buying%20spec%20-%20LCD%20TV%20AG.pdf

[47] Cf. http://susproc.jrc.ec.europa.eu/televisions/stakeholders.html, Task 2 report

The most critical driver of TV replacement in nearly all countries is a desire to trade up in size, followed by wanting to own a flat panel TV with improved picture quality. These factors, being the reason for currently decreasing lifetimes of TVs cannot be influenced by extended warranties. Further, a warranty of only two years as required in the current EU Ecolabel criteria would basically not facilitate the prolongation of the overall lifetime which is on average around seven years. On the other hand, WRAP indicates that longer warranties are only applied to higher-cost models.

Against this background, the study team decided not to retain the current TV criterion on a commercial guarantee in the revised proposal for electronic displays.

3.3.1.3 Stakeholder feedback following AHWG2 and further evidence

Discussions at the second AHWG meeting and written stakeholder feedback revealed that a Competent Body welcomed the proposal on deleting extended guarantee as main failures on displays normally lead to the TV replacement. However one stakeholder from NGO would like to follow similar approach to computer product group with extended legal guarantee as it contributes to the quality and durability of the product. The CB expressed that if guarantee is finally proposed it needs to be clear if is paid or not.

In order to align with computer product group it is proposed to include a requirement on guarantee in criterion 3.2 Repairability (see next section).

3.3.2 Criterion 3.2 – Repairability

To avoid an earlier replacement of the whole television or external computer display in case of defective single components, the repairability of products is a major factor facilitating a lifetime extension. Thus it is proposed to place one focus on the revision of this criterion.

3.3.2.1 Major proposed changes (first proposal)

Proposed revised criteria (first proposal)

Repairability:

For the purpose of undertaking repairs and replacements of worn out parts, or to upgrade older parts and components, the following criteria shall be fulfilled:

(a) Design for repair: All major repairable/replaceable components of televisions and external computer displays, if applicable, such as, screen assembly, backlight, printed circuit board, inverters and speakers shall be easily accessible and exchangeable by the use of universal tools (i.e. widely used commercially available tools).
As a minimum the following should be used: The back cover should be one piece and secured by screws to enable multiple access cycles. The backing chassis/PCBs should be removable in one assembly to access the screen components. Screw numbers should be minimised (e.g. by lugs and slots). Screw heads should be standardised with no more than three head sizes. Removable electrical connectors (e.g. clip or screw) should be used rather than soldered or crimped joints where access is required. The following should NOT be used: self-tapping screws, irreversible snap-fits or adhesives where access is required. Tamper-proofing (such as plastic covers or labels) should only be used to ensure authorised repair under warranty and should not inhibit other repairs outside of the warranty period.

(b) Repair manual: The applicant shall provide clear instructions in form of a repair manual (in hard or soft copy) to enable replacing of these key components.

(c) Availability of spare parts: The applicant shall ensure that spare parts are available for a certain time following the end of the model production.
   (i) Televisions: at least seven years;
   (ii) External computer displays: at least five years.

(d) Reasonable repair costs: The applicant shall ensure that the cost of individual spare parts is less than 20% (LCD screen assembly: less than 60%) of the cost of a new device.

(e) Repair Service / Information: Information should be included in the user instructions or the manufacturer's website to let the user know where to go to obtain professional repairs and servicing of the device, including contact details as appropriate.

Assessment and verification: The applicant shall declare the compliance of the product with these requirements to the competent body. Additionally, the applicant shall provide

- A copy of the repair manual
- A copy of the user instructions
- A list with prices of available spare parts.

- It is proposed to change the title "lifetime extension" of the criterion into "repairability" in case that there will be other sub-criteria to be subsumed under a cluster on "lifetime extension".

- The link to the end-user has been removed; today's products become increasingly complex and often the right to claim under guarantee becomes invalid, when repairs are executed by persons, who are not authorised.
- Design for repair: Detailed requirements for major components that shall be easily exchangeable have been included. The focus is set on those components that turned out to have a high failure rate. The term "easily accessible and exchangeable" has been illustrated with clear examples.
- A new criterion on reasonable repair costs has been proposed in order to avoid costs of single spare parts being more expensive than the purchase of a whole new product.

For more details cf. Task 4 report "Improvement Potential", section 4.2.3.2 "Repairability / Warranty / Service".

3.3.2.2 Stakeholder feedback and further evidence

- According to written stakeholder feedback following the first AHWG meeting, it is difficult to present precise/verifiable information for the comparison between part prices and new TV prices since retail prices vary per country and also over time. It may be more appropriate to require manufacturers to develop and disclose the ways in which they ensure that service part costs do not create a repair barrier (more flexible approach). It needs to be pointed out that it would be impossible to meet the propose criterion for all service parts, if a strict 20% price cap is applied since the prices of LCD screens as a replacement service part are usually more than 50% of the new TV prices.
- Manufacturers often provide a new TV when the LCD screens of an old TV are broken since consumers want to have a quick service. However, the old TVs with broken LCD screens are often retrieved by manufacturers for refurbishment. Since these units get a second life after successful refurbishment, often in other parts of the world. As an alternative criteria for the life-time extension could be to require manufacturers to provide such refurbishment-reuse services for eco-labelled TVs.

- Another stakeholder states that in its current wording the criterion on reasonable repair costs is not practical to implement and does not take into account total cost of repairs.
  - What is meant by “cost”? Recommended retail price? Does this include labour costs, which could be much higher than the cost of the spare parts.
  - Prices fluctuate and in general have been coming down. An equivalent new device may cost much less than the original anyway. An LCD panel for a one year old TV can cost much more than 60% of the original TV price, factor in labour and it is uneconomical to repair.
  - A business model which is in compliance with this requirement could necessitate a higher initial price to the consumer.
- One of the stakeholders prefers information about the manufacturing year on the television instead of setting a requirement on the price of spare parts (reasonable repair costs). Thus the user would have some idea when the availability of spare parts will run out.
- Another stakeholder states that for end- users the availability of professional repair options to fix day to day problems with the devices by reasonable costs is an important fact for a substantial prolongation of the use time. To stimulate such costly services, in addition to the requirements proposed in the current criteria document, a requirement to guarantee easy access to the necessary repair information, diagnostic tools and spare parts to third party reuse or repair shops or organisations is strongly supported.

Further research and evidence

A case study by WRAP (2011)[48] of three LCD television models to illustrate and encourage the durability and repair summarizes the following most common faults that cause failure and shorten the product’s lifetime:

- Screen faults – due to damage, sometimes caused by impact;
- Power circuit board faults;

[48] Cf. http://www.wrap.org.uk/sites/files/wrap/TV%20case%20study%20AG.pdf

- Main circuit board faults – including hardware and microchip software;
- Damage to connections – often between circuit boards; and
- Damage to television stands.

Assemblies such as the screen that are fragile and critical to use, are particularly susceptible to damage. Damage occurs through strains on connectors and PCBs (printed circuit boards) that are subject to flexing, causing strain on soldered joints. Electronic components and solder can also become damaged by variations in temperature and humidity for example, that exacerbates poorly soldered joints and corrupts chips.

However, other than for computer products (e.g. HDD, rechargeable battery), for electronic displays neither stakeholder feedback nor further research revealed existing quality standards for certain components which the EU Ecolabel could rely on.

3.3.2.3 Second proposal for repairability criteria

Proposed revised criteria (second proposal)
Repairability: For the purpose of undertaking repairs and replacements of worn out components or parts, the following criteria shall be fulfilled: (a) Design for repair: The following components of electronic displays, if applicable, shall be easily accessible and exchangeable by the use of universal tools (i.e. widely used commercially available tools as screwdriver, spatula, plier, or tweezers): (i) Screen assembly and LCD backlight, (ii) stands, and (iii) power and control circuit boards. *Indicatively, the following should be used: The back cover should be one piece and secured by screws to enable multiple access cycles; it should not use irreversible snap-fits. The backing chassis / PCBs should be removable in one assembly to access the screen components. Screw numbers minimised (e.g. by lugs and slots). Screw heads standardised with no more than three head sizes. Detachable electrical connectors (e.g. clip or screw) should be used rather than soldered or crimped joints where access is required. The following should not be used: self-tapping screws, irreversible snap-fits or adhesives where access is required. Tamper-proofing (such as plastic covers or labels) should only be used to ensure authorised repair under warranty and should not inhibit other repairs outside of the warranty period. Special tools include e.g. screwdrivers with special heads (e.g. torx), heat gun, thermal pad, soldering iron.* (b) Repair manual: The applicant shall provide clear disassembly and repair instructions (e.g. hard or soft copy, video) being publicly available, to enable a non-destructive disassembly of products for the purpose of replacing key components or parts for repairs. (c) Repair Service / Information: Information should be included in the user instructions or the manufacturer's website to let the user know where to go to obtain professional repairs and servicing of the electronic display, including contact details as appropriate. Service should not be limited exclusively to applicant's Authorized Service Providers.

(d) Availability of spare parts: The applicant shall ensure that original or backwardly compatible spare parts are publicly available for a certain time following the end of the model production:
    (i) Televisions: at least seven years
    (ii) External computer displays: at least five years

Assessment and verification: The applicant shall declare the compliance of the product with these requirements to the competent body. Additionally, the applicant shall provide a copy or online-version of the repair manual and the user instructions.

Major proposed changes

- The proposed criteria for reasonable repair costs have been deleted.
- The components that have to be exchangeable have been further detailed based on further research and evidence on those parts of electronic displays underlying most common faults and defects.
- The listed joining techniques and connections have been changed from being a 'minimum requirement' in the first criteria proposal to be proposed as 'indicatively'. Further research[49] revealed no verifiable proof that certain joining techniques such as adhesives are destructive to the products or components per se.
- An explicit distinction between repairs that might be undertaken by end-users and others only by professional repair services has not been made. Clarification is often provided in the product manual which repairs might be done by the consumer without affecting the manufacturers' guarantee/warranty.
- However, feedback from stakeholders proposed to support customer's choice for third party reuse or repair shops or organisations. In order to facilitate them easy access to the necessary repair information, diagnostic tools and spare parts, the criteria on spare parts and repair manual have been specified by having to be "publicly available"; the criterion on repair service includes a requirement that it must not be limited exclusively to applicant's Authorized Service Providers.

[49] For example the study 'Disassembly analysis of slates: Design for repair and recycling evaluation' by Fraunhofer IZM (2013), or iFixit (www.ifixit.com/Teardown/Asus+Zenbook+UX32VD+Teardown/10120)

- Repair manual: video demonstration of disassembly has been added as possibility.
- The criteria on availability of spare parts have been further detailed regarding the possibility of being “original or backwardly compatible”. The number of seven years for televisions and five years for computer displays, however, has not been shortened as partly being required. For electronic displays, it seems that the type of models changes every year; in order to facilitate a real lifetime *prolongation*, the availability of spare parts for 3 years (computer display) or 5 years (TV) would only address the average lifetime.

3.3.2.4 Stakeholder feedback following AHWG2 and further evidence

Discussions at the second AHWG meeting concerning repairability revealed an initial support from a manufacturer stakeholder side of the criteria and their aim to provide more information. They see an issue on making the manual publicly available. They showed a preference on providing the manual on a web interface or upon request.
Industry stakeholders stated that they have contracts with several service centres to guarantee quality.
There was concern on the difficulty of estimating the use/storage of spare parts.
A CB remarked the relevance of the availability of repair manual and availability of spare parts as key aspects for lifetime extension.
NGO requested that diagnostic tools (in addition to repair manual) are publicly available

The main points arising from written comments received after the 2nd AHWG meetings for Computers and Televisions were as follows:

- **Design for repair**

A CB expressed that the requirements on the screws and other materials are very stringent.
Importance of repairability criteria was remarked by a consumer organization stakeholder.
From a CB side it was suggested to delete the “if applicable”.
A stakeholder suggest to not restrict to screws as there other types of fasteners could also be considered to facilitate disassembly, such as temperature sensitive glues, quarter turn releasable fastener or elastomer fasteners and they provided additional evidence. They remarked that the big chunk of disassembly time (analysed to be more than 60%) is required for localization of the fasteners, easily identifiable fasteners should be used. For example, fasteners should not be hidden by labels. In addition, only one disassembly direction should be promoted to avoid the need of turning the product and facilitate the localization

Regarding the text “The back cover should be one piece and secured by screws to enable multiple access cycles”, an industry stakeholder proposes that the back cover should not be more than two pieces due to several design considerations, especially for bigger TV sizes.

Regarding the text “Screw heads standardised with no more than three head sizes.” An industry stakeholder proposes: "Screws to be removed can be disassembled with three types (sizes) of drivers.” as limiting the number of screw drivers used is more relevant than limiting the screw head sizes.

- **Repair manual**

From NGO side it is suggested to ensure the public availability of diagnostic tools.
A CB expressed that the eco-organisms responsible for Extended Producers Responsibility in France try to take into account the last development of the criteria document of the European Ecolabel. They suggest keeping the criteria on availability of spare parts and recycled content in the criteria document. It will allow giving an incentive to producers having the European Ecolabel.
An industry stakeholder stated that the manuals are already provided to service centres (also known by ‘service manuals’). To make this information widely available they proposes to provide this information on request basis (like what happens for Article 15 information under WEEE Directive, through a dedicated web interface were a request can be placed to the TV manufacturer).

- **Repair service/information**

An industry stakeholder stated that professional repairs can only be guaranteed with authorized service providers and that their service hotline will only engage authorized service providers to do repairs.
Another industry stakeholder proposed to delete "*Service should not be limited exclusively to applicant’s Authorized Service Providers*". They expressed that it

seems to be inappropriate for a manufacturer to indicate/recommend to users other repair centres since they do not have any control over their service quality (e.g., processes) and as a manufacturer they cannot ensure whether they list all available service centres existing in a country. Furthermore, authorized service centre information or service-related contact information is already included in their manuals.

- **3 (d) Availability of spare parts**

From industry side, manufacturers claimed that 7 and 5 years seem to be too high to be realistic values and they remarked that producers say that consumers tend not to repair televisions and monitors since it is not convenient for them. Furthermore, the stated that 7 years parts retention means a huge parts inventory and high cost especially if panels are included and there is a risk of producing additional waste if spare parts are not needed and have to be scrapped.

Another industry stakeholder expressed: *"It is preferable to ensure the availability of spare parts following end of the model production (not purchase date as proposed at the AHWG)"*

A CB claimed that the eco-organisms responsible for Extended Producers Responsibility in France try to take into account the last development of the criteria document of the European Ecolabel.
They defined recently the following criteria for the modulation of eco-contribution:
- Provision of a technical documentation for repairers and provision of spare parts (essential for the use of the equipment) for 5 years.
- Incorporation of post-consumer recycled materials (10%)
The CB suggested keeping the criteria on availability of spare parts and recycled content in the criteria document as it will allow giving an incentive to producers having the European Ecolabel in France.

Further research and evidence

The paper *Proof of concept of an elastomer based fastener enabling rapid disassembly*[50] refers to Active Disassembly. The author expressed that despite the availability of a number of Active Disassembly concepts which offer significant potential to make systematic product disassembly economically viable, the stage of mass industrial implementation has not yet been reached. They develop a new fastener concept based on the mechanical properties of elastomer materials in an attempt to overcome some of the barriers that impede implementation of Active Disassembly in electronic consumer products. The results of the initial tests are Promising however, further testing is needed to qualify and quantify the behavior of the fastener in more detail. Regarding that large-scale industrial implementation of such innovative fasteners has been limited up to now other aspects could be promoted as suggested by one stakeholder e.g. to not hidden fasteners by labels and. to allow only one disassembly direction."

Japanese Eco Mark criteria for Televisions Version 1.0[28] require *"Screws to be removed can be disassembled with 3 types (sizes) of drivers"* as standardizing the types of drivers to be used in manual disassembly can reduce the time of selecting/replacing the drivers.

Concerning the availability of spare parts Japanese Eco Mark criteria establishes the following criteria:

"Supply of the spare parts (parts for maintenance and repair to keep the functions/performance of a product) shall be ensured for eight years after production of the product stops.

[Certification Procedure]

Compliance with this item shall be indicated in the attached certificate. In addition, copies of a corresponding part in an instruction manual, leaflet, web site, etc. that

[50] Van den Bossche, W., Peeters, J., Devoldere, T., Duflou, J., Dewulf, W. (2014). Proof of concept of an elastomer based fastener enabling rapid disassembly. In Terje, K. (Ed.), 21st CIRP Conference on Life Cycle Engineering: Vol. 15 (2014). Conference on Life Cycle Engineering. Trondheim, 18-20 June 2014 (pp. 234-238) Elsevier

indicates the matters related to this item shall be submitted."

3.3.2.5 Revised proposal for repairability criteria

Proposed revised criteria
Repairability For the purpose of undertaking repairs and replacements of worn out components or parts, the following criteria shall be fulfilled: (a) Design for repair: The following components of electronic displays shall be easily accessible and exchangeable by the use of universal tools (i.e. widely used commercially available tools as screwdriver, spatula, plier, or tweezers): (i) Screen assembly and LCD backlight, (ii) stands, and (iii) power and control circuit boards. (b) Repair manual: The applicant shall provide clear disassembly and repair instructions (e.g. hard or soft copy, video) and make them publicly available, to enable a non-destructive disassembly of products for the purpose of replacing key components or parts for upgrades or repairs. (c) Repair Service / Information: Information should be included in the user instructions or the manufacturer's website to let the user know where to go to obtain professional repairs and servicing of the electronic display, including contact details as appropriate. During the guarantee period referred to in (e) this may be limited to the applicant's Authorized Service Providers. (d) Availability of spare parts: The applicant shall ensure that original or backwardly compatible spare parts are publicly available for a certain time following the end of the model production: (i) Televisions: at least seven years (ii) Computer monitors: at least five years. (e) Guarantee: The applicant shall provide at no additional cost a minimum of a three year guarantee during which time they shall ensure the goods are in conformity with the contract of sale. This guarantee shall include a service agreement with pick-up and return. ***Assessment and verification***: *The applicant shall declare the compliance of the product with these requirements to the competent body. Additionally, the applicant shall provide:* *(i) A copy of the guarantee or service agreement.* *(ii) A copy of the repair manual* *(iii) A copy of the user instructions*

Major proposed changes

- Indicatives examples are removed. The text will be included at the user manual as requested by stakeholders.
- The extended guarantee has been included (aligned to computer product group). It reflects the language used in Directive 99/44/EC on the sale of consumer goods and associated guarantees.
- It has also been clarified that the three year period referred to is inclusive of the minimum two year period of conformity, and that the same service shall be

provided as a commercial guarantee, including pick-up and return, at no cost to the consumer.

3.3.3 Criterion 3.3 – Upgradeability

There is a growing trend of televisions becoming so called “Smart TVs” providing users with integrated internet capabilities to check emails and social networking websites, browse the internet including app stores, or watch programmes via internet. In this context, some manufacturers offer possibilities to upgrade electronics and software of the television in use (for example “Smart Evolution Kit”[51], “Smart TV Upgrader”[52]). The additional plug-in devices shall provide regular TV owners access to Smart TV functions including premium online content, offering the latest TV features and services, building out app capabilities, or integrating more advanced game/3D functions into the panel.

With hardware enhancements, such as Central Processing Unit (CPU), memory and Graphics Processing Unit (GPU) up to the level of the latest Smart TV, users can use faster speeds for browsing the Internet and using apps while watching TV.

This kind of upgrading possibility addresses specific aspects of televisions, mainly the “smart” functionality.

For more details cf. Task 4 report “Improvement Potential”, section 4.2.3.1 “upgradeability”.

Consultation questions
• How do stakeholders expect the outlined upgrade devices to facilitate a prolonged lifetime of television products? How is the overall environmental impact of the additional modular device, initially adding material and energy consumption to the existing television, to be assessed? • Are there any other upgradeability options (e.g. certain number and kind of interfaces, upgradeable hardware components etc.) applicable to televisions and/or external computer displays?

3.3.3.1 Stakeholder feedback and further evidence

According to written stakeholder feedback following the AHWG meeting, a manufacturer provided information that hardware upgrade of its current TV models is not possible. For new functionalities, however, not necessarily a replacement of a TV-set is required. For newly introduced broadcast standards, set-top-boxes are

[51] http://www.samsung.com/us/aboutsamsung/news/newsIrRead.do?news_ctgry=irnewsrelease&news_seq=20329

[52] http://www.lg.com/de/tv/lg-ST600-upgrade-box

available in the market. “SmartTV” functionalities are often included in new BD-players or in audio equipment connected to TVs. Nowadays also the display content of a tablet or Smart Phone could be easily forwarded to TV screen.
By one of the stakeholders, the example of Samsung’s upgrade kit (Evolution Kit) for their high-end Smart TVs was provided. The consumer can fit it into a slot at the rear of the TV to upgrade the main processor, RAM, graphics processor and perhaps other components. A new style remote control is also provided. TVs with this upgradeability can be updated to the current models functionality. However, apart from the general possibility to upgrade TVs, there is no further information provided on the level of interest there has been for this kit or the level of Samsung’s commitment to the future development of this product.

3.3.3.2 Proposal for upgradeability criteria

Differently from computers products, where relevant hardware components as HDD, SSD, memory or rechargeable batteries can be upgraded for prolonging the product’s overall lifetime, for televisions and external computer displays this option has not proven to be possible so far. A so called upgrade kit enabling software and hardware upgrades for ensuring compatibility with future ultra-high definition (UHD) standards is only provided by one manufacturer so far and not common on the market. Firmware updates, on the other hand, are common for so called Smart TVs mostly adding a variety of features to the television. They can be carried out either by USB portable memory or via internet.
Further, the most critical driver of TV replacement in nearly all countries is a desire to trade up in size, followed by wanting to own a flat panel TV with improved picture quality according to the market analysis carried out within the Ecolabel criteria revision process[53]. As these factors, being the reason for currently decreasing lifetimes of TVs, cannot be influenced by single product’s upgrades of hardware components, the study team decided not to include a new criterion on upgradeability to the product group televisions / displays at all.

[53] Cf. http://susproc.jrc.ec.europa.eu/televisions/stakeholders.html, Task 2 report

3.3.3.3 Stakeholder feedback following AHWG2 and further evidence

No comments have been received with regard to upgreadibility criterion. There is no further information provided on the level of interest there has been for upgreadibility kit and having into account that the most critical driver of TV replacement is a desire to trade up in size the study team decided not to include a new criterion on upgradeability to the product group televisions / displays at all.

3.4 Cluster 4 – End-of-life management: Design and material selection

Similar to the cluster lifetime extension, the research results of Task 3 and Task 4 also revealed that high attention should be paid to the end-of-life (EoL) management of televisions and external computer monitors to reduce the overall environmental impacts since secondary resources from recycling can substitute primary production. In the current criteria documents, requirements affecting the EoL-management are spread across different discontinuous criteria. To illustrate the importance of EoL for televisions and external computer displays, for the revision it is proposed to cluster and rearrange the associated criteria, complementing them by some new proposals.

Present criteria, only Decision 2011/337
"Recycled content": The external plastic case of the monitor shall have a post-consumer recycled content of not less than 10% by mass. *Assessment and verification*: The applicant shall provide the competent body with a declaration stating the percentage post-consumer recycled content.

Present criteria, Decisions 2009/300 and 2011/337
"Design for disassembly": The manufacturer shall demonstrate that the [television/monitor] can be easily dismantled by professionally trained personnel/recyclers using the tools usually available to them, for the purpose of undertaking repairs and replacements of worn out parts, upgrading older or obsolete parts, and separating parts and materials, ultimately for recycling [or reuse]. To facilitate dismantling: (a) Fixtures within the [television/computer monitor] shall allow for its disassembly, e.g. screws, snap-fixes, especially for parts containing hazardous substances; (b) [Only computer criteria:] Circuit boards, and/or other precious metal-containing components, shall be easily removable using manual separation methods both from the product as a whole and from specific components (such as drives) that contain such boards to enhance recovery of high value material; (c) [Only computer criteria:] All plastic materials in covers/housing shall have no surface coatings incompatible with recycling or reuse; (d) Plastic parts shall be of one polymer or be of compatible polymers for recycling and have the relevant ISO 11469 marking if greater than 25 g in mass; (e) Metal inlays that cannot be separated shall not be used; (f) Data on the nature and amount of hazardous substances in the [television / computer monitor] shall be gathered in accordance with Council Directive 2006/121/EC and the Globally Harmonised System of Classification and Labelling of Chemicals (GHS). *Assessment and verification*: A test report shall be submitted with the application detailing the dismantling of the [television/computer monitor]. It shall include an exploded diagram of the [television/computer monitor] labelling the main components as well as identifying any hazardous substances in components. It can be in written or audio-visual format. Information regarding hazardous substances shall be provided to the competent body in the form of a list of materials identifying material type, quantity used and location.

3.4.1 Criterion 4.1 – Material selection and material information

3.4.1.1 Major proposed changes (first proposal)

Proposed revised criteria (first proposal)
"Material selection and information" (a) Variety of plastics: Plastic parts shall be of one polymer or be of compatible polymers for recycling if greater than 25 g in mass. (b) Surface coating: All plastic materials used for covers/housing shall have no surface coatings / metal inlays incompatible with recycling or reuse unless such coating is technically required. (c) Content of recyclates: The cover/housing incl. stand of the television or external computer display shall have a content of post-consumer recyclates material of not less than 10% by mass[54]. (d) Material information facilitating recycling: (i) Plastic parts with a mass greater than 25 grams shall be marked in accordance with ISO 11469 and ISO 1043, sections 1-4. For plastic parts > 200 grams, the marking should be enough large and located in a visible position in order to be easy to be identified by workers of specialized recycling firms. (ii) Data on the nature and amount of hazardous substances in the computer shall be gathered and provided in accordance with Council Directive 2006/121/EC and the Globally Harmonised System of Classification and Labelling of Chemicals (GHS). *Assessment and verification*: The applicant shall declare compliance of the product with these requirements to the competent body. The applicant shall provide the competent body with an exploded diagram of the television or external computer display in written or audio-visual format, labelling the main components, especially plastic parts greater than 25 grams in mass, as well as identifying any hazardous substances in components. The information shall include documentation to prove the conformity to the above mentioned ISO standards and additional specifications of the marking (dimension and position). Information regarding hazardous substances shall be provided to the competent body in the form of a list of materials identifying material type, quantity used and location. The applicant shall provide the competent body with a declaration stating the percentage post-consumer recycled content. In case of surface coating / metal inlays, the applicant shall provide the competent body with a declaration proving the technical demand.

- The different sub-requirements under the current criteria 'recycled content' and 'design for disassembly' have been rearranged and renamed to the following criteria 'material selection and material information' and 'design for recycling'.
- The criterion 'content of recyclates' has been proposed to be valid also to TVs.
- The criterion 'Material information facilitating recycling' has been specified regarding marking requirements.
- The assessment and verification requirements have been specified according to the new criteria structure.

[54] This refers to cover/housing and stand together, not each of them.

For more details cf. Task 4 report “Improvement Potential”, section 4.2.4.2 “End-of-life management of computer products”.

3.4.1.2 Stakeholder feedback and further evidence

According to written stakeholder feedback following the AHWG meeting, the compliance with harmonized standards is a benchmark to fulfil the essential requirements of the European Low Voltage Directive. For TV-sets, the harmonized safety standard is the EN 60065 Ed7 including the Amendment 11. EN 60065/A11 requires that TV-sets do comply with the external ignition (candle flame) requirements through passing the necessary tests as per TS 62441. According to TS 62441, the candle flame accessible area of TV housing is considered to comply, if it meets the requirements of either:

a) The total mass of the combustible materials located at the outer surface does not exceed 300 g.
b) The combustible material used in candle flame accessible areas is made of V-1 class material.
c) The combustible materials used in candle flame accessible areas do not exhibit flaming for more than 3 min.

This means that for TV plastic housings, compliance is generally achieved by using flame retardants.

Consideration of the environmental effects from the (pre-) production stage and possible barriers for high level recycling is crucial for any requirements for material selection, in line with the aim of the roadmap for a resource efficient Europe. Meaningful criteria are needed to address these issues. In this respect, one of the stakeholders explicitly welcomes the proposals included in the current criteria draft, but the need to strengthen the criteria for the following elements is seen:

- Variety of plastics:
  - Like in the proposal for computers the variety of polymer types in the housing of TVs/monitors should be clearly limited. Beyond such a reduction of polymer types as well a limitation of functional additives is a key prerequisite for any closed loop recycling attempt.

- Feedback by another stakeholder indicates that in principle the criterion could be supported, but it should be noted that different methodologies may be used to determine whether certain polymers are compatible or not. It needs to be researched what methodology provides a scientific and realistic compatibility analysis table for this criterion.

- Surface coating/metal inlays:
  - One of the stakeholders can fully support the metal inlay related restriction, but the scope of surface coating (including also thin film coating? paint? spray?) needs to be better clarified since not all surface coating is incompatible with recycling or reuse.
  - Another stakeholder asks that the opening clauses “incompatible with recycling” and “technically requirements” should be skipped. The first one is not meaningful with respect to the variety of current recycling processes and the second is too imprecise.
- Content of recyclates:
  - One of the manufacturers – while seeing the value of promoting the use of post-consumer recycled material in eco-labelled products – is afraid that the proposed target is too ambitious, especially if it concerns post-consumer recycled plastics. Over the years, they have researched the feasibility of using post-consumer plastics for TVs, but so far they have not managed to apply post-consumer recycled plastics to their products mainly due to the concerns over material reliability and increased economic cost. If the EU Commission should incorporate the use of post-consumer recycled plastic in the eco-label criteria, the targets should be adjusted significantly so that it becomes feasible for manufacturers to start commercial experiments at a smaller scale, focusing on parts that are relatively less critical in terms of material reliability. An alternative could be targeting other materials (metals, paper/cardboard).
  - From an environmental perspective, another stakeholder asks for a much higher recycled content than the current 10% being stimulated. This is

feasible under the current market conditions as the results from independent assessment schemes like the TCO Certified Edge Label shows asking for > 65% post-consumer-recyclate. In 2012 more than 20 screens where labelled by TCO. Another example being provided: “In 2009, Lenovo worked with a Lenovo recycled plastic supplier to develop and qualify a new HB-ABS recycled material with 65% PCC plus 20% PIC for use in producing decorative monitor parts.” (Source: A Lenovo Environmental Success Story “Using Recycled Content Plastics”)[55]. The stakeholder welcomes any proposal allowing real front running companies to communicate in a meaningful way real recycling solutions (e.g. recycled content > 80%).

- Another stakeholder would be in favour of this criterion, maybe lowering it to 5% being an improvement as the present criterion might be a problem for the license holders. It is proposed to involve the recycling sector in the discussion if the focus should be shifted to the recycling of metals, because it is understood that the recycling rate of metals is already very high (for example printed circuit boards can be taken out before shredding).
- Public Waste Agency of Flanders (OVAM) confirmed that recyclates are available on the market.
- Regarding the verification of recycled content a certification scheme QA-CER started in Belgium. The certification distinguishes 3 levels of certification.
- Recyclates could also be screened for the presence of certain hazardous substances.

- Material information: one of the stakeholders proposes that additionally the inclusion of critical raw materials in the components of the products shall be identified with type an amount of such materials in respective documentations (recycling pass) in order to support more target recalling activities in future.

[55] http://www.lenovo.com/social_responsibility/us/en/GreenPaper_Recycled_Content.pdf

Further research and evidence

- The study 'Disassembly analysis of slates: Design for repair and recycling evaluation' by Fraunhofer IZM (2013) [56] indicates on the basis of an interview with a recycler that plastics are separated in white (including light grey) plastics which are of significantly higher recycling value, and black plastics. Metal foils attached to plastic parts reduce the value of the plastics fraction, and might be given to an additional shredding process for separation. Coating and plastics parts attached to bulk plastics parts reduce the value of the plastics fractions PC/ABS, white mixed plastics and black mixed plastics from the perspective of the dismantler. Meaning that mono material plastic housing parts without coatings, inserted metal windings, metal shields attached are better to recycle than composite materials.
- On the other hand, according to Köhnlechner (2014)[57], plastic sorting technologies can increasingly cope with black coloured plastics. Amongst others, sorting based on density separation as well as electrostatic properties of different polymer types can achieve high quality output for ABS and HIPS[58] – independent from the plastic colour.
- In 2013, EFRA finalised a pilot project [59] on the recycling of plastics containing flame retardants (FR) from Liquid Crystal Display (LCD) TVs. Some of the main reasons for the low plastics recycle rate in Europe identified were the lack of information on the polymer type, the FR applied and the huge variety of different plastics types used in E&EE among others.
- Concerns were raised at the first AHWG about the verification of recycled content.

[56] Cf. http://www.izm.fraunhofer.de/content/dam/izm/de/documents/News-Events/News/2013/urn_nbn_de_0011-n-255111-18-1.pdf

[57] Source: Köhnlechner, R.: Erzeugung sauberer PS- und ABS-Fraktionen aus gemischtem Elektronikschrott. In: Thome-Kozmiensky, K.T.; Goldmann, D.: Recycling und Rohstoffe, Volume 7. Munich, 2014.

[58] HIPS: High Impact Polystyrene; ABS: Acrylnitril-Butadien-Styrol

[59] EFRA 2013. Recycling of Plastics from LCD Television Sets.Pilot project on mechanical plastics recycling from post-consumer flat panel display-LCDs.

An example of a traceability system was provided by the Belgian Competent Body. The QA-CER system is a third party verified quality management system developed by a Belgian certification body and the Flemish Plastics Centre[60]. The system is based on ISO 9001, as well the EN standards EN 15347 relating to the characterisation of waste polymers[61] and EN 15343 relating to the traceability of waste polymers[62]. The standard EN 15343 is of particular interest as an underlying reference for QA-CER as it described a system for tracing polymer waste flows recognising that a system for analytical testing to verify recycled content does not exist.

- Research by Peeters et al.[63] has highlighted the importance of considering the flame retardants incorporated into plastic components, particularly casings and enclosures, as these are added to the polymer to provide fire protection. The study looked at PC/ABS, which is understood to be commonly used in electronic displays housings and enclosures. Problems with the stability of the polycarbonate component arise because of the need to use water-based density separation techniques for shredded black plastics. In the scenario examined an 82% pure PC/ABS could be obtained post shredding, density and optical separation. However, in reality the plastic recovered is required to achieve a V1 fire rating and a so-called 'yellow card' for the recyclate certifying its fire rating. The result is a recommended upper limit of recycled content of 10%.

[60] QA-CER, *QA-CER certification of the quality management system for recycling and production companies*, Version 1, January 2013

[61] CEN, *Recycled plastics – characterisation of plastics wastes*, EN 15347, December 2007.

[62] CEN, *Plastics recycling traceability and assessment of conformity and recycled content*, EN 15343, December 2007.

[63] Peeters.J.R, Vanegas.P, Tange.L, Van Houwelingen.J and J.R.Duflou, *Closed loop recycling of plastics containing Flame Retardants*, Journal of Resources, Conservation and Recycling, 84 (2014) p-35-43

3.4.1.3 Second proposal for material selection criteria

Proposed revised criteria (second proposal)

"Material selection and information to improve recyclability"

(a) Variety of plastics:

(i) Plastic parts with a mass greater than 25 grams may consist of a single polymer or a polymer blend compatible for the recycling. The compatibility for recycling shall be verified.

(ii) Overall in the product there shall be a maximum of 4 types of plastic used of plastic parts with a mass greater than 25 grams.

(iii) Plastic used for housings and enclosures shall consist of a maximum of two polymers in a form that is compatible with recycling. The compatibility for recycling shall be verified.

(b) Surface coating / metal inlays: All plastic materials used for housings and enclosures shall have no surface coatings or metal inlays.

(c) Material information to facilitate recycling: Plastic parts with a mass greater than 25 grams shall be marked in accordance with ISO 11469 and ISO 1043, sections 1-4. For plastic parts greater than 25 grams the CAS number of flame retardants shall additionally be marked "FR(ISO 1043-4 code) - CAS No". For plastic parts > 200 grams, the marking should be large enough and located in a visible position in order to be easily identified by workers of specialised recycling firms.

Exemptions are made in the following cases:

(i) Where the marking would impact on performance or functionality of the plastic part, including light guides

(ii) Where parts cannot be marked because there is not enough available appropriate surface area for the marking to be of a legible size to be identified by a recycling operator;

(iii) Where marking is technically not possible due to the moulding method; or

(iv) Where the addition or location of marking causes unacceptable defect rates under quality inspection, leading to unnecessary wastage of materials

(d) Recycled content: Plastic parts of the housings and enclosures as well as of structural elements with a mass > 25 grams shall have a total content of post-consumer recyclates material of not less than 10% by mass. Where the post-consumer recyclates content is higher than 25% a declaration may be made in Box 2 of the Ecolabel (see Criterion 7.2). Recycled content shall be demonstrated according to the requirements of ISO 15343. Recyclates may contain flame retardants that are specifically derogated in Criterion 2(c).

Printed circuit boards as well as transparent plastics that form part of display units are exempted from this requirement.

(e) Recyclability of plastic containing flame retardants: The potential for closed loop recycling in a new electronic product of plastic required to meet fire protection standards shall be greater than 25%.

(f) Recyclability of metal housings and enclosures: The recyclability of metals and alloys used for casings shall be verified.

Assessment and verification:

- The applicant shall declare compliance of the product with these requirements to the Competent Body.
- The applicant shall provide the Competent Body with an exploded diagram of the electronic display in written or audio-visual format, identifying the plastic parts greater than 25 grams in mass, their polymer composition and compatibility for the recycling, as well as associated markings and identifications of flame retardants.

- The information shall include documentation to prove the conformity to the above mentioned ISO standards, specifications of the marking (dimension and position) and, where applicable exemptions. A technical justification shall be provided where an exemption applies.
- The applicant shall provide the Competent Body with documentation verifying traceability for the post-consumer recycled content according to the above mentioned ISO standard.
- The recyclability of the housing and enclosures shall be verified by a declaration from a permitted treatment operation in accordance with Article 23 of Directive 2008/98/EC (the WEEE Directive) that there is an end-market for the materials.

Major proposed changes

- The heading has been changed from “Material selection and information” to “Material selection and information to improve recyclability”.
- **Variety of plastics**: The requirement has been strengthened limiting at a maximum of 4 types of plastic used of plastic parts with a mass greater than 25 grams in the overall product.
- **Surface coating / metal inlays:** The requirement has been tightened and there are no exemptions considered for the use of coatings and/or metal inlays.
- **Recycled content**: The requirement is not limited to external plastics any more but now applies to all plastic parts and structural elements > 25 grams. The threshold of 10 % remains unchanged because there are still practical problems faced by even front runner manufacturers in consistently meeting a higher requirement. Instead it is proposed that, following the example of cotton content claims in the textile product group, where a higher content can be demonstrated that there is an option to display this in Box 2 next to the Ecolabel. This would provide a benefit to manufacturers wishing to work towards a high recycled content, without placing an overall burden which could reduce the selectivity of the Ecolabel.
- **Verification of recycled content:** Concerns were raised at the first AHWG about the verification of recycled content. Given the existence of EN 15343 which provides a system for tracing the original and flows of waste polymers it is proposed that this is introduced as a third party verification required for recycled polymer content. It is to be discussed further with manufacturers whether the information currently collected to verify recycled content claims is sufficient to enable verification according to EN 15343.

- **Material information facilitating recycling**: Although some stakeholder comments claimed that plastic marking has little influence on recycling practices, other stakeholders reported that recyclers do use this information for their sorting activities. As the marking is widely established in practice, it is suggested to retain this requirement. In the new proposal, exemptions are made for cases where technical limitations result in marking not being feasible. A technical justification shall be provided where an exemption applies. In addition it is proposed that the CAS number of any flame retardant incorporated into the plastic is marked according to the suggested notation.
- **Recyclability of plastic containing flame retardants:** There is the potential for a contradiction between the incentive within the criteria to increase the recycled content of plastics and a predicted future increase in the WEEE derived recyclate on the market containing flame retardants. Depending on the final ambition level of the hazardous substance Criterion 2 (c) this may restrict the use of certain recyclate. However, if a flame retardant is restricted in the Ecolabel because of concerns relating to, for example, incineration in end of life phase then it would seem beneficial to permit continued functional use within recyclate. It is therefore proposed that, subject to the FR not being restricted under REACH, identified as an SVHC on the ECHA Candidate List or restricted under EU End of Waste criteria, they shall be permitted within recyclate.
- **Metal used for enclosures:** It is understood that the certain alloys and associated coatings which may be used instead of plastic for enclosures may present recycling problems. It is proposed that the applicant verify the recyclability of their material choice. Further information is required in this area.

3.4.1.4 Stakeholder feedback following AHWG2 and further evidence

The main points arising from the 2nd AHWG meetings for Televisions were as follows:

- With regard to the criteria on material selection and information clarification on the criteria was requested. The references to polymer blend and to 4 types of plastic seem to be incompatible. Housings and enclosures and structural elements are all very vague definitions.

- Other issue raised by industry was the verification of compatibility for recycling. Benefit on limiting to 4 types of plastic and the use of CAS number was questioned.

- Industry stakeholder's view on percentage of recycled material was diverse. One sees the value easy to achieve while other sees the limit as very ambitious.

- Several stakeholders expressed recycled content should be referred to as on average. It does not need to be product specific. This is the standard procedure already with organic cotton.

- Industry stakeholders asked for exemptions on surface coating and express their willingness to provide more data. They also see an issue on CAS confidentiality. They proposed that "light guides" be replaced with "plastic optical components".

- JRC IES mentioned the availability of studies proving that some plastics can be recycled together without problems whereas the use of pigments and additives can generally hamper the recycling of certain plastics and blends. JRC-IES proposes to use the results from these studies to provide scientific evidence about the pros and cons of this measure.

- Regarding material selection, NGOs supported the proposed limitation of the number of plastics and requested that it is added compatibility for recycling shall avoid downcycling.

- NGOs supported marking of plastics, including CAS number of FRs.

The main points arising from written comments received after the 2nd AHWG meetings for Televisions were as follows:

- **Material selection and information to improve recyclability - (a) Variety of plastics/ compatibility for recycling.**

An industry manufacturer proposed to delete points (i) and (iii) since it is not clear what is the objective method for plastic compatibility verification. They pointed the existence of a 'Polymers compatibility guide' in ECMA 341 standards however they said it is controversial.
They also proposed to delete point (ii) because if compatible or separable plastics are used in products, the number of plastic types is not a significant issue for recycling. As an alternative, they suggested to consider the Japanese Eco Mark criteria for Televisions Version 1.0 that says: *"Subassemblies made of mutually incompatible materials are separable, or connected by separation aids."* And if plastics are not separable, the compatibility for recycling can be verified.

ACB stakeholder asked: *"How will it be decided when polymers are compatible? Based on the recycling installations in each country? Shall a list of compatible polymers be provided to the CB's? Will there be a list of problematic flame retardants, additives, thermal properties?"* They claimed that they asked feedback from the recyclers but they are not sure if they will provide a more practical interpretation of "compatible for recycling".

From NGO side they expressed that compatibility for recycling shall be ensured to avoid down cycling.

The number of plastics is not seen as important as it easy separation by one stakeholder.

Clarification is requested for following terms: *plastic parts, types of plastics, housings and enclosures and structural elements.*

A stakeholder expressed that establishing a procedure to assess compatibility of plastic mixes for recycling is still a research challenge. They said that the feasibility of increasing the compatibility of the applied materials for recycling, as well as the feasibility to only apply non-compatible materials for recycling with distinct physical properties, which will facilitate their separation, should be considered. For example, replacing stainless steel inserts in aluminum components by aluminum inserts or by applying steel inserts, which can be separated with high efficiency by a magnetic separator from the aluminium

- **Material selection and information to improve recyclability - (b) surface coating/metal inlays**

An industry stakeholder proposed the following changes *"All plastic materials>25g used for housing and enclosures shall have no surface coatings that are not compatible with reuse and recycling or metal inlays"* and as verification method they proposed the following based on EPEAT's conformity assessments protocol 1680.3: 4.3 *Design for end of life: Compatibility of surface coatings with reuse and recycling for each plastic part >25g shall be demonstrated through*:

1) Evaluation by the manufacturer that these materials individually or combined do not alter the original functional and/or physical properties per design drawing specifications. Compatibility of adhesives, coatings, paints, finishes, or

pigments associated with surface coatings with recycling shall be demonstrated through:

i) Test results showing that these materials individually or combined do not significantly impact the physical/mechanical properties of the recycled plastic; or

ii) Peer reviewed published literature concluding that these materials individually or combined do not significantly impact the physical/mechanical properties of the recycled plastic; or

iii) A statement from at least one recycler who meets this standard's criterion for recyclers in 4.6.2.1 and is experienced in processing products with similar design technology, confirming these materials individually or combined do not significantly impact the physical/mechanical properties of the recycled plastic.

References and details: "Significant impact" is defined as no more than a 25% reduction in the notched Izod impact at room temperature, as measured using ASTM D256, ISO 180, or ISO 179.

- **Material selection and information to improve recyclability - (c) Material information to facilitate recycling**

An industry manufacturer claimed that regarding ISO 1043 section 2 and 3, TV manufacturers may not have the information at their disposal on fillers and plasticizers due to contractual restriction with plastic suppliers. They referred to the DE position paper on non energy requirements for TVs. In addition, they stated that they can't support marking CAS number of flame retardants since this information is commonly confidential (e.g, in past EU Ecolabel applications from industry, it was necessary a NDA between Competent Body and resin supplier).

A CB stakeholder stated that after having discussions with recyclers they are in favour of this criterion. They stated that it is very important that the marking is clear and in a visible place. Secondly one recycler suggested marking in more than 1 place and if a part could be separated into pieces that each piece should be marked. They

confirmed that it is not useless for them. Marking is for them easy to find and fast information and a sign of confidence.

Another stakeholder claimed that FR-code according to ISO-1043-4 is enough to classify a FR. They said that if the CAS-No of FR has to be added flexibility to choose a better FR of same kind is lost as the mould cannot be changed easily.

A stakeholder claimed that producers specify the basic type of FR e.g. FR(40) and the basic flammability requirement e.g. V0 and give the supplier flexibility and that often suppliers reject to disclose detailed FR information.

A stakeholder expressed that establishing a procedure to assess compatibility of plastic mixes for recycling is still a research challenge. They said that in principle, plastics fractions with high purity are needed to get high quality recyclates and efforts to improve identification and separation such as labelling will improve recycling rates. An issue in this regard is mismarking of plastic components, it is estimated that around 20 % of mould indications are wrong.

A scientific researcher stakeholder claimed that sorting FR plastics after a shredder-based treatment has been demonstrated to be inefficient and still requires multiple technical challenges to be tackles. On the other hand, identification after manual disassembly can be facilitated by explicitly labelling the type of FR utilized e.g. BR, P or by labelling large plastic components with the appropriate ISO code.

- **Material selection and information to improve recyclability - (d) Recycled content**

An industry stakeholder doesn't support point d) for Televisions. They said that for the current criteria revision this requirement should only be applicable computer monitors, allowing more time to research for available/suitable alternatives to be used in Televisions.

They said that monitors can potentially comply with this criterion since they are normally smaller than televisions and do not need to contain flame retardants in accordance with EN60065. They said that quality of molding injection using PCR for monitors (resin (ABS) without flame retardant) is better than when using a resin with flame retardant (PC+ABS+flame retardant).

As a stakeholder previously mentioned the eco-organisms responsible for Extended Producers Responsibility in France try to take into account the last development of the criteria document of the European Ecolabel.
They defined recently the following criteria for the modulation of eco-contribution:

- Provision of a technical documentation for repairers and provision of spare parts (essential for the use of the equipment) for 5 years.
- Incorporation of post-consumer recycled materials (10%)

And they suggested keeping the criteria on availability of spare parts and recycled content in the criteria document. It will allow giving an incentive to producers having the European Ecolabel.

An industry stakeholder claimed that 10% of recycled plastics on each product is too high and it could be calculated on the average of the total plastics used for the Ecolabelled productions.

A scientific researcher stakeholder claimed that within their research they have proofed that for housing plastics it is possible to obtain 100 % post-consumer plastics recyclates with a quality that is comparable to virgin material. However, currently obtaining large volumes of recyclates is a challenge, so they supported to establish 10% as a lower bound. Furthermore, they advised setting out clear targets to increase the required recycling content to stimulate investments in recycling facilities. For example, 10% in 2015 and 20% in 2020.
Clarification was requested regarding if the 10% recycled content is for all parts (above 25 g) or for the sum of plastic, or the total weight of the product.

- **Material selection and information to improve recyclability - (e) Recyclability of plastics containing FRs**

A stakeholder requested clarification on the aim and wording of closed loop recyclability rate of plastic containing flame retardants.

A stakeholder raised concern on how will the recyclability be verified. They also expressed that the presence of certain chemicals also has an influence on the transportation restrictions of the recycled products.

- **Material selection and information to improve recyclability - (f) Recyclability of metal housings and enclosures**

A stakeholder expressed that the verification requirement appears to contain an incorrect reference to the WEE Directive (i.e. 2008/98/EC is the Waste Framework Directive). Furthermore, Article 23 of the WEEE directive 2012/19/EC is concerned with "Inspection and Monitoring". While WEEE directive 2002/96/EC contains only 18 articles and Article 23 of the WFD directive is concerned with the "Issue of Permits". Clarification is required and further comments may then be forthcoming.

Further research and evidence

The recyclability of plastics

The sub-criterion in 4(a) were re-reviewed against the underlying criterion of successful US ecolabel EPEAT - the IEEE 1680.1 standard for the environmental assessment of computer products [64]. The IEEE 1680.1 criterion of relevance include:

- A requirement relating to the avoidance of paints of coatings that are incompatible with recycling;
- An option criterion that plastic enclosures shall not contain molded-in or glue-on metal unless the metal inserts can be easily removed;

[64] IEEE Computer Society, *Standard for Environmental Assessment of personal computer products*, IEEE Std 1680.1-2009, 5th March 2010.

- Only one plastic material shall be used in each plastic enclosure part greater than 100g.

Whilst the relevance of the first two points has already been highlighted by research and feedback on design for recycling, the definition of what constitutes compatibility with recycling has previously raised concerns with stakeholders. 'Compatible' is defined as being when:
'Paints and coatings on plastic parts are proven to be compatible with recycling processes if they do not significantly impact the physical/mechanical properties of the recycled resin. Significant impact is defined as >25g reduction in notched Izod impact at room temperature as measured using ASTM D256-05.'

Alternatively the term 'recyclable' is also used in relation to materials and components and is defined as:
'Materials or components that can be removed or recovered from the whole product or package and put back into productive use as a material, not including energy recovery, using standard technologies, or as otherwise demonstrated.'

Easily removed is not specifically defined but the verification options include listing of commonly available tools that can be used to remove a metal insert and a statement from a recycling company with electronics recycling expertise confirming that product design meets the requirements.

JRC-IES is developping a report [JRC- IES (2014 draft)][65] on material efficiency for product policy support focused on computers and television product groups. With regard to recyclability of plastics parts, they mentioned that the scientific literature largely discussed the relevance of considering the recyclability of plastic parts in WEEE. They highlighted Peeters et al. (2014)[63] where the authors discussed the

[65] JRC - IES (2014 draft). Analysis of material efficiency for EU Ecolabel criteria: the example of two product groups. Environmental Footprint and Material efficiency support for product policy (Not published yet)

compatibility for the recycling of different mixtures of plastics in television (including flame retardants and different enclosures). According to these authors, plastics fractions with high purity are needed to get high quality recyclates, so efforts to improve identification and separation such as labelling will improve recycling rates. The report remarked that compatibility for recycling should be also extended to other materials assembled/attached to plastic parts. The use of materials with distinct physical properties could facilitate their separation. For example replacing stainless steel inserts in aluminium components by aluminium inserts or by steel inserts (separable by high efficiency magnetic separators) could improve their recyclability.

The ENFIRO project highlighted the importance of retaining the functional value of FR's by increasing recycling.

A further issue highlighted by the US EPA's study of flame retardants in Printed Circuit Boards [66] relates to aluminium oxide arising from aluminium FR additives. Their high loading in PCB materials together with insolubility in furnace slag means that if they arose in larger quantities in waste PCBs smelters would need to use more energy. The potential for this trade-off to occur was confirmed from discussions with an FR specialist involved with the ENFIRO project.

3.4.1.5 Revised proposal for material selection and information criteria

Proposed revised criteria
Material selection and information to improve recyclability (a) Recyclability of plastics: (i) Parts with a weight greater than 25 grams shall consist of a single polymer or a polymer blend or alloy that are recyclable; (ii) Parts with a weight greater than 25 grams shall not be painted or coated in such a form that it means they are not recyclable; (iii) Casings, enclosures and bezels shall not contain molded-in or glued on metal unless they are

[66] Chem Sec, *Leading Electronics companies and Environmental organisations urge EU to restrict more hazardous substances in electronic products in 2015 to avoid more global dioxin formation*, 19th May 2010, http://www.chemsec.org/images/stories/publications/ChemSec_publications/RoHS_restrictions_Company__NGO_alliance.pdf

easy to remove with commonly available tools;

(iv) Casings, enclosures and bezels incorporating flame retardants shall be recyclable.

(v) Printed Wiring Boards greater than 10 cm2 shall not contain aluminium based flame retardants or additives.

(b) Material information to facilitate recycling: Plastic parts with a mass greater than 25 grams shall be marked in accordance with ISO 11469 and ISO 1043, sections 1-4. Plastic parts incorporating flame retardants may additionally be marked with the CAS number. For plastic parts > 100 grams, the markings should be large enough and located in a visible position in order to be easily identified.

Exemptions are made in the following cases:

(i) Where the marking would impact on performance or functionality of the plastic part including optical plastics;

(ii) Where parts cannot be marked because there is not enough available appropriate surface area for the marking to be of a legible size to be identified by a recycling operator;

(iii) Where marking is technically not possible due to the moulding method; or

(iv) Where the addition or location of marking causes unacceptable defect rates under quality inspection, leading to unnecessary wastage of materials

(c) Recycled content: The product shall contain on average a minimum 10% post-consumer recycled plastic, measured as a percentage of total plastic (by weight) in the product excluding Printed Wiring Boards. Where the recycled content is greater than 25% a declaration may be made in the text box accompanying the Ecolabel (see Criterion 7(a)). *Products with a metal casing are exempt from this sub-criterion.*

***Assessment and verification**:*

The applicant shall provide the Competent Body with an exploded diagram of the electronic display in written or audio-visual format. This shall identify the plastic parts greater than 25 grams by their weight, their polymer composition, and their ISO 11469 and 1043 markings. The dimensions and positions of the marking shall be illustrated and, where exemptions apply, technical justifications provided.

The applicant shall verify recyclability by providing evidence that the plastics either individually or combined do not impact the technical properties of the resulting recycled plastics in such a way that they cannot be used again in electronic products. This could include:

- *A declaration from an experienced plastics recycler or permitted treatment operation in accordance with Article 23 of Directive 2008/98/EC ('the Waste Framework Directive');*
- *Test results from an independent laboratory or an experienced plastics recycler;*
- *Peer and industry reviewed technical literature applicable to Europe.*

The applicant shall provide third party verification and traceability for post-consumer recycled content.

Major proposed changes

- It is proposed to reflect EPEAT criterion that address the compatibility for recycling of plastics with coatings/paints and the ease of removal of molded-in or glued-on metal inserts.

- The recyclability of casings, enclosures and bezels that incorporate flame retardants shall be verified and, furthermore, the use of aluminium-based FR's with a high loading in PCB base materials shall not be permitted because they require more energy to smelt in the end-of-life phase.
- In order to address concerns relating to the definitions of 'compatibility with recycling' or 'recyclable' greater flexibility is proposed in the assessment and verification, again reflecting EPEAT, with three different options based on (i) declarations from recyclers, (ii) test results and/or (iii) technical literature relevant to the EU market.
- The sub-criterion 4(b) requiring plastic marking is proposed to be retained, with the provision of additional information about FR's (e.g. CAS No) encouraged instead of mandatory. The set of technical exemptions remain and were not commented on further by stakeholders.
- The sub-criterion 4(c) requiring a minimum 10% post-consumer recycled plastic content is proposed to be retained, but has been reworded to allow for an average recycled content for each model and to exclude Printed Wiring Boards.
- Products with metal casings are excluded from the recycled content requirement because the quantity of plastic remaining would be too low for the sub-criterion to be practical.

3.4.2 Criterion 4.2 – Design for disassembly and recycling

As laid out in the Task 4 report, manual dismantling is an important means to improve material recovery of precious and critical metals and thus reducing the overall impacts of televisions and external computer displays. This can be facilitated by appropriate design. Nevertheless, the current requirements are not very specific regarding the dismantling process and key components being affected. Here, suggestions provided by Ardente & Mathieux (2012) and approaches taken in other ecolabels (in particular Blue Angel RAL-UZ 78a) are quite more specific; although these refer to computers, it is proposed to adapt them for televisions and computer displays accordingly. Thus, it is suggested to introduce more specific requirements for the most relevant components of televisions and computer displays in terms of material recovery of precious and critical metals, which are

- Printed circuit boards > 100 cm^2
- Displays > 100 cm^2

This selection is based on the WEEE-Directive, which requires recyclers to separate these components during end-of-life management[67].

3.4.2.1 Major proposed changes (first proposal)

Proposed revised criteria (first proposal)
"Design for disassembly and recycling" For recycling purposes displays shall be designed so that (a) They facilitate easy (manual) disassembly in order to separate display units >100 cm² and printed circuit boards >100 cm². (b) An efficient (manual) disassembly of display units >100 cm² and printed circuit boards >100 cm² by a specialized firm can be done by the use of widely used commercially available tools (i.e. pliers, screw-drivers, cutters). (c) One person alone can be able to disassemble display units >100 cm² and printed circuit boards >100 cm². (d) Electrical modules can be easily removed from the case.

[67] Although the WEEE-Directive also requires separate treatment of other components (e.g. external electrical cables, plastic containing brominated flame retardants, mercury containing backlights), these fractions are of less relevance for the European Ecolabel as some constitutes are excluded from labelled products (e.g. plastic containing brominated flame retardants, mercury containing backlights) or do not represent any challenge in dismantling processes (e.g. external electric cables).

Assessment and verification: The applicant shall declare compliance with the requirements to the competent body. The applicant shall provide a 'test disassembly report' to the competent body including disassembly procedures, tools needed for the disassembly and the time (in seconds) needed for the different steps to disassemble the components during the testing. The report shall be submitted either in writing including photo or drawing, or in video format.

- The criterion 'design for disassembly' has been renamed into 'design for disassembly and recycling'; the focus of this criterion has been clearly set to recycling purposes by removing the introduction "…for the purpose of undertaking repairs and replacements of worn out parts, upgrading older or obsolete parts…". Typically dismantling for repair or upgrade purposes is carried out significantly different from dismantling for recycling: While the first one requires caution to avoid any damages, the latter can widely accept damages to parts as it solely aims at recycling. Thus, the structure of the requirements should clearly distinct between both purposes. For this reason, requirements for the access and exchange of components for repair and/or upgrade are specified under 'repairability'. In that sense, Peeters et al. (2012)[68] provides a very helpful structure of different demanufacturing processes, distinguishing between non-destructive, semi-destructive and destructive demanufacturing, depending on the purpose (repair, reuse, recycling).

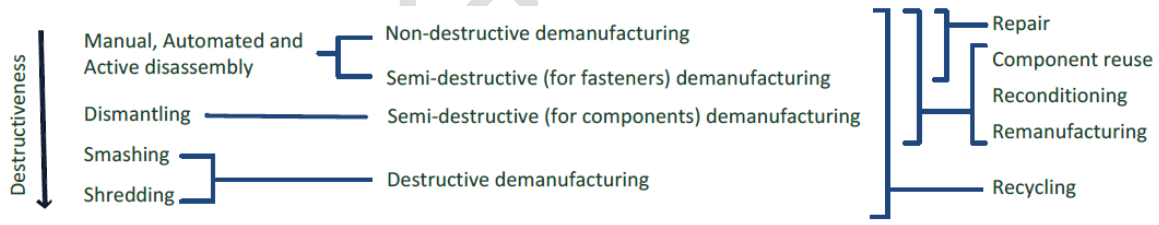

Figure 10: Overview of different demanufacturing processes and their level of destructiveness (Source: Peeters et al. 2012)

- Some of the sub-requirements under the current criterion 'design for recycling' have been removed to the new proposed criterion 'material selection and information to improve recyclability'.

[68] See https://lirias.kuleuven.be/bitstream/123456789/348771/1/i-sup2012

- The components being relevant in terms of material recovery of precious and critical metals have been specified.
- The disassembly process has been specified (specialized firm, one person alone, use of universal tools).
- For the assessment and verification, the provision of a 'test disassembly report' has been proposed.

Ideally, as requested by Ardente & Mathieux (2012)[69], the above listed requirement would also incorporate a threshold for the disassembly time in seconds of the different specified parts and components. However, according to Ardente & Mathieux (2012), the test and verification of such a dismantling-time benchmark would require a detailed standardised test and measurement procedure as the manual dismantling time depends on various factors:

- Minimum working experience of disassembler or operators (e.g. number of years working in the sector);
- Pre-conditions for the measurement (e.g. knowledge of the product's structure and location of the part to be disassembled, including access to relevant information from manufacturers as videos and exploded diagrams of the product);
- sequence of the steps of the disassembly;
- Tools or machine / equipment to be used for the disassembly (e.g. common tools and machines in use in the recycling plants for dismantling);
- Typology and precision of instruments used for measurement of the time;
- Uncertainty of the measurement and tolerance of the results.

As such test and measurement procedure is not available the above listed criteria have to refer to other means for verification.

For more details cf. Task 4 report "Improvement Potential", section 4.2.4.2 "End-of-life management of televisions and computer displays".

[69] Ardente, F.; Mathieux, F.: Integration of resource efficiency and waste management criteria in European product policies – Second phase. Report no 2, Application of the project's method to three product groups. Joint Research Centre – Institute for Environment and Sustainability, Ispra, 2012

3.4.2.2 Stakeholder feedback and further evidence

According to written stakeholder feedback following the first AHWG meeting, the criteria proposed for (easy) disassembly are explicitly supported by one of the stakeholders, because separate treatment of the respective components allows a much higher efficiency of the following material recycling steps. However, the proposed requirement (d) “Electrical modules shall be easily removed from the case.” needs to be phrased more clearly.

As example, in Screens LED from the backlighting system include a relevant share of critical raw materials. In this respect, the treatment of LEDs in a separate waste/recycling stream should be addressed. Whether an easy manual dismantling is the appropriate requirement to support such separated treatment needs further assessments.

For TV screens and Monitors, it might be appropriate to consider ongoing developments for their targeted treatment (focussing on a quantitative recovering of the included critical raw materials). This would contribute to the formulation of more precise requirements on design for recycling supporting such treatments in further revisions of the Ecolabel.

The criterion is supported by one of the stakeholders, seeing it as a good addition to the existing criteria of disassembly report preparation. However, there is not seen a significant value in the 3rd party (recycler) verification since manufacturers' own disassembly and time measurement would be a rather conservative estimate compared to recyclers' actual operation (considering that recyclers would not be constrained by the need to take the samples apart more carefully to avoid the subsequent damages on part functionality).

<u>Further research / evidence</u>

Based on the feedback from stakeholders, follow-up research focused on the potential to support the recovery of critical raw materials and other relevant materials. The research aimed at identifying materials and components that should be prioritised for the EoL treatments, reflecting the approach taken by JRC-IES in

support of the draft revision of the Ecodesign Implementing Measure for Televisions (and Displays) EC/642/2009[70].

Identifying Critical Raw Materials from an EU perspective

A first step is to define and identify Critical Raw Materials. The availability of Critical Raw materials has been highlighted as a strategic policy issue by the European Commission. Under the EU Raw Materials Initiative a working group has identified and listed the Critical Raw Materials from a geo-political and economic point of view[71]. The list is based on a time horizon of ten years, so geological scarcity was not a central consideration, the increasing demand for products containing CRM's cited instead as an important factor. Recyclability and the potential for substitution were also factors considered in the creating the initial list.

Table 24: Initial list of critical raw materials at EU level

Antimony	Indium
Beryllium	Magnesium
Cobalt	Niobium
Fluorspar	PGMs (Platinum Group Metals)[a]
Gallium	Rare earths[b]
Germanium	Tantalum
Graphite	Tungsten

Notes:

a) Platinum, palladium, iridium, rhodium, ruthenium and osmium

b) Yttrium, scandium, and the 'lanthanides' - lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium and lutetium

Lithium and chromium were at the time on the borderline of being identified as CRM. It is understood that in the meantime their economic importance and supply risk may have shifted, bringing them within the definition of 'criticality'.

[70] European Commission, Integration of resource efficiency and waste management criteria in European product policies: Application of the project's methods to three product groups, JRC-IES, November 2012

[71] European Commission, *Critical raw materials for the EU*, Report of the Ad Hoc Working Group on defining critical raw materials, DG Enterprise and Industry, 30th July 2010

Of direct relevance to development of this EU Ecolabel criterion is the recommendation made within the 2010 report that policy actions are undertaken to *'make recycling of raw materials-containing products more efficient'* including *'mobilising end of life products with critical raw materials for proper collection*'. A specific recommendation is also made that:

> *'…overall material efficiency of critical raw materials should be achieved by…minimising raw material losses into residues from where they cannot be economically-recovered.'*

Identifying metal, CRM and plastic components of life cycle significance

The preliminary background reports for the revision of the EU Ecolabel criteria for electronic displays products published in September 2013 contained a screening of LCA (Life Cycle Assessment) studies for electronic displays[72]. The aim of this screening was to identify comprehensive, quality studies that would support the identification of 'hot spots' of environmental impact in the life cycle of these products. These studies have been screened further in order to identify hot spots relating to specific metals, CRM's or plastics. The results are summarised in Table 25 below.

Table 25: Screening of LCA evidence for relevant metals or plastics

Study	Component hot spots	Sub-component hot spots	Metals (including CRM's), and other relevant materials
Plasma Television Displays			
Hischier, R & I, Baudin (2010)	Based on the normalised results for human toxicity and photochemical oxidation at the production phase: • PCB • Housing • Plasma display unit (resource depletion)	• Silicon wafer, • PWB Inductors and capacitors • Aluminium parts • Plastic parts • Gas in the filled panel	• Palladium production (SO_2 emissions). • Aluminium production (Vanadium emissions)

[72] http://susproc.jrc.ec.europa.eu/televisions/docs/Task3_Report_Ecolabel_Technical_Analysis.pdf

Study	Component hot spots	Sub-component hot spots	Metals (including CRM's), and other relevant materials
LCD Television Displays			
Hischier,R & I, Baudin (2010)	Based on the normalised results for human toxicity,freshwater ecotoxicity and other mid-points at production phase: • LCD module • PWB	It was not possible to identify sub-component hot spots from the published study.	• Vanadium and Nickel to water. • Chrome steel
Bakker.C, Ingenegeren.R, Devoldere.T, Tempelman.E, Huisman.J and D, Peck (2012)	Based on ReCiPe indicators. Components with significant impacts in the manufacturing phase: • PCB • Aluminium chassis	It was not possible to identify sub-component hot spots from the published study.	

Critical metals and raw materials inventory

A number of bills of materials (BOM) for electronic displays products were identified and presented in the background report on Hazardous Substance published in September 2013[73]. Aside from metal and plastic associated with enclosures and the chassis these did not identify CRM occurrence within product sub-components. Literature was therefore reviewed in order to identify a bill of materials for CRM's. Indicative BOM's have been identified for a LED LCD PC monitor and a LED LCD TV based on analysis by Oeko-Institut[74]. It can be seen from the BOM that CRM's are concentrated in a small number of main components, primarily the PCB and contacts and LED backlights. Sub-components can then be identified that would then require extraction in order to recover the CRM's.

[73] http://susproc.jrc.ec.europa.eu/televisions/docs/Task_Special_Hazardous_Substances_docx.pdf

[74] Oeko-Institut, Recycling critical raw materials from waste electronic equipment, Commissioned by the North Rhine-Westphalia State Agency for Nature, Environment and Consumer Protection, 24th February 2012

Table 26: Indicative occurrence of high value metals and CRM's in electronic displays

Metal	Content per LCD (LED backlit) [mg]		LCA hot spot	EU CRM	Occurrence in the product
	TV	Monitor			
Silver	580	520			PCB and contacts (100%)
Indium	260	82		✓	Internal coating on display (100%)
Gold	140	200			PCB and contacts (100%)
Yttrium	4.8	3.20		✓	Background illumination (100%)
Palladium	44	40	✓	✓	PCB and contacts (100%)
Europium	0.09	0.06		✓	Background illumination (100%)
Cerium	0.30	0.2		✓	Background illumination (100%)
Gallium	4.90	3.30		✓	Background illumination (100%)
Gadolinium	2.30	1.50		✓	Background illumination (100%)

Market potential for dismantling and CRM recovery

Whilst it is possible to identify components and sub-components for selective extraction it does not follow that their extraction is currently economically or technically feasible. Relevant market commentary on the potential for their recovery and recycling has therefore been briefly reviewed summarised in order to inform the identification of components and sub-components for which recycling is a realistic prospect either now or within the validity period for the Ecolabel criteria. The three main sources are Oeko-Institut[75], JRC-IES[76] and WRAP[77]. Other sources are referenced where relevant.

The collection of WEEE in Europe has grown rapidly since the introduction of the WEEE Directive in 2003 and this is set to increase further as the recast WEEE Directive is transposed at a European level. Treatment centres tend to be a mixture of large processing centres handling a wide range of different types of WEEE and

[75] Oeko-Institut, Recycling critical raw materials from waste electronic equipment, Commissioned by the North Rhine-Westphalia State Agency for Nature, Environment and Consumer Protection, 24th February 2012

[76] European Commission, *Report n° 2. Application of the project's methods to three product groups (final)*, JRC-IES, November 2 01 2

[77] WRAP, *Strategic raw materials, recovery capacity and technologies*, Final report, 26th March 2012, UK.

niche operators concentrating on a few or even single streams. Centres may consist of a combination of manual dismantling and sorting of components with bulk shredding and detoxification (e.g. mercury removal from LCD screens)[78]. Selected components may then be sent to specialist smelters (e.g. PCB's) or be subject to automatic or manual separation (e.g. plastics).

The main plastics fraction (e.g. PC/ABS casing), steel and aluminium chassis, alloy casings (painted or unpainted), external power cables and Printed Circuit Board's larger than 10 cm^2 are generally extracted and passed on to the relevant markets for materials recycling.

From a resource point of view, leading actors in the specialist metals and CRM market claim that some manual pre-treatment, including complete removal of PCBs and other components followed by subsequent recovery of the precious metals would enable a significantly more efficient recovery of various metals, CRM's and REE's[79]. Taking silver, gold and palladium as examples the recovery rate could be increased in selected scenarios from 12-26% to 90%.

A recent industry survey conducted by WRAP suggested that to a great extent removal by manual treatment of circuit boards (88-94%), plastics incorporating brominated flame retardants (82%) and LCD displays (88%) already takes place, although it is not clear the extent to which this can be taken to be representative of the picture across the EU.

Plastic casings

The market value of a plastic casing containing flame retardants that meet a specified fire protection standard is not currently clear. JRC-IES states in their Ecodesign case study that plastics containing flame retardants are generally not recyclable after shredding, as evidenced by IEC 62635. A recent study on industry

[78] Meskers.C.E.M and C.Hageluken, *The impact of different pre-processing routes on the metal recovery from PC's*, Conference paper *Resource management and technology for material and energy efficiency*, EMPA Materials Science and Technology, September 2009.

[79] C. Hagelüken and C. E. M. Meskers, *Complex life cycles of precious and special metals*, Chapter 10 from *Linkages of Sustainability* (2010) Strüngmann Forum Report, Edited by Thomas E. Graedel and Ester van der Voet.

trials suggested that a purity rate up to 82% can be achieved for the separation of some plastics, as PC/ABS containing phosphorus FR's[80]. This result is based on optical and density-based sorting treatments of plastics after shredding.

Technically there is not understood to be a barrier to use of this recyclate, although the plastic and the incorporated FR must first be identified, and such separation for recycling is not yet commonplace. Despite the prevalence of shredding the recent REWARD/EFRA pilot study highlights the importance of plastics marking and the provision of information about the FR's used as being important to facilitate recovery and recycling[81].

Printed Circuit Boards (PCB's)

The main economic aim of recovering PCB's is to recover the copper, gold, silver and palladium. Currently, CRMs are primarily recovered from circuit boards at large metal refining facilities designed to handle complex streams of metal containing wastes[82]. They can then be refined from copper alloys.

LCD/LED display units

Displays are usually recycled thermally in waste incineration plants or in the Waelz kiln process for steel mill dust. The organic components (liquid crystals, polarisation filters, resins) are generally shredded and may then be incinerated, and the glass along with the oxidized metals remains bound in an inert slag. The indium contained in the displays is generally lost through dissipation[83].

Several pilot and laboratory technologies have been already developed for Indium[84] and rare earths[85] recovery. However there are currently no large scale recycling

[80] Peeters et al. (2013)

[81] EFRA (2013) *Recycling of plastics from LCD television sets*

[82] Van Kamp.M and A, Vasseur, *Raw materials sustainability: Collaborating towards a better world*, Presentation to the Future Circular Materials Expo, Sweden, 2013

[83] See Oeko Institut (2012)

[84] Kye-Sung Park, Wakao Sato, Guido Grause, Tomohito Kameda, Toshiaki Yoshioka. *Recovery of indium from In_2O_3 and liquid crystal display powder via a chloride volatilization process using polyvinyl chloride.* Thermochimica Acta 2009

[85] See HydroWEEE projects

facilities for the separation and refining of indium from the display units and the rare earths from the background illumination. The very low indium content and lack of another significant metal to recover in each LCD unit makes the economics of recovery very challenging. However, with indium supplies being dependant on lead or tin extraction there is the potential for exposure of the electronics sector to price volatility.

In view of the need to protect future supplies of indium, Germany is understood to be considering storage of dismantled display units for recycling at a later date. It has been postulated that some form of chemical leaching process might in the future be more promising than a smelting process.

The rare earth elements contained in the luminescent materials are currently not recycled. Up until now the luminescent materials and rare earth elements contained in display units e.g. yttrium, europium, terbium, were sent to landfill following shredding. However, several mobile pilot plants are being developed to recover metals like copper, manganese, zinc, yttrium, indium from WEEE by hydrometallurgical processes.

LED backlights

The CRM's and rare earth metals used in the manufacture of LED backlight units are related to doping and luminescence. They can include indium, gallium, cerium, europium, yttrium and gadolinium. The weight per substance typically amounts to only μg's per LED. There is no current reliable information on the potential to recycle LED chips.

PMMA display light guide

The plastic light guides within an LCD display constitute a large proportion of the plastic used in a TFT display. In particular the PMMA light guide has been identified as a sub-component that is readily identified and which is readily recyclable according to IEC 62635. JRC-IES identified that, without prior manual separation, the PMMA light guide would be dispersed among other shredded fractions. This would cause the contamination and consequent downcycling of the recyclates. On the other

hand, PMMA sorted from other fractions before shredding can be recycled for the production of new boards with the same quality.

Potential benefits of manual dismantling and time threshold for extraction of key components

During 2013 JRC-IES carried out further analysis of electronic displays to provide scientific support to help assess the benefits of the extraction of key components from electronic displays, and to assess their benefits and environmental impacts. Further analysis has been carried out including a literature review of related studies, a campaign of measurement of the time for the dismantling of electronic displays carried out in an Italian electronic equipment waste recycling plant and identification and assessment of suitable thresholds for the time taken to extract key components. JRC-IES's 2012 analysis together with the new analysis refers to electronic displays (TVs and monitor) with Liquid Crystal Display (LCD) currently at their end of life (EoL) but that have been designed in the past 5-8 years. According to manufacturing associations, modern displays have a significant lower mass and also their design for dismantling purposes has been improved.

The analysis has identified several possible thresholds for the total time taken to extract key components, differentiated according to different sizes of devices. The analysis focused on two types of key components in displays: Printed Circuit Boards (PCB) and Thin Film Transistor (TFT) units. The extraction of the PCB and TFT units has some common steps. Therefore, the setting of a single time threshold for the extraction of both of these components is considered to introduce less uncertainty. Moreover, a requirement on the combined extraction of PCB and TFT panel would lead to greater flexibility as regards the design of products that are compliant within the expected thresholds.

Electronic displays can use cold cathode fluorescent lamps (CCFL) or, in newer models, light emitting diodes (LED) as backlighting systems. JRC-IES highlight that both types of backlight units can be configured as back-lit or side-lit units in the

screens[86]. Even though there is a large variety in their design[87], LEDs are often mounted in rails and strings, similarly to CCFL, thus their extraction is analogous to that of CCFL tubes. Therefore, both types of backlight units have a similar dismantling sequence and analogous times for extraction.

3.4.2.3 Second proposal for disassembly and recycling criteria

Proposed revised criteria
"Design for dismantling and recycling" For recycling purposes electronic displays shall be designed so that: (a) For the following components an efficient manual disassembly by one person in a specialised company shall be possible to carry out using common commercially available tools (i.e. pliers, screw-drivers, cutters and hammers as defined by ISO 5742, ISO 1174, ISO 15601): (i) Printed Circuit Boards >10 cm^2 (ii) Thin Film Transistor (TFT) unit >100 cm^2 and film conductors (iii) Polymethyl Methacrylate (PMMA) board light guide (b) The time required for extract these components shall not exceed the following: (i) 220 seconds for display with a size smaller than 25 inches (diagonal screen size); (ii) 320 seconds for displays with a size greater than or equal to 25 inches and smaller than 40 inches (diagonal screen size); (iii) 480 seconds for displays with a size greater than or equal to 40 inches and smaller than 55 inches (diagonal screen size). (c) At least one of the following optional components shall also be efficiently manually disassembled with reporting of the additional time requirement based on the fastest identified sequence following on from (b): (i) LED backlight units (ii) Speaker unit magnets (for display sizes greater than or equal to 25 inches) (iii) HDD drive (if applicable in the case of smart devices) *Assessment and verification*: The applicant shall declare compliance with the requirements to the competent body. The applicant shall provide a 'test disassembly report' to the competent body including the adopted disassembly sequence (steps and procedures), identification of the optional components selected, the reported timings and the tools needed for the disassembly. Reference shall be made to the extraction timing method outlined in the user manual. The report may be submitted either in writing or in digital format, supported by photos, drawings and/or videos. The reported timings for disassembly and the related disassembly sequence shall be provided for verification by either:

[86] European Commission, Joint Research Centre – Institute for Environment and Sustainability. Analysis of dismantlability draft 2014.

[87] Veit H., Juchneski N. C. F., Scherer J. and I. H. Grochau (2013). "Disassembly and characterization of liquid crystal screens." Waste Management & Research 31(6): 549-558.

(i)	A third party, testing body.
(ii)	A specialised recycling firm that is a permitted treatment operation in accordance with Article 23 of Directive 2008/98/EC.

Major proposed changes:

- The heading has been changed from “design for disassembly and recycling” to “design for dismantling and recycling”.
- The threshold for the extraction of printed circuit boards has been lowered from 100 cm^2 to 10 cm^2 as this is in line with the relevant threshold of the current WEEE-Directive.
- The identification of components has been expanded and made more specific in order to reflect the LCA hot spots, CRM/REE occurrence and market potential identified by the follow-up research.
- A requirement on measuring the dismantling time is proposed. This criteria is currently analysed for its introduction into EU product policies, being an important proxy for the design for dismantling of EEEE and for the economic viability of manual dismantling processes. The threshold values proposed are estimated to be feasible for 20% of the products analysed by JRC-IES in a dismantling plant, subdivided into 3 screen size ranges. For TVs greater than 55’’ it was not possible to gather evidence to support timing. These TVs are therefore not considered for the thresholds of the time for dismantling (sub-criteria b), but still considered for the other sub-criteria a) and c).
- A separate list of components and, where relevant, sub-components that are more challenging to extract are also identified. It is proposed that in order to draw attention to their importance applicants shall demonstrate a timed extraction for a minimum number of these components or sub-components, which in some cases are specific to certain product form factors.
- Verification for the timed extraction of components is proposed to be flexible, with two alternative options presented - a third party option and a ‘real-life’ option in a WEEE treatment facility. It is proposed that the manufacturer establishes a suitable dismantling sequence for its product, and then uses this

as the basis for commissioning the testing/measurement of the timing (to verify compliance to the criteria). The testing would therefore be carried out by a third party knowing in advance the sequence suggested by the manufacturer.

- The potential for a manufacturer to self-verify in their own labs is not felt to be appropriate because it would represent optimised conditions whereas in real-life a dismantler may have to deal with a wide variety of models without the benefit of an OEM's familiarity with their own product.
- It is under analysis and discussion to develop a standardized method for the measurement of the timing of dismantling. The timing for this process is likely to extend beyond the programme for adoption of the new Ecolabel criteria for displays. In the interim a comparable method would therefore need to be outlined in the User Manual based on the work to date by JRC-IES[88]. Outline steps for the method are for example described in Box 2.

Box 2: Outline steps for the measurement of the time for the extraction of certain target parts in electronic displays

Terms and definitions

- *Target parts:* Parts and/or components that are targeted for the extraction process.

Operating conditions for the extraction

- *Extraction sequence to be followed:* The Extraction sequence to be followed has to be set out prior to the measurement. The sequence shall be documented and provided to the third party carrying out the extraction.
- *Tools for extraction:* The extraction operations should be performed using manual or power-driven standard tools.

Extraction time measurement

- *Measurement sample:* The sample of EEE to be used for the measurement shall be undamaged.
- *Measurement:* The extraction time measurement consists of the measurement with an instrument of the time elapsed between the starting of the first operation listed in the extraction sequence documentation and the end of the last one.

3.4.2.4 Stakeholder feedback following AHWG2 and further evidence

The main points arising from the 2nd AHWG meetings for Televisions were as follows:

[88] Joint Research Centre – Institute for Environment and Sustainability - "Analysis of dismantlability" - draft 2014

- Concerning the design for dismantling a CB stakeholder does not see added value on timing and disagreed the setting of a threshold on time for dismantling since there are a lot of facts that will affect that time and are out of the control of the manufacturer.

- An industry stakeholder sees the proposal on time threshold as very ambitious and disagreed with third party verification since it will mean to send to destruction a high number of TVs.

- Other CB sees an added value on having the time threshold as it is what makes bigger difference with the legal requirements of WEEE directive. NGOs also expressed added value on having the time threshold.

- JRC IES stated that the design for dismantling is critical and should be addressed and measured someway. The costs are proportional to the time required to separate manually diverse parts of the products, thus the cost for labor. If the EU ecolabel aims to enhance more environmental friendly products, the accessibility to certain parts and materials to facilitate the recovery and recycling of economic valuable and also critical metals, should be guaranteed.

The main points arising from written comments received after the 2nd AHWG meetings for Televisions were as follows:

A CB stakeholder contacted with recyclers of electronic waste and they stated that in general they support the criteria. They said that although, they don't manually dismantle the products the proposed criteria help them with the detoxification of the products. On the other side they see the criteria as a tool to raise awareness of producers about the recyclability of their products. They expressed that it is unclear what the future will bring concerning the level of manual dismantling and that

sometimes a large batch of a certain product has to be destroyed, in these cases more information on the product becomes more relevant.
They claimed that if the producer organizes the take-back of his products and ensures they will be used for refurbishment or recycling, they do not have to comply with the criterion on end-of-life since the waste they generate stays their proper responsibility.

A scientific researcher stakeholder expressed that the key components targeted seem to be the most representative, considering that the back cover must be taken to extract the PWBs. They claimed that no correlation was found in their studies between size and disassembly time. TVs smaller than 25 inches are becoming very rare, so it seems better to classify based on functionality and to distinguish monitors and TVs, rather than on size e.g.*"All the PWBs are considered, whereas the focus should be on the PWBs containing high concentrations of precious and critical metals, which are, in case of an LCD TVs, the mainboard processing the input signals, and the so called T-con which provides the required interface between the main board and the LCD display*."

A CB stakeholder asked why there are no time requirements for TV's bigger than 55 inch.
A stakeholder suggested that a sort of recycling checklist available online for each product could have added value. It would have to indicate the presence which components are present in the product and their location, so the recycler has information on what has to be taken out.

Another CB stakeholder claimed that this criterion is too specific regarding timings and they are not convinced this will have any effect on the design of products.
They said that much of the end of life equipment that will be received by recyclers will be damaged and this can affect timings considerably. Also the timings will in many cases reflect the efficiency of the techniques employed by specialised recyclers.

They said that although there is a communication gap between the producer and recycler, this is acting as a spur to recyclers to find innovative and specialised ways to recover valuable materials from the waste stream, therefore there is no need to specify specific dismantling times. Thus, they would be more supportive of a requirement that manufacturers clearly label the product and components to indicate what is included e.g. mercury present etc.

An industry stakeholder doesn't support verification for points b) and c). They claimed that there is no clear environmental benefit coming from this criterion, since in the future disassembly using automated mechanical processes will be more common. In addition, the verification method would only be acceptable if a manufacturer is interested in applying for very limited number of models. In case a manufacturer would be interested in applying for EU Ecolabel for the majority of its line-up, the destruction of several TVs would be an economical but also environmental loss.

Further research and evidence

With regard to End of life of waste electronic displays the JRC-IES report [JRC- IES (2014 draft)][89] on material efficiency remarked that about 30 million of estimated devices reaching their EoL in the EU by 2015, waste flat panel display is one of the most relevant waste categories[90].
According to Ardente and Mathieux 2014[91] manual dismantling is currently the most common processing in the EU regarding analysis of treatments of waste displays at the recycling plants. The report referred several papers and reports that although some automated recycling technologies (based on the shredding in controlled

[89] JRC - IES (2014 draft). Analysis of material efficiency for EU Ecolabel criteria: the example of two product groups. Environmental Footprint and Material efficiency support for product policy (Not published yet)
[90] Fakhredin, F. and J. Huisman (2013). Analyzing End of Life LCD TV WEEE Flows in Europe. conference EcoDesign 2013 International Symposium, Jeju Island (South Korea).
[91] Ardente, F. and F. Mathieux (2014). "Identification and assessment of product's measures to improve resource efficiency: the case-study of an Energy using Product" Journal of Cleaner Production 83(15): 126–141.

environment and mechanical sorting of recyclable fractions) are under development and being tested[92] Europe is missing of automated commercial-scale processes which can recycle electronic displays.[93].

The JRC-IES draft report remarked that according to various authors the most effective approach for disassembling/dismantling LCD systems would involve systems that combine manual and automated processes. They performed a review of environmental criteria for electronic displays and revealed that the need for an easy dismantling of electronic displays and for the extraction of some key components has been highlighted in criteria for environmental labelling (SeeTable 27).

Table 27: Environmental criteria for electronic displays (TVs and monitors) (source: JRC-IES report[89])

Environmental label/scheme	Criteria
Current EU Ecolabel	The manufacturer shall demonstrate that the television can be easily dismantled by professionally trained recyclers using the tools usually available to them, for the purpose of: undertaking repairs and replacements of worn-out parts; upgrading older or obsolete parts, and separating parts and materials, ultimately for recycling
Blue Angel (RAL-UZ-145)	The appliance shall be so designed and as to allow an easy and quick disassembly for the purpose of separating resource-containing components and materials
Nordic Ecolabelling	The manufacturer shall demonstrate that the product can be easily dismantled […] for the purpose of separating parts and materials, ultimately for re-cycling. […] To facilitate the dismantling: fixtures within the products shall allow for this disassembly, e.g. screws, snap-fixes, especially of parts containing hazardous substances
IEEE Std. 1680.3™ -2009	The time for dismantling the television for recycling shall be "at most 10 minutes for products weighting less than 50 pounds (18.7 kg); and at most 10 min plus 1 min per each additional 5 pounds (1.87 kg) of total product weight, for products weighting 50 pounds or more

[92] McDonnell, T. and K. Williams (2010). The location and character of mercury in waste LCD backlights. Summary research report of WRAP. J. F.-B. o. W. t. Dialogue, WRAP: 1-41

[93] Cyran, J., K. Freegard, et al. (2010). Demonstration of Flat Panel Display recycling technologies (WRAP Project)

With regard to the design for dismantling relevant parts in electronic display the JRC-IES draft report[89] review further scientific sources which further remark the evidence reported at the section 3.4.2.2. According to the analysis of current EoL treatments at the European recyclers, the product's parts more relevant are:

- mercury containing components (backlighting lamps). The extraction of backlighting lamps is probably the most critical phase in the recycling of the displays due to the risk of accidentally breaking the lamps and releasing the mercury.
- printed circuit boards (PCBs) including capacitors: The extraction of PCBs is relevant because they can contain a number of hazardous substances, including arsenic, antimony, beryllium, brominated flame retardants, cadmium and lead and also several precious and valuable metals (including gold, silver and platinum group metals).[94]
- liquid crystal display (LCD). The LCD contains the Thin-Film-Transistor (TFT) panel, which is relevant for its indium content[95] Indium in electronic displays is generally also used together with other substances such as arsenic, phosphorous and tin potentially hazardous and can cause lung disease and cancer.[96]
- PMMA board. This is highly recyclable and valuable thanks to its high purity, relatively large mass (ranging from a few hundred grams in small displays to several kilogrammes in large displays) and high market price. The PMMA board is therefore stored separately and sold to plastics industries for monomer

[94] Chancerel, P., C. E. M. Meskers, et al. (2009). "Assessment of Precious Metal Flows During Preprocessing of Waste Electrical and Electronic Equipment." Journal of Industrial Ecology 13(5): 791-810.

[95] Chou, W.-L., C.-T. Wang, et al. (2009). "Effect of operating parameters on indium (III) ion removal by iron electrocoagulation and evaluation of specific energy consumption." Journal of Hazardous Materials 167(1–3): 467-474

[96] National Toxicology Program (2001). Technical report on the toxicology and carcinogenesis studies of indium phosphide (cas no. 22398-80-7) in F344/N rats and B6C3F1 mice (inhalation studies), U.S. department of health and human services: 1-348.

recycling[97]. Also other large plastic parts (e.g. support, frames) have are economically and environmentally relevant for recycling [91,63].

At JRC-IES draft report[89] they presented an analysis of studies in the literature on the dismantling of electronic displays. Unfortunately these studies generally refer to the full disassembly of the displays (without a detail of the dismantling of the above mentioned key parts) and results are presented as aggregated average result over a large number of devices. In order to cope with this data gap, the study have performed a survey of recycler in Europe and 4 facilities (two in Italy, one in UK, one in Belgium and one in Spain) have been visited. The time for dismantling the key components has been recognised as a proxy for the "design for dismantling" of the display. The time for dismantling is one of the most relevant parameter driving the treatments at the recycling facilities. In fact, the recyclers try to get a balance between the costs for disassembly (mainly the labour costs) and the potential revenues from a more accurate separation of components[69,98].

A previous JRC-IES report on benefits and impacts/costs of options for different potential material efficiency requirements for Electronic displays[98] provided further data concerning the campaign for the collection of data about the treatments of waste displays and the dismantling of around 70 waste displays in a Italian recycler (mentioned at 3.4.2.2.).

Based on these data, they show the percentage of displays of different sizes with a time for dismantling PCB (larger than 10 cm^2), PMMA and TFT panels below certain thresholds. It is observed that around 50% of the displays smaller than 25'' have a time for extraction lower than 250 seconds. Analogously, around 50% of the displays with a size between 25'' and 40'' have a time for extraction lower than 470 seconds.

[97] Kikuchi et al., 2014

[98] JRC-IES (2013). Report on benefits and impacts/costs of options for different potential material efficiency requirements for Electronic displays. Integration of resource efficiency and waste management criteria in European product policies - Second phase, Joint Research Centre - Institute for Environment and Sustainability of the European Commission.

JRC- IES (2014 draft) report gathered additional data about the time for dismantling for electronic displays from other studies than JRC-IES and based on various recycling facilities in the EU. Two other relevant studies were analysed. They used the results from these studies to check the robustness of the results obtained by JRC-IES and also to enlarge the experimental sample to aid in the definition of thresholds for the time for dismantling electronic displays. The final results (related to the entire data sample) are subdivided in three size ranges (S < 25''; 25'' ≤ S < 40''; 40'' ≤ S ≤ 55'').

Therefore, focusing on 30% of displays meeting the requirement, the thresholds would be about:

Table 28:Time for dismantling target components (s). (*Source* JRC-IES (2014 draft) report)

Size	S < 25''	25'' ≤ S < 40''	40'' ≤ S ≤ 55''
Threshold of the time for dismantling [s]	260	340	400

Based on these results, the report suggested building an Ecolabel criterion about the "time for dismantling" of key components. They argument that proposed criterion is more detailed compared to generic claim for the "design for recycling" (as e.g. introduced in the 'Blau Engel' and 'Nordic' Swan labelling systems for televisions) and in line with the criteria set in the IEEE (2012) labelling. Furthermore a criterion based on time thresholds leave enough freedom to the manufacturers to decide the best design strategy to comply with.

They suggested verification based on the following procedure:

"Manufacturer shall provide a disassembly report (available online) indicating the location of the above mentioned target components, the fastening systems adopted and the disassembly sequence (steps, procedures and tools needed for the disassembly). Manufacturer shall also provide a video showing the extraction of the above mentioned target components, and the compliance to the time thresholds".

3.4.2.5 Revised proposal for design for disassembly and recycling criteria

Proposed revised criteria

Design for dismantling and recycling

For recycling purposes electronic displays shall be designed so that the identified sub-assemblies and components are easily extracted from the product. A disassembly test shall be carried out according to the test procedure in *Appendix 2*. The test shall record the time required to extract those components identified from sub-criterion (a), the number of steps required and the associated tools and actions required to extract those components identified from sub-criterion (a) and (c).

(a) For the following components, as relevant to the product, a manual disassembly shall be carried out by one person using widely used commercially available tools (i.e. pliers, screw-drivers, cutters and hammers as defined by ISO 5742, ISO 1174, ISO 15601):

(i) Printed Wiring Boards >10 cm^2
(ii) Thin Film Transistor (TFT) unit >100 cm2 and film conductors
(iii) Polymethyl Methacrylate (PMMA) board light guide

(b) The time required for extract these components shall not exceed the following:

(i) 260 seconds for display with a size smaller than 25 inches (diagonal screen size);

(ii) 340 seconds for displays with a size greater than or equal to 25 inches and smaller than 40 inches (diagonal screen size);

(iii) 480 seconds for displays with a size greater than or equal to 40 inches and smaller than 55 inches (diagonal screen size).

(c) At least *one* of the following optional components shall also be possible to manually disassemble using common commercially available tools:

(i) LED backlight units
(ii) Speaker unit magnets (for display sizes greater than or equal to 25 inches)
(iii) HDD drive (if applicable in the case of smart devices)

***Assessment and verification*:**

The applicant shall provide a 'test disassembly report' to the competent body detailing the adopted disassembly sequence, including a detailed description of the specific steps and procedures, for the components listed in (a) and the optional components selected from (c), The tools used for the disassembly of each component shall additionally be specified

The disassembly shall be carried out by either by:

(i) The applicant, or a nominated supplier, in their own laboratory, or;

(ii) An independent third party testing body, or;

(iii) A specialised recycling firm that is a permitted treatment operation in accordance with Article 23 of the Waste Framework Directive.

Major proposed changes

- Design for efficient dismantling is considered by DG ENV and JRC to be an important proxy for cost effective dismantling/recycling and should be an important factor in product design.
- The criterion is therefore proposed to be retained. However, the time required for extract the components have been adapted to reflect further evidence collected by JRC IES.
- Concerning the verification processes, and the dismantling by the manufacturer has been added as an option. This simplifies the burden for verification and it does not require the analysis of many models, but just one exemplary.
- There are few TV>55'' currently reaching the EoL and few data available. Furthermore, these still represent a limited share of the market. These TVs are therefore not considered for the thresholds of the time for dismantling (sub-criteria b), but still considered for the other sub-criteria a) and c).
- An outline test procedure has been drafted, to be provided in the Appendix to the criterion annex.

3.4.3 Criterion 4.3 – Packaging

Present criteria, only Decision 2011/337
Where cardboard boxes are used, they shall be made of at least 80 % recycled material. Where plastic bags 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 or equivalent. *Assessment and verification*: a sample of the product packaging shall be provided on application, together with a corresponding declaration of compliance with this criterion. Only primary packaging, as defined in European Parliament and Council Directive 94/62/EC, is subject to the criterion.

Consultation questions
• The technical analysis and literature review of LCA studies (see Task 3) clearly shows that the packaging of computers and displays is of negligible relevance with regard to environmental impacts. Against this background it shall be discussed if this criterion should be retained?

3.4.3.1 Stakeholder feedback and further evidence

According to written stakeholder feedback following the AHWG meeting on Televisions, one of the stakeholders states that the requirements set out should remain unchanged in order to ensure consistency with other EU policies.
Another stakeholder points out that this criterion is important because the consumer who buys the product could be very disappointed in the EU Ecolabel when the product is not packed in an environmentally sound way.
Further, written stakeholder feedback following the first AHWG meeting of *Computers* has been provided being also valid for the packaging of external computer displays and televisions:

- If it is decided to include packaging, a complete harmonization with EPEAT, the IEEE1680.2 standard is recommended.
- One of the MS stakeholders proposed to keep the criterion if it is feasible for the applicants. Given the amount of packaging from all computers sold the impact is not negligible (however insignificant). In order to ensure consistency with other EU policies, the requirements set out should remain unchanged.
- The requirements on plastic packaging in the different EU Ecolabel product groups are confusing, both quantitatively and qualitatively. The percentages vary from zero to 100 % of a variety of materials such as recycled material,

recyclable material, renewable material, biodegradable material, compostable material, etc.

- It should be proven that packaging has a major influence on the sustainability impact of the whole system (content + packaging) if criteria should be set. For computers, as for many other energy using products, the impact of the packaging over the full life cycle is usually marginal. The technical analysis and literature review of LCA studies clearly shows that the packaging of computers[99] is of negligible relevance with regard to environmental impacts. If this is true and the EU Ecolabel criteria should address main environmental impacts, then there should not be criteria on packaging.
- There are strong doubts on the feasibility of this requirement regarding a minimum percentage of recycled material for packaging. The proposed percentage is definitely too high for plastics and for many other packaging materials. A fixed minimum percentage of recycled material for the different plastics used in packaging is neither feasible nor acceptable for the industry, because it does not allow guaranteeing the required level of quality and performance. A lower performance of the packaging will result in increased likelihood of damaging the packed product, and hence will increase the amount of waste. Such a criterion would discriminate/exclude most plastics from being used as packaging materials for this product group.
- The use of recycled material is environmentally beneficial only if: material losses in the recycling loop are limited; the substitution ratio is higher than about 0.7 (i.e. 1 part of recycled material replacing about 0.7 parts of virgin material). When the virgin material performance is improved in such a way that the thickness can be reduced, then the use of recycled material may become environmentally more damaging. We are very sceptical about using recycled content as a criterion for plastic packaging in EU Ecolabel criteria. Also for

[99] Explanatory note of the study team: This fact is also valid for external computer displays and televisions, see Task 3 report on Technical analysis; http://susproc.jrc.ec.europa.eu/televisions/stakeholders.html

packaging, a life-cycle benefit from used recycled materials cannot automatically be assumed, but would be dependent on the plastics type and the impacts of the collection/recycling process. Besides, computers[100] are not packaged on ‘plastic bags”. They may be protected by a plastic film which must ensure effective protection from humidity, dust, etc. Using recycled material in such relatively thin, but very protective, films may not be possible. Since we do not see any comparative life cycle analysis showing that the requirement of “at least, 75% recycled material “, is beneficial for the environment, we ask to remove this requirement.

- Comments on “biodegradable or compostable” plastic bags for packaging: Biodegradability or compostability, according to EN 13432, is not a guarantee of superior environmental performance. It only guarantees that the material, if discarded in the right waste fraction, collected and adequately managed, will disappear as water and CO_2, which means no resource saving. The inadequately managed fraction that will end in landfill will generate methane. Methane is a greenhouse gas more than 20 times more powerful than CO_2. We advise using for packaging the most sustainable packaging material as proven by a life-cycle analysis for the respective application. Recycling content or biodegradability can be part of a life-cycle analysis, but per se they are no indicators for a more sustainable or "greener" packaging. It is questionable whether biodegradable packaging for computers brings any environmental advantage. We wonder where the life cycle assessments are, guaranteeing that these two criteria will reduce the impact on the environment. Again, by lack of scientific proof, we ask to remove the requirements for biodegradable and compostable material.

Further research and evidence

Compostable plastics

[100] Explanatory note of the study team: This fact is also valid for external computer displays and televisions.

The term “biodegradable” is not equivalent to “compostable”. Whereas biodegradability is an inherent property that is independent of time and space, compostability is specifically related to the conditions in a composting plant. Compostability is the apability of biological degradation in a defined time under controlled conditions in a composting plant. The European standard (EN 13432 standard for bioplastic packagings and EN 14995 for plastic waste) requires 90% degradation within 90 days.

According to UBA (2012) there was criticism because typical rotting times in reality are often shorter than 12 weeks, the period for which biodegradability was tested. In these cases it was possible that packaging components were not fully degraded thus decreasing the value of the compost. Even if biodegradable plastics are fully degraded they do not have an added value from ecological perspective as they disintegrate into water and CO_2 and do not provide any nutrients to the compost[101]. Relating to the energy balance composting is not effective as no energy is recovered as long as it does not go into biogas production systems where energy can partly be recovered. However, according to an interview with an expert from the German Federal Environment Agency (UBA)[102], the separation techniques of composting plants are not so elaborated that they can distinguish between conventional and biodegradable plastics. Plastics are generally disturbing and thus sorted out.

Biodegradable plastics

A current study commissioned by the German Federal Environment Agency “Analysis of the environmental impact of biodegradable plastic packaging” evaluated a total of 85 life cycle assessments, studies and professional articles with a view to all of the environmental pros and cons of every type of packaging (UBA 2012)[103].

[101] Source: Interview with Franziska Krüger, expert for plastic recycling at German Federal Environment Agency (UBA); cf. http://www.planet-wissen.de/alltag_gesundheit/werkstoffe/kunststoff/biokunststoffe.jsp

[102] Source:

[103] Cf. http://www.umweltbundesamt.de/en/press/pressinformation/bioplastics-not-superior; study: http://www.umweltbundesamt.de/sites/default/files/medien/461/publikationen/4446.pdf

The study resulted that biodegradable plastics used in packaging, which are made from renewable biomass sources, do not prove to offer an overall ecological advantage. Whereas their CO_2 emissions and consumption of petroleum of bioplastics are lower, they are negative in a number of other environmental areas particularly through the use of fertilisers: The farming and processing of the plants used in packaging cause more severe acidification of soil and eutrophication of water bodies than the production of common plastic packaging. Moreover, they cause higher levels of particulate emissions.

Further, the study revealed that packaging made of biodegradable plastics was also unsuccessful in retail. During the 2009 period covered in the study, the market share of bioplastics packaging was a maximum of 0.5 per cent. Germany consumed a total of 2,645 million tonnes of plastic packaging in 2009.

The study was commissioned to determine whether the special provisions for biodegradable plastic packaging introduced by the German Packaging Ordinance are still defensible from an ecological viewpoint. The overall conclusion of the study was that bioplastic bags have no ecological advantages over common plastic bags. Reusable bags made of fabrics and other durable materials are in fact the real ecological alternative.

3.4.3.2 Second proposal for packaging criteria

Proposed revised criteria (second proposal)
"Packaging" Where cardboard boxes are used, they shall be made of at least 80 % recycled material. Where plastics are used for the final outer packaging, they shall be made of at least 75 % recycled material. Plastics used for protectively covering the product within the outer packaging are exempted from this requirement. *Assessment and verification*: A sample of the product packaging shall be provided on application, together with a corresponding declaration of compliance with this criterion. Only primary packaging, as defined in European Parliament and Council Directive 94/62/EC, is subject to the criterion.

Major proposed changes

- According to stakeholder feedback and further evidence, it is proposed to delete the requirement concerning biodegradable or compostable plastic materials as they did not proof to be of environmental benefit.

- Regarding the requirement of using recycled plastic materials, an exemption has been added for plastic materials that are used for protecting the electronic display against damage (e.g. shock absorbance).

3.4.3.3 Stakeholder feedback following AHWG2 and further evidence

The main points arising from the 2nd AHWG meetings for Televisions were as follows:

- With regard to packaging industry stated that 80% for cardboard boxes is in the limit due to mechanical problems. Clarification was requested concerning plastics/materials inside the cardboard boxes.

- A CB stated that the recycled contents should be verified by providing copies of purchases. There is no need for 3rd party verification.

The main points arising from written comments received after the 2nd AHWG meetings for Televisions were as follows:

From industry side stakeholders stated that 80% recycled cardboard makes the packaging too fragile and that producers would allow only up to 50-60%. They said that the percentage of recycled material in a cardboard box depends on the type of box (higher percentages can problematic in terms of mechanical performance). One in stakeholder proposed a percentage that varies between 40 and 70%.

Another stakeholder requested clarification: *It firstly states that "plastics used for final outer packaging" shall be made from at least 75% recycled material and then exempts plastics used to protectively cover the product.*

An industry stakeholder would like to see a clarification excluding EPS foam bricks out of the scope for the 75% limit on plastics.

The technical analysis and literature review of LCA studies shows that the packaging of displays is of negligible relevance with regard to environmental impacts. EU Ecolabel criteria should address main environmental impacts, in the view of a large number of further relevant criteria it is proposed to not include criteria on packaging. Moreover, cardboard already contains high levels of recycled content.

Regarding the low feedback and that packaging is not one of the main environmental hot spots the study team decided not to include a criterion on packaging for the product group televisions / displays at all.

3.5 Cluster 5 – Corporate Responsibility

Within the hotspot analysis for televisions and external computer displays, some additional issues concerning environmental as well as social impacts were identified. Within this context it shall be discussed if the revision of the EU ecolabel for electronic displays shall also introduce new requirements on corporate responsibility, meaning that they cannot be implemented and verified at product level but need to be implemented already at production level, possibly already during production stages not carried out by the applicant himself.

3.5.1 Criterion 5.1 – Labour conditions during manufacture

Proposed options for a new criterion (first proposal)
Option (a): No social criteria at all **Option (b): Social labour conditions during manufacture** The applicant must have a code of conduct or a comparable policy that requires adherence to the core labour standards of the International Labour Organisation (ILO Core Labour Standards). This code of conduct and/or policy must also address the assembly-stage of the production even in cases the assembly is not carried out by the applicant. The applicant must ensure that the code of conduct is communicated to all suppliers / subcontractors (up to the level of product assembly) together with a requirement that these shall also comply with a code of conduct that follows the ILO Core Labour Standards. *Assessment and verification*: The applicant shall declare the compliance with these requirements and shall provide a copy of the code of conduct and a description of the implementation process at suppliers/sub-contractors (up until assembly) to the competent body. **Option (c): Social labour conditions during manufacture** Fundamental principles and rights with respect to the universal human rights, as specified in the applicable core labour standards of the International Labour Organisation (ILO Core Labour Standards) shall be complied with during manufacture (assembly) of the European eco-labelled products. *Assessment and verification*: Option (1): The applicant shall declare the compliance with these requirements to the competent body. Option (2): The applicant shall declare the compliance with these requirements to the competent body and provide evidence by third-party verified certification of the production sites (up until assembly), e.g. by SA8000.

Note: Requirements regarding the social labour conditions during manufacturing are difficult to integrate in ecolabel criteria, especially in terms of assessment and verification. Examples from the past show that the reputation of the overall Ecolabel might be at risk if breaches of social labour conditions of ecolabelled products become known.

For more details cf. Task 4 report “Improvement Potential”, section 4.2.5.1 “General CSR criteria: Challenges for the implementation into ecolabels”.

Consultation questions
• Should a criterion addressing labour conditions be included? • Which further social aspects might be required beyond the ILO *Core* Labour Standards (e.g. wages, working time, occupational health & safety)? • Are there specific hot spots in the supply chain that might provide for a more focused criterion? (see also proposed criteria 5.3) • Which verification mechanisms shall apply in order to best ensure compliance with the required criteria?

3.5.1.1 Stakeholder feedback and further evidence

According to written stakeholder feedback following the AHWG meeting, the inclusion of such a criterion is explicitly supported by more than one of the stakeholders.
One of the stakeholders prefers a step by step approach and therefore starting with option b). It is asked to verify the costs of these certifications suspected to be very expensive with “SA8000 certifications of 10,000 € per production site for three years”.
This is supported by another stakeholder preferring to rely on EICC audits for 3rd party certification scheme rather than SA 8000 mentioned in the proposed criterion. It would be good for EICC audits to be also mentioned as an example considering they are highly effective and widely used in the electronics industry.
In general, one of the stakeholders asks to have a uniform approach how to write the social criteria in different criteria documents.
Finally, the criterion is asked to be aligned with the result from the horizontal task force on social aspects when they have a result.
Further, written stakeholder feedback following the first AHWG meeting of *Computers* has been provided being also valid for labour conditions during the manufacture of external computer displays and televisions:

- The inclusion of a criterion on labour conditions seems to be generally supported by the stakeholders.
- It is asked to have a uniform approach how to write the social criteria in different criteria documents.

- The criterion is welcomed by one of the CBs preferring either option b) or c) with sub-option 1. Also from the outcomes of the “Horizontal Task Force on social and ethical criteria for the EU Ecolabel- March 2013”, it is understood that third-party verification can be way too expensive (“SA 8000: 10,000 € per production site for three years”).
- One of the MS stakeholders is in favour of option (b) as it sets a standard but doesn’t put an excessive burden on the applicant to prove compliance with it. Verification by a third party is proposed to be demanded perhaps in the next revision period.
- According to feedback from a manufacturer it should be further discussed if one incident related to one applicant for the TCO ecolabel should lead to the conclusion not to require social criteria for computers at all. The positive side of the TCO social criteria is that there are now 15 companies that have certified displays for which compliance to these social criteria is a condition (criteria version 6.0). All of these companies have worked hard to demonstrate compliance to these requirements by annually showing an independent external audit report. Thus the inclusion of social criteria into the EU Ecolabel is supported. If included, a complete harmonization with TCO is recommended.
- CSR criteria should at least be in line with public and private procurement demands and for credibility be 3rd party verified. CSR is either a progressive approach such as EICC code of conduct and validated audit process for members or SA8000 certification of factories (not headquarters) where a certain standard is reached before certification is issued. Global compact and GRI do not guarantee a level of implementation at factory level without factory audits. EICC membership does not assure a level of implementation at factory level that is controlled by a 3rd party. If the progressive improvement methodology is chosen then to move forward from adopting principles, an agreement should be entered where the brand follows a code of conduct that is based on labour standards and principles that includes social and ethical production and where also exists a structured CSR policy of control routines for monitoring their

production facilities. CSR demands as these create a tool for brands and facilitate the sharing of information between the supplier, purchaser and a 3rd party ("3 way interest group"). At a stage of setting a minimum level of verified social commitment, progressive improvement is not a proof of good working conditions but it should be seen as a phase of ambitious 3rd party follow-up audits that communicates to stakeholders that social issues are important.

- To not push the industry into CSR for the reason of avoiding criticism is seen as sending the wrong signal to stakeholders.
- TCO Certified is 3rd party verified. If compliance is questioned (as one incident has been at TCO) then it in part is often dependent on a misunderstanding that can lead to a productive dialogue and perhaps future criteria improvements. TCO Development, as part of a watchdog system, is dependent on external information and will open a dialogue with informants and - if there are causes - start an investigation into the claims.
- It is recommended to avoid the phrase 'guarantee compliance' as this cannot be done without progressive improvement. It should be worked from the base up to know where to bring about positive change in the facilities where the certified products are manufactured.
- It has to be clearly communicated, to which tier of the supply chain the criteria are addressed to bring progressive improvement and where reasonable efforts are accepted. A network of approved 3rd party expert CSR verifiers will be needed to control the quality of the 3rd party audits are in line with demands and can review corrective action plans (CAPs) for their corrective effectiveness.
- The suggestion of being involved in other initiatives which more target the most relevant social hot spots could be a good approach, however brands may be unwilling to accept yet another initiative involvement, so there is the need to assess those where they are already involved in. Perhaps this is an option that should be included as a complementary option to conducting audits, such as the proposed tier (optional) scheme.

- There is no mention of the advancements created by the new TCO Certified CSR criteria: It is communicated to the stakeholders that social issues are important by setting a minimum level of verifying social commitment. It is communicated that TCO Development is primarily verifying the brand owner's procedures for promoting legal and human labour standards throughout the supply chain as specified in the mandate, but control audits for now are limited to the final production (1st tier). Here a brand shall conduct independent audits and address all findings (violations to the TCO mandate) with a corrective action plan (CAP). To date TCO Development cannot guarantee that violations don't occur but they are verifying a structured CSR policy and control routines toward production facilities. By entering in an agreement with TCO Development the brand agrees to annual 3rd party audits at supply factories and the sharing of audit reports, findings and corrective actions plans between the buyer, supplier and 3rd party (TCO Development and approved assessors) and also spot checks. It has taken some brands over 1.5 years to implement the necessary changes to their Code of Conducts and production control routines to be in-line with TCO Certified (even though brands have been involved with more established CSR initiatives for a long time). To date there are 17 brands TCO Development works with and requires that they annually demonstrate their commitment toward improving working conditions for socially responsible production at supplier level.

Further research and evidence

The international **standard SA8000**[104] is an auditable certification standard. Based on international workplace norms of International Labour Organisation (ILO) conventions, the Universal Declaration of Human Rights and the UN Convention on the Rights of the Child, it entails nine elements to measure social compliance. The third party accredited certification scheme foresees audits being conducted by approved SA8000 auditors.

[104] See http://www.sa-intl.org/index.cfm?fuseaction=Page.ViewPage&PageID=937

Table 29: SA8000 standard and their basis of ILO fundamental and further labour conventions

SA8000	8 ILO fundamental labour conventions	Further ILO labour conventions relevant to SA8000 implementation and auditing
Child Labour: No use or support of child labour; policies and written procedures for remediation of children found to be working in situation; provide adequate financial and other support to enable such children to attend school; and employment of young workers conditional.	• **Minimum Age** Convention (No. 138) • Worst Forms of **Child Labour** Convention (No. 182)	
Forced and Compulsory Labour: No use or support for forced or compulsory labour; no required 'deposits' - financial or otherwise; no withholding salary, benefits, property or documents to force personnel to continue work; personnel right to leave premises after workday; personnel free to terminate their employment; and no use nor support for human trafficking.	• **Forced Labour** Convention (No. 29) • Abolition of **Forced Labour** Convention (No. 105)	
Health and Safety: Provide a safe and healthy workplace; prevent potential occupational accidents; appoint senior manager to ensure OSH; instruction on OSH for all personnel; system to detect, avoid, respond to risks; record all accidents; provide personal protection equipment and medical attention in event of work-related injury; remove, reduce risks to new and expectant mothers; hygiene- toilet, potable water, sanitary food storage; decent dormitories- clean, safe, meet basic needs; and worker right to remove from imminent danger.		• Occupational Safety and Health Convention (No. 155) • Occupational Health Services Convention (No. 161) • Safety in the Use of Chemicals at Work Convention (No. 170); Prevention of Major Industrial Accidents Convention (No. 174) • Asbestos Convention (No. 162); White Lead (Painting) Convention (No. 13); Radiation Protection Convention (No. 115); Benzene Convention (No. 136) • Occupational Cancer Conv. (No. 139); Guarding of Machinery Conv. (No. 119); Maximum Weight Conv. (No. 127); Maternity Protection Conv. (No. 183 rev.); Medial Examination of Young Persons (Industry) Conv. (No. 77)
Freedom of Association and Right to Collective Bargaining: Respect the right to form and join trade unions and bargain collectively. All personnel are free to: organize trade unions of their choice; and bargain collectively with their employer. A company shall: respect right to organize unions	• **Freedom of Association** and Protection of the Right to Organise	• Workers' Representatives Convention (No. 135) • Collective Bargaining (No. 154)

SA8000	8 ILO fundamental labour conventions	Further ILO labour conventions relevant to SA8000 implementation and auditing
& bargain collectively; not interfere in workers' organizations or collective bargaining; inform personnel of these rights & freedom from retaliation; where law restricts rights, allow workers freely elect representatives; ensure no discrimination against personnel engaged in worker organizations; and ensure representatives access to workers at the workplace.	Convention (No. 87) • Right to Organise and **Collective Bargaining** Convention (No. 98)	
Discrimination: No discrimination based on race, national or social origin, caste, birth, religion, disability, gender, sexual orientation, union membership, political opinions and age. No discrimination in hiring, remuneration, access to training, promotion, termination, and retirement. No interference with exercise of personnel tenets or practices; prohibition of threatening, abusive, exploitative, coercive behaviour at workplace or company facilities; no pregnancy or virginity tests under any circumstances.	• **Discrimination** (Employment and Occupation) Convention (No. 111) • Equal **Remuneration** Convention (No. 100)	• Workers with Family Responsibilities Conv. (No. 156); Vocational Rehabilitation and Employment (Disabled Persons) Conv. (No. 159); Indigenous and Tribal Peoples Conv. (No. 169); Maternity Protection Conv. (No. 183); Migration for Employment Conv. (No. 97 rev.); Night Work (Women) Convention (Nr. 89 rev.)
Disciplinary Practices: Treat all personnel with dignity and respect; zero tolerance of corporal punishment, mental or physical abuse of personnel; no harsh or inhumane treatment.		
Working Hours: Compliance with laws & industry standards; normal work-week, not including overtime, shall not exceed 48 hours; 1 day off following every 6 consecutive work days, with some exceptions; overtime voluntary, not regular, not > 12 h/w; required overtime only if negotiated in CBA.		• Hours of Work (Industry) Convention (No. 1)
Remuneration: Respect right of personnel to living wage; all workers paid at least legal minimum wage; wages sufficient to meet basic needs & provide discretionary income; deductions not for disciplinary purposes, with some exceptions; wages and benefits clearly communicated to workers; paid in convenient manner – cash or check form; overtime paid at premium rate; prohibited use of labour-only contracting, short-term contracts, false apprenticeship schemes to avoid legal obligations to personnel.		• Minimum Wage Fixing Convention (No. 131)
Management Systems: Facilities seeking to gain&maintain certification must go beyond simple compliance to integrate the standard into their management systems & practices.		

The SA8000 standard includes the **eight fundamental labour conventions but goes far beyond them** including also principles on health and safety, disciplinary practices, working hours, remuneration (by especially addressing "living wages" and "overtime payment" linking to some major hot spots of the ICT manufacturing industry) and management systems.
Further, the standard strives towards **feasible implementation** of; for example, the Principle on Freedom of Association and Right to Collective Bargaining. In situations where the Right to freedom of association and collective bargaining are restricted under law, SA8000 standard still requires companies to allow workers to freely elect their own representatives. Furthermore, in cases where above mentioned fundamental rights are restricted under law SA8000 still requires that employers, as to the actions of their companies and suppliers, have the responsibility to allow the workplace to be one where workers can fully and without fear of retaliation exercise their right to unimpeded collective representation[105]. No discrimination against personnel being engaged in worker organizations shall be ensured; and representatives' access to workers at the workplace shall be ensured. With these specific additions and amendments to the ILO Core Labour standards, being able to be applied to any company, of any size, anywhere in the world, the SA8000 standard is viewed as the most globally accepted independent workplace standard[106].

According to EICC (2012)[107], the industry initiative Electronic Industry Citizenship Coalition's **(EICC) code of conduct** is applied by 60 manufacturers which voluntarily committed to ensure that working conditions in the electronics industry supply chain are safe, that workers are treated with respect and dignity, and that business operations are environmentally responsible and conducted ethically. However, WSI (2012)[108] identified some significant weaknesses of the EICC code of conduct:

[105] SA8000 ® Consolidated Guidance – Freedom of Association and Right to Collective Bargaining
[106] Cf. www.sgs.com/~/media/Global/Documents/Brochures/SGS_SSC_NG_SA_8000_web_LR.pdf
[107] Cf. http://www.eicc.info/documents/EICCCodeofConductEnglish.pdf
[108] WSI (2012): Wirtschafts- und Sozialwissenschaftliches Institut (WSI) in der Hans-Böckler-Stiftung: Öffentliche Beschaffung von IT-Mitteln (PCs) unter Berücksichtigung sozialer Kriterien; WSI-Diskussionspapier Nr. 183. Düsseldorf, 2012. Cf. http://www.boeckler.de/index_wsi.htm

- The labour standards are not based on the fundamental ILO labour conventions but rather on the national laws which might be weaker in some countries.
  - Especially regarding the Freedom of Association and Right to Collective Bargaining, the EICC codex falls behind the ILO and the SA8000 standards.
  - Further, the codex only implies regional minimum wages and not wages sufficient to meet basic needs (“living wages").
  - The right on employment security is not included at all.
- The monitoring is mainly based on self-evaluation; a systematic independent external audit is not part of the codex. In the monitoring process, no independent trade unions or labour rights organisations are included. Controls of the self-evaluation of suppliers are only taking place on a random basis.

The current **CSR criteria of TCO Development** include ILOs eight core conventions 29, 87, 98, 100, 105, 111, 138, and 182, the UN Convention on the Rights of the Child, Article 32, the health and safety legislation in force in the country of manufacture, and the labour law, including rules on minimum wage and the social security protection in the manufacturing country. In situations where the right to freedom of association and collective bargaining are restricted under law, workers shall be permitted to freely elect their own representatives. The verification mechanism is based on four different options (a) to (d):

(a) The Brand owner is a member of EICC and provides documented proof of third party audits conducted at production facilities of TCO certified products.

(b) The Brand owner is SA8000 certified **or** carrying out the production at SA8000 certified facilities and provides documented proof of third party audits conducted at production facilities of TCO certified products.

(c) The Brand owner shall complete the self-documentation according to a questionnaire provided by TCO Development and provide documented proof of third party audits conducted at production facilities of TCO certified products.

(d) The Brand owner applies for a 12 month grace period by sub-mitting a signed declaration stating which option above (a, b or c) shall be implemented by them and an estimation of when all the necessary documented proof will be available.

According to WSI (2012), the linkage to the eight ILO core conventions, the explicit addressing of options in cases where freedom of association and collective bargaining are restricted under law, as well as the more explicitly regulated monitoring approach go far beyond that of EICC. However, WSI (2013) sees optimization potential with regard to the following aspects:

- In case of weaker national laws, the TCO standards are hardly going beyond the ILO core conventions as for example aspects as living wages or social security are not addressed.
- Option (b) allows the interpretation or possibility that a headquarter of a brand company, situated in a Western developed country, could be SA8000 certified to fulfil the criteria on verification.

From perspective of Germanwatch, an independent development and environmental organization in Germany with focus and deep expertise on CSR activities in the supply chain, which has been interviewed by the study team on 19 March 2014, membership in EICC and self-declaration would not be a sufficient option as verification mechanism.

3.5.1.2 Second proposal for social supply chain criteria

Proposed new criterion (second proposal, Option A)
'Labour conditions during manufacturing' (<u>required</u>) The applicant shall demonstrate that the product is manufactured under working practices that promote good labour relations and working conditions by proving that more than 90% of the first-tier suppliers (final product assembly) comply with the following ILO Conventions: a) **Child Labour**: i. ILO Core Convention "Minimum Age" (No. 138) ii. ILO Core Convention "Worst Forms of Child Labour" (No. 182) b) **Forced and Compulsory Labour**: i. ILO Core Convention "Forced Labour" (No. 29) ii. ILO Core Convention "Abolition of Forced Labour" (No. 105) c) **Freedom of Association and Right to Collective Bargaining**: i. ILO Core Convention "Freedom of Association and Protection of the Right to Organise" (No. 87) ii. ILO Core Convention "Right to Organise and Collective Bargaining" (No. 98) d) **Discrimination**: i. ILO Core Convention "Discrimination (Employment and Occupation)" (No. 111) ii. ILO Core Convention "Equal Remuneration" (No. 100) e) **Working Hours**: i. ILO Convention "Hours of Work (Industry)" (No. 1)

f) **Remuneration**:

i. ILO Convention "Minimum Wage Fixing" (No. 131)

ii. **Living wage**: The applicant shall ensure that wages paid for a normal work week shall always meet at least legal or industry minimum standards and shall be sufficient to meet the basic needs of personnel and to provide some discretionary income; with reference to SA8000 Consolidated Guidance "Remuneration" regarding definition, implementation, auditing and evidence of compliance

Assessment and verification:

The applicant shall declare compliance with these requirements to the Competent Body providing the copies of the certificates of Accredited Certification Bodies (CBs) accredited by Social Accountability Accreditation Services (SAAS) showing the compliance with the above requirements in more than 90% of the first-tier suppliers (final product assembly).

Additionally, the applicant shall provide to the Competent Body

- A list of first-tier suppliers representing at least 90% of procurement expenditure for final product assembly of computers.
- The independent social audit reports to verify that he is fulfilling its obligations according to this mandate.

Additionally, the applicant shall publish the independent social audit reports of the first-tier suppliers online to provide evidence to interested consumers.

Major proposed changes

- Despite feedback from manufacturers asking for a "slight" version not putting an excessive burden on the applicant to prove compliance with the criteria (i.e. code of conduct, self-declaration), the study team recommends – when implementing criteria on labour conditions during manufacturing into the EU Ecolabel at all – these should be adequate, effective and verifiable.
- According to expert judgement, a basic linkage to the 8 fundamental ILO labour conventions and the (often weaker) national labour laws would not be sufficient enough to address the social hot spots being specific to computers' manufacturing processes, especially those on working hours and remuneration.
- Thus, as minimum criteria the 8 ILO core conventions are proposed, added by two further ILO conventions on working hours and remuneration, together with an independent third-party auditing scheme.
- In terms of remuneration, ILO's Minimum Wage Fixing Convention 131 (1970) specifies in Article 3 (a) and (b) that the following two elements are taken into consideration in determining the minimum wage:

- 1. “The Needs of workers and their families taking into account the general level of wages in the country, the cost of living, social security benefits, and the relative living standards of other social groups;
- 2. Economic factors, including the requirements of economic development, levels of productivity, and the desirability of attaining and maintaining a high level of employment.”

According to SA8000[109], they experienced that in most countries these two considerations are odds and may not be weighted equally in the determination of the minimum wage. To attract foreign investment and international buyers, countries may emphasize economic growth and development. Minimum wages are often set to compete with low cost suppliers in other countries and not to promote workers’ interests. Therefore, many countries have minimum wage levels that do not meet the basic needs of workers and their families. These wages also frequently do not reflect inflation and other factors that affect actual standards of living. Lack of enforcement of even these minimal rates of pay is common, forcing workers to work excessive overtime just to earn the legal minimum wage. Due to this reason, the proposed EU Ecolabel criteria include an additional requirement on “living wage” being sufficient to meet the basic needs of personnel and to provide some discretionary income. For definition of “living wages”, interpretations, implementation, auditing and evidence of compliance, reference is made to the SA8000 Consolidated Guidance on Remuneration[110].

- Regarding assessment and verification, the fulfilment of requirements shall be verified by providing certificates of independent accredited certification bodies.
- The social requirements are proposed not to address the whole supply chain but only first-tier suppliers (final product assembly). This is due to the fact that first-tier suppliers (contract manufacturers) more and more act vertically within the supply chain from purchasing to final assembly (cf. WKI 2012). Further,

[109] Source: http://www.sa-intl.org/_data/n_0001/resources/live/SA8000Remuneration.pdf
[110] See http://www.sa-intl.org/_data/n_0001/resources/live/SA8000Remuneration.pdf

social aspects regarding hotspots of raw materials extraction will be addressed more specifically by criterion 5.2 'Use of conflict-free minerals'.

- For most manufacturers, the final assembly of their ICT products takes place at a limited number of contract manufacturers. Providing a list of first-tier suppliers summing up to at least 90% of procurement expenditure for final assembly (see for example Apple's information on suppliers[111]) would facilitate the Competent Bodies to cross-check with the availability of independent audit reports as also being required for verification. Online publication of audit reports would improve the overall transparency of the ICT supply chain.

Proposed new criterion (second proposal, Option B)
'Labour conditions during manufacturing' (optional) The applicant shall demonstrate that the product is manufactured under working practices that promote good labour relations and working conditions by proving that more than 90% of the first-tier suppliers (final product assembly) comply with the following principles (derived from SA8000, including ILO all fundamental as well as further relevant labour conventions): a) **Child Labour**: No use or support of child labour; policies and written procedures for remediation of children found to be working in situation; provide adequate financial and other support to enable such children to attend school; and employment of young workers conditional. b) **Forced and Compulsory Labour**: No use or support for forced or compulsory labour; no required 'deposits' - financial or otherwise; no withholding salary, benefits, property or documents to force personnel to continue work; personnel right to leave premises after workday; personnel free to terminate their employment; and no use nor support for human trafficking. c) **Health and Safety**: Provide a safe and healthy workplace; prevent potential occupational accidents; appoint senior manager to ensure OSH; instruction on OSH for all personnel; system to detect, avoid, respond to risks; record all accidents; provide personal protection equipment and medical attention in event of work-related injury; remove, reduce risks to new and expectant mothers; hygiene- toilet, potable water, sanitary food storage; decent dormitories- clean, safe, meet basic needs; and worker right to remove from imminent danger. d) **Freedom of Association and Right to Collective Bargaining**: Respect the right to form and join trade unions and bargain collectively. All personnel are free to: organize trade unions of their choice; and bargain collectively with their employer. A company shall: respect right to organize unions & bargain collectively; not interfere in workers' organizations or collective bargaining; inform personnel of these rights & freedom from retaliation; where law restricts rights, allow workers freely elect representatives; ensure no discrimination against personnel engaged in worker organizations; and ensure representatives access to workers at the workplace. e) **Discrimination**: No discrimination based on race, national or social origin, caste, birth, religion, disability, gender, sexual orientation, union membership, political opinions and age. No discrimination in hiring, remuneration, access to training, promotion, termination, and retirement. No interference with exercise of personnel tenets or practices; prohibition of threatening, abusive, exploitative, coercive behaviour at workplace or company facilities; no pregnancy or virginity tests

[111] Cf. http://www.apple.com/supplier-responsibility/our-suppliers/ and http://images.apple.com/supplier-responsibility/pdf/Apple_Supplier_List_2014.pdf

under any circumstances.

f) **Disciplinary Practices**: Treat all personnel with dignity and respect; zero tolerance of corporal punishment, mental or physical abuse of personnel; no harsh or inhumane treatment.

g) **Working Hours**: Compliance with laws & industry standards; normal work-week, not including overtime, shall not exceed 48 hours; 1 day off following every 6 consecutive work days, with some exceptions; overtime voluntary, not regular, not > 12 h/w; required overtime only if negotiated in CBA.

h) **Remuneration**: Respect right of personnel to living wage; all workers paid at least legal minimum wage; wages sufficient to meet basic needs & provide discretionary income; deductions not for disciplinary purposes, with some exceptions; wages and benefits clearly communicated to workers; paid in convenient manner – cash or check form; overtime paid at premium rate; prohibited use of labour-only contracting, short-term contracts, false apprenticeship schemes to avoid legal obligations to personnel.

i) **Management Systems**: Facilities seeking to gain and maintain certification must go beyond simple compliance to integrate the standard into their management systems & practices.

Assessment and verification:

The applicant shall declare compliance with these requirements to the Competent Body providing the copies of the certificates of Accredited Certification Bodies (CBs) accredited by Social Accountability Accreditation Services (SAAS) showing the compliance with the above requirements in more than 90% of the first-tier suppliers (final product assembly).

Additionally, the applicant shall provide to the Competent Body

- A list of first-tier suppliers representing at least 90% of procurement expenditure for final product assembly of computers.
- The independent social audit reports to verify that he is fulfilling its obligations according to this mandate.

Additionally, the applicant shall publish the independent social audit reports of the first-tier suppliers online to provide evidence to interested consumers.

Major proposed changes

- Despite feedback from manufacturers asking for a “slight” version not putting an excessive burden on the applicant to prove compliance with the criteria (i.e. code of conduct, self-declaration), the study team recommends – when implementing criteria on labour conditions during manufacturing into the EU Ecolabel at all – these should be adequate, effective and verifiable.
- According to expert judgement, a basic linkage to the 8 fundamental ILO labour conventions and the (often weaker) national labour laws would not be sufficient enough to address the social hot spots being specific to computers’ manufacturing processes.
- On the other hand, the nine elements of the SA8000 standard, based on the 8 ILO core conventions but adding further relevant requirements and providing modified options for cases where the national law restricts those rights, together

with an independent third-party auditing scheme, are seen as best practicable option to date. Thus, a general linkage to the nine principles as used by the SA8000 standard builds the basis for this criterion, however not referencing to SA8000 directly.

- Regarding assessment and verification, the fulfilment of requirements shall be verified by providing certificates of independent accredited certification bodies.
- The social requirements are proposed not to address the whole supply chain but only first-tier suppliers (final product assembly). This is due to the fact that first-tier suppliers (contract manufacturers) more and more act vertically within the supply chain from purchasing to final assembly (cf. WKI 2012). Further, social aspects regarding hotspots of raw materials extraction will be addressed more specifically by criterion 5.2 'Use of conflict-free minerals'.
- For most manufacturers, the final assembly of their ICT products takes place at a limited number of contract manufacturers. Providing a list of first-tier suppliers summing up to at least 90% of procurement expenditure for final assembly (see for example Apple's information on suppliers[112]) would facilitate the Competent Bodies to cross-check with the availability of independent audit reports as also being required for verification. Online publication of audit reports would improve the overall transparency of the ICT supply chain.

Complying with the principles of SA8000 is proposed not to be defined as minimum requirement / exclusion criteria but as option for complying manufacturers to highlight this fact besides the label.

[112] Cf. http://www.apple.com/supplier-responsibility/our-suppliers/ and http://images.apple.com/supplier-responsibility/pdf/Apple_Supplier_List_2014.pdf

3.5.1.3 Stakeholder feedback following AHWG2 and further evidence

The main points arising from the 2nd AHWG meetings for Televisions were as follows:

- Several stakeholders stated the necessity of focusing on practical and implementable social criteria. Option A that address 8 fundamental ILO conventions and additional hot spots of the IT industry (working hours and wages) is seen as practical and feasible criteria.

- From industry side, they remarked difficulties in complying with TCO. Go beyond that would be very ambitious.

- However other CB stated that Ecolabel is an environmental project and should not try to tackle social issues. This would result in additional workload and discourage uptake.

- Clarification by JRC that is not the production but the final assembly having the social audit and that further explanations (e.g. Living wage definition) will be included in user manual.

The main points arising from written comments received after the 2nd AHWG meetings for Televisions were as follows:

There was a general preference for Option A as presented (a strengthened version of the TCO approach). A Member State highlighted the need to be practical and felt that it was difficult to go further than the ILO conventions. Another stakeholder stated that the focus should be on what is implementable today.

A Member State questioned the extent to which the proposed additional provision for a living wage would have an impact. Transparency via publication of activities was welcome, however.

Concern was raised by another Member State that the Ecolabel was an environmental and not a social label. It could result an additional workload and discourage uptake. They were not in a position to verify and control such a criterion. On one hand it is easy for verification to be faked whilst on the other hand third party verification can be expensive.

An industry stakeholder expressed that in the assessment and verification part for this criterion a differentiation between OEM (original equipment manufacturer) and ODM (original design manufacturer) should be made, since the meaning of "first-tier suppliers" in this context differs.They said that their company is an OEM that owns the EU TV final assembly facilities. For this reason, the requirement for "90% of procurement expenditure" should not be applicable for OEMs.

An industry stakeholder submitted a proposal for the criterion to be based on the EICC Code of Conduct. Other Codes of Conduct could also be accepted, as is the case with the TCO Development criterion. Supplementary to this main proposal it was also suggested that manufacturers should:

- Identify how they are engaging with suppliers to building their capacity for social and environmental responsibility;
- Publish a list of 1st tier manufacturing sites;

Publish aggregated audit results linked to coverage by expenditure;

Further research and evidence

- *Addressing identified perceived weakpoints with EICC processes*
- Feedback from industry stakeholders requested alignment with the Electronic Industry Citizenship Coalition's (EICC) Code of Conduct. As was previously

highlighted, the EICC CoC, although providing a positive framework for action on social issues by manufacturers, raises a number of concerns relating to 'social hot spots' in the supply chain and the monitoring/audit processes:

- The labour standards are not based on the fundamental ILO labour conventions but rather on the national laws which might be weaker in some countries.
  - The Freedom of Association and Right to Collective Bargaining requirements fall behind the Core ILO and SA8000 standards.
  - Moreover, the CoC only implies regional minimum wages and not wages sufficient to meet basic needs ("living wages").
  - Rights relating to employment security are not addressed.
- Monitoring is mainly based on self-evaluation and in the monitoring process, no independent trade unions or labour rights organisations are included. Controls of the self-evaluation of suppliers only take place on a random basis.
- Reviewing further the EICC it can be seen that a 'Validated Audit Process' is also offered alongside monitoring based on self-assessment. Audits are carried out by third party auditors that are trained and accredited by the EICC's appointed audit manager, Vectra [113].
- Although the SA8000 audit process focusses in a similar way to the EICC VAP audit process on interviews with the employer and workforce, it also identifies consultation with external stakeholders as being important. The SA8000 audit guidance describes how stakeholders shall be involved prior to the audit process [114]:

  'The interested stakeholders to be consulted include: workers, trade unions, research institutions, NGOs, community organisations, and labor experts. The groups being consulted may be asked if any facility in the area has particular problems and/or for comments on a list of facilities including the audited

[113] EICC, *Validate Audit Process*, Accessed 2014, http://www.eiccoalition.org/standards/assessment/validated-audit-process/

[114] Social Accountability International (2004) *Guidance document for Social Accountability 8000*,

facility, but auditors should not identify the applicant facility prior to certification.'

This wider engagement is intended to assist auditors to 'build up a picture of working conditions at the enterprises in advance of the verification process'. The guidance specifically refers to the convening of meetings of local groups.

3.5.1.4 Revised proposal for labour conditions during manufacturing criteria

Proposed revised criterion
Labour conditions during manufacturing The applicant shall obtain third party certification that the fundamental principles and rights at work as described in the International Labour Organisation's (ILO) Core Labour Standards, the UN Global Compact and the OECD Guidelines for Multi-National Enterprises are respected by final assembly plants for the product. For the purpose of verification the following ILO Core Labour Standards and supplementary provisions shall be referred to: g) **Child Labour**: i. ILO Core Convention "Minimum Age" (No. 138) ii. ILO Core Convention "Worst Forms of Child Labour" (No. 182) h) **Forced and Compulsory Labour**: i. ILO Core Convention "Forced Labour" (No. 29) ii. ILO Core Convention "Abolition of Forced Labour" (No. 105) i) **Freedom of Association and Right to Collective Bargaining**: i. ILO Core Convention "Freedom of Association and Protection of the Right to Organise" (No. 87) ii. ILO Core Convention "Right to Organise and Collective Bargaining" (No. 98) j) **Discrimination**: i. ILO Core Convention "Discrimination (Employment and Occupation)" (No. 111) ii. ILO Core Convention "Equal Remuneration" (No. 100) k) **Working Hours**: i. ILO Convention "Hours of Work (Industry)" (No. 1) l) **Remuneration**: i. ILO Convention "Minimum Wage Fixing" (No. 131) ii. **Living wage**: The applicant shall ensure that wages paid for a normal work week shall always meet at least legal or industry minimum standards and shall be sufficient to meet the basic needs of personnel and to provide some discretionary income; with reference to SA8000 Consolidated Guidance "Remuneration" regarding definition, implementation, auditing and evidence of compliance The audit process shall include consultation with external stakeholders in local areas around sites, including trade unions, community organisations, NGO's and labour experts. The applicant shall publish the audit reports online to provide evidence to interested consumers.

Assessment and verification**:** *the applicant shall certify compliance with these requirements by providing copies of certificates of compliance and supporting audit reports for each final product assembly plant for the model(s) to be ecolabelled.*

Certificates shall be issued by certification bodies accredited by Social Accountability Accreditation Services (SAAS) or approved auditors for the Electronics Industry Citizenship Coalition's (EICC) Validated Audit Process. Valid certifications from schemes or processes that audit compliance with the listed Core ILO Conventions, together with the additional provisions on working hours and remuneration, shall be accepted.

Major proposed changes

- The basic safety net of the Core ILO Conventions is to be retained, together with the additional provisions relating to minimum and living wages.
- Additional reference is to be made to the UN Global Compact and the OECD Guidelines for Multi-National Enterprises, reflecting discussions in other product groups with DG Trade.
- Additional reference shall be made in-line with SA8000 to the need to involve 'trade unions, community organisations, NGO's and labour experts' in the local area around sites.
- The potential for third party auditing by EICC accredited VAP auditors is proposed alongside SAAS accredited auditors. This is considered to provide greater scope for applicants who are members of EICC to comply with the criterion, albeit with stricter additional requirements relating to the audit process, ILO coverage and minimum/living wages.
- It is to be discussed by the EUEB whether with the proposed level of assurance the criterion would be too selective for the product group as a whole.

3.5.2 Criterion 5.2 – Use of 'conflict-free minerals' during production

3.5.2.1 First proposal for conflict-free minerals criteria

Proposed new criterion (first proposal)
'Conflict-free minerals' in electronics The applicant must make efforts to support the responsible sourcing of "conflict-free minerals" from the African Great Lakes Region for the use in the electronics of his electronic displays. *Assessment and verification*: The applicant shall declare the compliance with these requirements and shall provide additionally a description of the way he engages in responsible sourcing projects in the African Great Lakes Region (e.g. membership in a voluntary industry initiative, e.g. the Public Private Alliance, the Conflict-Free Tin Initiative or the Solutions for Hope Project) to the competent body.

Electronic displays like televisions and external computer displays contain a whole range of scarce resources which are largely mined in the Democratic Republic of Congo, a conflict region, under dangerous conditions, without sufficient maintenance of health and safety standards and often by children. However, instead of a criterion to exclude of the use of conflict minerals, bearing the potential for a de facto embargo of minerals from a whole region being economically and socially dependent from the mining industry, for the EU ecolabel revision a process oriented approach has been proposed to stimulate sustainable sourcing.

For more details cf. Task 4 report "Improvement Potential", section 4.2.5.2.1 "Minimizing the risk of using 'conflict metals' in electronics".

3.5.2.2 Stakeholder feedback and further evidence

According to written stakeholder feedback following the AHWG meeting, the inclusion of such a criterion is explicitly supported by one of the stakeholders.

Another stakeholder supports this criterion since they have put in place due-diligence mechanisms to avoid the purchase of minerals illegally sourced from conflict regions. However, it is proposed that the EU Commission rewords this criterion since manufacturers cannot legally guarantee or certify 100% conflict free mineral sourcing. Due to the inherent issues in complex supply chain management, what manufacturers can offer is to put in place a good due-diligence mechanism, but cannot fully control or verify the initial sourcing of the minerals by their upstream suppliers.

Further research and evidence show that the requirement needs to specify the materials in scope, which is mostly defined as tin, tantalum, tungsten and their ores and gold. Responsible sourcing projects can be specified geographically by defining activities carried out within on the fringes of the resource-conflict hot spot (the eastern parts of the Democratic Republic of the Congo) and by their compliance with the *OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas,* which was specifically tailored to the responsible sourcing of tin, tantalum, tungsten and gold.

3.5.2.3 Second proposal for conflict-free minerals criteria

Proposed new criterion (second proposal)
'Conflict-free minerals' in electronics The applicant shall support the responsible sourcing of "conflict-free minerals" from the African Great Lakes Region. In this context, the material scope encompasses tin, tantalum, tungsten and their ores and gold. *Assessment and verification*: The applicant shall declare the compliance with these requirements and shall provide additionally a description of the way he engages in responsible sourcing projects in the African Great Lakes Region for at least one of the above listed conflict minerals to the Competent Body. As responsible sourcing projects, all activities carried out within the Democratic Republic of the Congo that aim to source minerals in accordance with the *OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas* are eligible (e.g. the Public Private Alliance for Responsible Minerals Trade, the Conflict-Free Tin Initiative, and the Solutions for Hope Project).

Major proposed changes

- The section "[…] for use in their computer products" *has been* removed as this significantly limits the possibilities of companies (e.g. activities in the great Lakes Region that lead to responsible sourcing did not yet yield material output should also be able to qualify for this requirement).
- The scope is further specified (tin, tantalum, tungsten and their ores and gold).
- It is specified that applicants have to engage in activities that address at least one of the above listed materials.
- The definition 'responsible sourcing projects' was further specified and encompasses projects carried out within the Democratic Republich of the Congo being in accordance with the widely recognised OECD Due Diligence Guidance for

Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas.

- The focus on the Democratic Republic of the Congo is justified by the fact that it is the primary conflict region and the region where mineral mining and trading are closely linked to conflict. Although the other countries of the Great Lakes Region are covered by relevant policy instruments (e.g. Dodd-Frank Act Section 1502), this has to do with fact that these countries might act as transit countries for smuggled ores from the DR Congo. Generally, it is widely recognised that a focus on the DR Congo has the highest development priority.

3.5.2.4 Stakeholder feedback following AHWG2 and further evidence

The main points arising from the 2nd AHWG meetings for Televisions were as follows:

- Concerning the criteria on conflict free mineral DG TRADE briefly explained the current EU initiatives on promoting clean chains of supply for 3TG. There is a regulation establishing a voluntary system of certification of EU importers and a publication by the EC of a list of responsible smelters. Besides there is a communication to further incentivise responsible supply (e.g. public procurement condition to EU institutions). The issue concerning Ecolabel is to assure a level of homogeneity between instruments.

- It was mentioned that maybe Ecolabel should be awarded only to products that can prove they source from conflict regions but do so responsibly. It was remarked the difficulties on defining conflict free region.

- An industry stakeholder mentioned that their company is too far down the supply chain to influence smelters. A CB stakeholder sees the proposal to force sourcing from conflict regions as being unrealistic.

The main points arising from written comments received after the 2nd AHWG meetings for Televisions were as follows:

A CB stakeholder expressed that they like the idea of the criterion but they think it could be tighter and they proposed the following lines: "*The applicant shall not use "conflict free" minerals (tin, tantalum, tungsten and their ores and gold) from the African Great Lakes Region.*
Assessment & Verification: The Applicant shall make a declaration to this effect and supply supporting evidence e.g. proof of use of a smelter participating in the conflict-free smelters program or equivalent"

An industry stakeholder understands that the current criterion proposal will suffer considerable changes, so further comments will be provided when new wording is proposed.

Towards an integrated EU approach

At the AHWG2 DG TRADE outlined work by the Commission to address the Conflict-free sourcing for end-products containing tin, tantalum, tungsten and gold. The proposed approach is outlined in Joint Communication JOIN(2014)8 [115] which includes proposals for public procurement guidance.

Although the Communication highlights the significance of the OECD's Due Diligence guidance as a framework for action it cites fragmented compliance efforts, including a wide range of public and private initiatives, as well as the limited incentives to act as barriers to further progress.

A draft Regulation is proposed which would introduce a requirement for due diligence along the supply chain for EU importers, reflecting the approach promoted by the OECD. It describes a responsible importer due diligence self-certification requirement linked to the establishment of a list of responsible smelters and refiners .

[115] Joint Communication to the European Parliament and the Council on *Responsible sourcing of minerals originating in conflict-affected and high-risk areas: Towards an integrated EU approach*, JOIN(2014)8

The Commission also proposes to broaden the geographical scope of conflict areas adopted under the Dodd Frank Act to any '*areas in a state of armed conflict, fragile post-conflict as well as areas witnessing weak or non-existing governance and security, such as failed states, and widespread and systematic violations of international law, including human rights abuses*.'

3.5.2.5 Revised proposal for conflict free minerals criteria

Proposed revised criterion
Sourcing of 'conflict-free' minerals The applicant shall support the responsible sourcing of tin, tantalum, tungsten and their ores and gold from conflict-affected and high-risk area by: (i) Conducting due diligence in line with the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas, and (ii) by actively supporting at least one on-the-ground-project promoting responsible mineral production and trade in accordance with OECD and EU guidance within conflict-affected and high-risk areas. ***Assessment and verification***: *The applicant shall declare the compliance with these requirements together with the following supporting information:* • *A report describing their due diligence activities along the supply chain for the four minerals identified, and* • *Descriptions of the project(s) they are engaged with, which of the four minerals are addressed and how they contribute to responsible sourcing.*

Major proposed changes

- Reflecting the Commission's proposed approach the criterion has been redrafted with a less geographically specific focus and with reference to the OECD guidance on Due Diligence.

3.6 Cluster 6 – Further criteria

3.6.1 Criterion 6.1 – Ergonomics

So far, no ecolabel explicitly for televisions include criteria on visuable ergonomics, however, for external computer displays, TCO Certified Displays 2012, contain criteria regarding visual ergonomics (image detail, luminance, luminance contrast, reflection and screen colour) and work load ergonomics (vertical tilt, and vertical height); the Blue Angel ecolabel for computer monitors (2012) as well as Nordic Swan align to TCO Certified Displays with regard to ergonomics.

Consultation questions
• Should the EU ecolabel for electronic displays, especially for the external computer displays, include criteria for (visuable and/or workload) ergonomics, e.g. aligning them to the TCO criteria?

3.6.1.1 Stakeholder feedback and further evidence

According to written stakeholder feedback following the AHWG meeting, one of the stakeholders states that ergonomics criteria can be introduced but if an impulse should be given to this EU Ecolabel product group, it is proposed not to align too much to other private labels which are more known and widespread than the Ecolabel in this sector and that could, at the end, be preferred by the applicants instead of the Ecolabel just because being better known on the market and maybe because they require less number of criteria to comply with.

Further research and evidence

The label TCO Certified Displays 6.0 defines a broad range of requirements for visual and workload ergonomics:

Visual ergonomics		**Workload ergonomics**
Image detail characteristics	• Native display resolution requirement	Vertical tilt
Luminance characteristics	• Luminance level • Luminance uniformity • Black level • Luminance uniformity – angular dependence • Greyscale gamma curve	Vertical height
Luminance contrast characters	• Luminance contrast – characters • Luminance contrast – angular dependence	
Reflection characteristics	• Front frame gloss	
Screen colour	• Correlated colour temperature, CCT, variation	

characteristics	• Colour uniformity • RGB settings • Colour uniformity – angular dependence • Colour greyscale linearity	

The German Ecolabel Blue Angel for Computer Monitors (RAL UZ 78c, edition January 2012)[116] includes the following criterion regarding ergonomics (however, no ergonomics criteria are in place for Televisions, RAL UZ 145):

The ergonomic properties of flat-panel monitors for personal computers shall be tested according to DIN EN ISO 9241-307 and at least meet the requirements of pixel error class 2. This requirement shall be considered met if the product is certified under TCO Certified Displays 5.2.
Compliance Verification
The applicant shall evidence compliance with the ergonomics requirements by submission of the test protocol prepared by an independent testing laboratory accredited under DIN EN ISO/IEC 17025. Alternatively, the applicant shall provide evidence (Annex 3) that the product has been certified under TCO Certified Displays 5.2.

Also, the ECMA-370 standard[117], specifying environmental attributes and measurement methods for ICT and CE products, defines an ergonomics criterion for computer products:

For computing products it shall be declared if the monitor/display meets the ergonomic requirements of ISO 9241-307.

Pixel error class

According to Fujitsu[118], TFT monitors are made up of a set number of pixels with each three sub-pixels being red, green and blue. They each consist of their own transistors that control whether or not it lights up. Due to the way in which panels are made, defects can appear resulting in 'dead pixels' which cannot be repaired neither can it be predicted when the failure may occur. The monitor can be working at 100% however can consist of pixels or sub-pixels which are either:
a) Permanently dark or light which is not always evident, OR
b) A constant flash which is more noticeable.

[116] Cf. http://www.blauer-engel.de/en/products_brands/search_products/produkttyp.php?id=619
[117] Cf. http://www.ecma-international.org/publications/standards/Ecma-370.htm
[118] Source: http://uk.ts.fujitsu.com/rl/servicesupport/techsupport/monitors/iso_13406-2.htm

The standard ISO 9241-307 Class II defines the LCD specific ergonomics standards. One of the quality criteria of the ISO standard is the pixel error tolerance. The standard ISO 9241-307 Class II provides transparency and gives the customer and the manufacturer a clearly defined and thus comparable warranty claim definition, in which the pixel fault classes are given. An overview of the pixel fault classes and types is shown in the following excerpt from the standard ISO 9241-307 Class II[119]. The table defines the maximal permissible number and kind of pixel faults per 1 million pixel.

Table 30: Overview of pixel fault classes and types (Source: Edge10)

Pixel defect category	The number of pixel defects is defined per 1 million pixel.		
	Defect Typ 1 (constantly bright pixel)	Defect Typ 2 (constantly dark pixel)	Defect Typ 3 (defect subpixel, either constantly bright red, green, blue or constantly dark)
I	0	0	0
II	2	2	5
III	5	15	50
IV	50	150	500

Class I monitors are guaranteed products which do not have any defects at all however it is rare to find a manufacturer offering such high quality products.

3.6.1.2 First proposal for ergonomics criteria

Following stakeholder feedback, it is proposed not to align the total ergonomics requirements of the label TCO Certified Displays to the EU Ecolabel criteria as this is a well-established label on the market especially known for ergonomics of display products.

Thus, it is proposed to set a minimum quality criterion on the pixel error class as defect pixels might lead to shorter lifetime of the overall display product. For this reason, it could be discussed if this criterion should be moved to Cluster 3 on Lifetime extension criteria.

[119] Source: http://www.edge10.com/en/support-5/pixel-policy.html

Proposed new criterion (first proposal)
'Ergonomics' The ergonomic properties of electronic displays shall be tested according to EN ISO 9241-307 and at least meet the requirements of pixel error class 2. *Assessment and verification* The applicant shall evidence compliance with the ergonomics requirements by submission of the test protocol prepared by a testing laboratory accredited under EN ISO/IEC 17025.

3.6.1.3 Stakeholder feedback following AHWG2 and further evidence

The main points arising from the 2nd AHWG meetings for Televisions were as follows:

- Visual ergonomics was presented as further criteria which apart of minimum quality could have an influence on lifetime extension. A CB stakeholder expressed that quality should only be addressed when there is a clear trade-off with environmentally relevant issues.

The main points arising from written comments received after the 2nd AHWG meetings for Televisions were as follows:

- A stakeholder asked to verify the cost of this test EN ISO 9241-307

- From industry side they said that it is technically complicate (e.g., wide viewing angle and Gamma Curve requirements are particularly difficult to satisfy) and economically burdensome.

Regarding the low feedback and that there is not a clear trade-off with environmentally relevant issues of visual ergonomics the study team decided not to include a new criterion on ergonomics to the product group televisions / displays at all.

3.6.2 Criterion 6.2 – Emission of fluorinated GHG during LCD production

3.6.2.1 First proposal for fluorinated GHG criteria

Proposed new criterion (first proposal)
Fluorinated GHG emission during LCD production Electronic displays with integrated LCD panel must be produced in a way that the fluorinated greenhouse gases NF_3 and SF6, if part of the production process, are abated by a system that is an integrated part of the production process. *Assessment and verification*: The applicant shall declare the compliance with these requirements and shall additionally provide a description of the implementation process at suppliers/sub-contractors (i.e. LCD panel makers) to the competent body.

Fluorinated greenhouse gases (GHG) are among the most potent and persistent GHG contributing to global climate change; they are relevant in the manufacture of semiconductors, light emitting diodes and LCD flat panel displays. As it is currently difficult set product-related criteria (difficulties to compare panel suppliers' F-GHG emissions due to a lack of consistency in estimating emissions, estimating emissions reductions, and monitoring the efficacy of installed abatement systems), within the EU ecolabel revision a process oriented approach has been proposed, based on a proposal in the current revision of Nordic Ecolabelling criteria for television displays. For more details cf. Task 4 report “Improvement Potential”, section 4.2.5.2.2 “Minimizing the use of F-gases in the production”.

3.6.2.2 Stakeholder feedback and further evidence

According to written stakeholder feedback following the AHWG meeting, one of the stakeholders confirms this new criteria proposal to be interesting and important but asks to verify the feasibility in order to prevent that no one could apply for Ecolabel Criteria with too stringent or too ambitious criteria.
Another stakeholder explicitly supports the inclusion of such a criterion.
On the other hand, concerns are raised by one of the manufacturers arguing that they cannot interfere with suppliers' manufacturing processes that do not have direct impacts on the parts they supply to manufactures. For this reason, there is a limitation in TV manufacturers requiring display manufacturers to implement certain Fluorinated GHG (F-gas) abatement programs; however they could encourage them

to address the F-gas abatement issue as part of their environmental management. The criterion, if maintained, needs to be a general information requirement rather than a prescriptive requirement. It should be noted that there may be a confidentiality issue relating to actual F-gas abatement programs implemented by display manufacturers, so NDA may be required in submitting relevant information to the competent body.

Further research and evidence

The overall consensus of stakeholder opinion following the 1st Ad-Hoc Working Group (AHWG) meeting in October 2013 was to explore further the feasibility of such a criterion. In order to do this further technical information was required from manufacturers of electronic displays and their LCD panel suppliers by a short questionnaire.

- Feedback was given that the manufacturer of a television is not a manufacturer of flat panel displays. Thus, improving the emissions from flat panel display manufacturing would have to take place at their suppliers.
- Specific requirements concerning the reduction of fluorinated GHGs to LCD suppliers are seen as difficult as the manufacturer cannot interfere with suppliers' manufacturing processes that do not have direct impacts on the parts they supply to manufacturers. Thus, there is a limitation in TV manufacturers requiring display manufacturers to implement certain Fluorinated GHG (F-gas) abatement programs.
- It is seen as possible from manufacturer’s view to encourage/support their display suppliers to address the F-gas abatement issue as part of their environmental management.
- According to a display supplier there are technical limitations effecting it currently being inevitable that F-Gases have to be used in LCD manufacturing processes.
- Further, there might be a confidentiality issue relating to actual F-gas abatement programs implemented by display manufacturers.

- Following efforts are known for improving the emissions from flat panel display manufacturing:
  - Participation in WLICC (Word LCD Industry Cooperation Committee) with Korean, Japanese, Chinese and Taiwanese LCD manufacturers companies making several efforts to reduce F-gas emission voluntarily. WLICC has been organized in July 2001 for a new industrial mechanism aimed at contributing to the promotion of global LCD industry cooperation to work on environmental issues. WLICC has made efforts to reduce PFC emission through fair and equitable burden among members, and active information exchanges, adopting effective approaches toward implementation of global warming countermeasures.
  - Being designated as one of the companies that are managed and controlled by the Korean GHG gas regulation, i.e. having plans for prolonged investment in treatment facilities to reduce F-gas emission.
- Generally, LCD panel manufacturers have used the following F-Gases:
  - NF_3, being used in chamber cleaning of the deposition process;
  - SF_6, being used in LCD surface treatment of dry etching process;
  - CF_4 and c-C_4F_8, being used for OLED Panel manufacturing.
- A consideration could be changing SF_6 to NF_3, since the last has a lower GWP (GWP - SF_6: 23,900, NF_3: 17,200).
- In theory there is the possibility that F_2 and COF_2 may replace NF_3, but in practice these two gases have been scarcely used. The reasons are that F_2 has lack of stability and COF_2 has lack of usage record and manufacturing. Because of these reasons, it is inevitable that F-Gases have to be used in LCD manufacturing processes.

3.6.2.3 Second proposal for fluorinated GHG criteria

Currently it is difficult to compare panel suppliers' F-GHG emissions due to a lack of consistency in estimating emissions, estimating emissions reductions, and monitoring the efficacy of installed abatement systems. Also stakeholder feedback did not

provide enough information to establish a prescriptive criterion on abating fluorinated GHG emissions during LCD production.

Thus, it is proposed to introduce a general requirement of information and manufacturers' encourage to LCD suppliers to use abatement systems. US EPA (2013)[120] has developed sets of questions that are intended to be a starting point to help panel purchasers and retailers to understand how their suppliers are reducing their F-GHG emissions and identify opportunities for discussions to target and implement further mitigation efforts. The following criterion is based on these questions and the US EPA document could be provided as indicative reference to the questionnaire format to be established.

Proposed new criterion (second proposal)
Fluorinated GHG emission during LCD production The applicant shall encourage their display suppliers to abate fluorinated greenhouse gases NF_3 and SF6, if part of the production process, by a system that is an integrated part of the production process. For this reason, the applicant shall gather following information from their display suppliers: (a) Description of goals in place and steps taken to reduce F-GHG emissions, for example process optimization, use of alternative chemistries, capture / recycling, and / or abatement technologies. (b) Specification which of the used F-GHGs (i.e. SF_6, NF_3, PFCs, and HFCs) are being reduced. (c) Information if the supplier participates in any national or international consensus-based or voluntary efforts to reduce F-GHG emissions from flat panel display manufacturing. (d) Information about the methods applied to estimate aggregate annual F-GHG emissions (e) Estimated annual F-GHG emissions intensity (if possible, in kg CO_{2e} per m² of flat panel displays (array glass) produced) across manufacturing fabs for the most recent year. (f) Indication of the destruction or removal efficiencies (DREs) of the installed abatement systems for each of the F-GHGs used. *Assessment and verification*: The applicant shall declare the compliance with these requirements and shall additionally provide the information sheets of their display suppliers to the Competent Body.

3.6.2.4 Stakeholder feedback following AHWG2 and further evidence

The main points arising from the 2nd AHWG meetings for Televisions were as follows:

- Concerning the criteria on emission of fluorinated GHG during LCD production a CB stated that if the emission is a problem we shall have a stricter criterion on it.

[120] http://www.epa.gov/climateleadership/documents/questions_for_suppliers.pdf

- Other CB expressed that it is a lot of information and that a licence cannot be refused due to the criteria. Suggestion on reducing to key bullet points was made.

- Industry expressed that they cannot influence on suppliers. It is not their production but the production side of someone else.

The main points arising from written comments received after the 2nd AHWG meetings for Televisions were as follows:

- A CB stakeholder claimed that if it not possible to create a restrictive criterion they suggested its deletion. They asked what will the CB do with the information.

- An industry stakeholder stated that they cannot interfere with suppliers' manufacturing processes. They see a limitation in TV manufacturers requiring display manufacturers to implement certain Fluorinated GHG (F-gas) abatement programs, while they could encourage them to address the F-gas abatement issue as part of their environmental management. *"The criterion, if maintained, needs to be a general information requirement rather than a prescriptive requirement. It should be noted that there may be a confidentiality issue relating to actual F-gas abatement programs implemented by display manufacturers, so NDA may be required in submitting relevant information to the competent body."*

- *'Criteria for the production process, including the use/emission of NF_3, SF_6 and alike. The relevance of setting criteria for the emission can be revealed. A criteria can in the first while be a requirement of information'*.

3.6.2.5 Revised proposal for fluorinated GHG criteria

Proposed revised criterion
Activities to reduce supply chain fluorinated greenhouse gas (GHG) emissions The applicant shall gather the information detailed in *Appendix 3* from their LCD display suppliers by which they shall demonstrate their activities to reduce GHG emissions from the production process, including the performance of abatement systems they have installed. ***Assessment and verification:*** *The applicant shall provide the information sheets of their display suppliers to the Competent Body.*

Major proposed changes

- Based on the discussions at the 2nd AHWG meeting, the criterion has been redrafted.
- It has been clarified that the applicant shall gather the GHG emissions information from suppliers and provide to CBs.
- The information to be collected has been reduced showing fewer bullet points with focus on relevance to address the target of future setting of limits (e.g. amount and type of GHG used per display/abated amount ratio). See appendix 3.

3.7 Cluster 7 – Information

3.7.1 Criterion 7.1 – User instructions

Present criteria, Decisions 2009/300 and 2011/337
Televisions: The television shall be sold with relevant user information that provides advice on its proper environmental use. The information shall be located in a single, easy-to-find place in the user instructions as well as on the manufacturer's website. The information will include in particular: (a) The television's power consumption in the various modes: on, off, passive standby, including information on energy savings possible in different modes. (b) The television's average annual energy consumption expressed in kWh, calculated on the basis of the on-mode power consumption, operating 4 hours a day and 365 days a year. (c) Information that energy efficiency cuts energy consumption and thus saves money by reducing electricity bills. (d) The following indications on how to reduce power consumption when the television is not being watched: - turning the television off at its mains supply, or un-plugging it, will cut energy use to zero for all televisions, and is recommended when the television is not being used for a long time, e.g. when on holiday, - using the hard off-switch will reduce energy use to near zero (where one is fitted), - putting the television into standby mode, will reduce energy consumption, but will still draw some power, - reducing the brightness of the screen will reduce energy use. (e) The position of the hard off-switch (where one is fitted). (f) Repair information regarding who is qualified to repair televisions, including contact details as appropriate. (g) End-of-life instructions for the proper disposal of televisions at civic amenity sites or through retailer take-back schemes as applicable, which shall comply with Directive 2002/96/EC of the European Parliament and of the Council (1). (h) Information that the product has been awarded the flower (the EU Ecolabel) with a brief explanation as to what this means together with an indication that more information on the Ecolabel can be found at the website address http://www.ecolabel.eu *Assessment and verification*: The applicant shall declare compliance of the product with these requirements and shall provide a copy of the instruction manual to the competent body assessing the application.

External computer displays:

The computer display shall be sold with relevant user information that provides advice on its proper environmental use. The information shall be located in a single, easy-to-find place in the user instructions as well as on the manufacturer's website. The information shall include in particular:

(a) Energy consumption: TEC value in accordance with Energy Star v5.0, as well as the maximum power demand in each operating mode. In addition, instructions must be provided on how to use the devices energy-saving mode;

(b) Information that energy efficiency cuts energy consumption and thus saves money by reducing electricity bills and that unplugging your computer display reduces energy consumption to zero;

(c) The following indications on how to reduce power consumption when the computer display is not being used:

  (i) Putting the computer display into off mode will reduce energy consumption but will still draw some power;

  (ii) Reducing the brightness of the screen will reduce energy use;

  (iii) Screen savers can stop [personal computer monitors] / [notebook displays] from powering down into a lower power mode when not in use. Ensuring that screen savers are not activated on [computer monitors] / [notebook computers] can therefore reduce energy use;

(d) Information should be included in the user instructions or the manufacturer's website to let the user know where to go to obtain professional repairs and servicing of the computer display, including contact details as appropriate;

(e) End-of-life instructions for the proper disposal of computer displays at civic amenity sites or through retailer take-back schemes as applicable, which shall comply with Directive 2002/96/EC of the European Parliament and of the Council.

(f) Information that the product has been awarded the EU Ecolabel with a brief explanation as to what this means together with an indication that more information on the Ecolabel can be found at the website address http://www.ecolabel.eu

(g) Any instruction/repair manual(s) should contain recycled content and should not contain chlorine bleached paper.

Assessment and verification: the applicants shall declare the compliance of the product with these requirements to the competent body.

3.7.1.1 Major proposed changes (first proposal)

Proposed revised criteria (first proposal)

The television and external computer display shall be sold with relevant user information that provides advice on its proper environmental use. The information shall be located in a single, easy-to-find place in the user instructions as well as on the manufacturer's website. The information will include in particular:

(a) The power consumption of the product in the various modes, expressed in Watts:

  (i) Televisions / external computer displays: on, off, passive standby;

  (ii) Televisions: quick start mode; active standby (low) for networked television sets.

(b) Televisions: The average annual energy consumption expressed in kWh, calculated on the basis of the on-mode power consumption, operating 4 hours a day and 365 days a year.

(c) Information that energy efficiency cuts energy consumption and thus saves money by reducing electricity bills.

(d) The following indications on how to reduce power consumption:

(i) Information on the product's settings that facilitate energy savings in different modes;
(ii) Turning the product off at its mains supply, un-plugging it, or using the hard off-switch (where one is fitted) will cut energy use to (near) zero;
(iii) Putting the product into standby mode will reduce energy consumption, but will still draw some power;
(iv) Increasing the brightness of the screen will increase energy use; using manual and/or automatic brightness control (ABC) facilitates energy savings;
(v) External computer displays:
- Note that screen savers can stop displays from powering down into a lower power mode when not in use. Ensuring that screen savers are not activated on displays can therefore reduce energy use;

(vi) Televisions:
- Note that the Quick Start Function causes increased power consumption;
- Note that integrated functions, such as a receiver for digital signals (e.g. DVB-T) or hard disk recorders may help reducing power consumption if, as a result, an external device becomes redundant.

(e) The position of the hard off-switch (where one is fitted).
(f) Information that extension of the product's lifetime reduces the overall environmental impacts.
(g) The following indications on how to prolong the lifetime of the product:
(i) Clear instructions in form of a repair manual to enable replacing of key components for upgrades or repair.
(ii) A list of available spare parts with current prices.
(iii) Information to let the user know where to go to obtain professional repairs and servicing of the product, including contact details as appropriate;
(h) End-of-life instructions for the proper disposal of the product at civic amenity sites or through retailer take-back schemes as applicable, which shall comply with Directive 2012/19/EU of the European Parliament and of the Council.
(i) Information that the product has been awarded the EU Ecolabel with a brief explanation as to what this means together with an indication that more information on the Ecolabel can be found at the website address http://www.ecolabel.eu
(j) Any instruction/repair manual(s) should contain recycled content and should not contain chlorine bleached paper.

Assessment and verification: the applicants shall declare the compliance of the product with these requirements to the competent body.

- Integration of both consumer information for televisions and external computer displays into one criterion;
- Inclusion of information on newer functions and modes (manual/automatic brightness control, quick start mode, active standby for networked products).
- Inclusion of more detailed instructions for the extension of the product's lifetime.

3.7.1.2 Stakeholder feedback and further evidence

The requirement for recycled content in instruction/repair manuals may have unintended consequences (e.g. prevent the use of an alternative media than paper)

3.7.1.3 Second proposal for user instructions criteria

Proposed revised criteria (second proposal)

The electronic display shall be sold with relevant user information that provides advice on its proper environmental use. The information shall be located in a single, easy-to-find place in the user instructions as well as on the manufacturer's website. The information shall include in particular:

(a) Energy consumption:
  (i) The maximum power demand in each operating mode, expressed in Watts.
  (ii) Instructions must be provided on how to use the device's energy saving mode (e.g. Automatic Power Down).
  (iii) The annual energy consumption in kWh per year, based on the power demand of the electronic display operating 4 hours per day for 365 days. Additional note that the actual energy consumption will depend on how the display is used.

(b) Information that energy efficiency cuts energy consumption and thus saves money by reducing electricity bills;

(c) The following indications on how to reduce power consumption:
  (i) Turning the product off at its mains supply, un-plugging it, or using the hard off-switch (where one is fitted) will cut energy use to (near) zero;
  (ii) Putting the product into standby mode will reduce energy consumption, but will still draw some power;
  (iii) Reducing the brightness of the screen will reduce energy use; using manual and/or automatic brightness control (ABC) facilitates energy savings;
  (iv) External computer displays: Note that screen savers can stop displays from powering down into a lower power mode when not in use. Ensuring that screen savers are not activated on displays can therefore reduce energy use;
  (v) Televisions:
    - Note that a Quick Start Function might cause increased power consumption;
    - Note that integrated functions, such as a receiver for digital signals (e.g. DVB-T) or hard disk recorders may help reducing power consumption if, as a result, an external device becomes redundant.

(d) Network connectivity (if applicable): Information on how to deactivate networking functions

(e) The position of the hard off-switch (where one is fitted).

(f) Information that extension of the product's lifetime reduces the overall environmental impacts.

(g) The following indications on how to prolong the lifetime of the product:
  (i) Clear disassembly and repair to enable a non-destructive disassembly of products for the purpose of replacing key components or parts for repairs.
  (ii) Information to let the user know where to go to obtain professional repairs and servicing of the product, including contact details as appropriate; service should not be limited exclusively to applicant's Authorized Service Providers.

(h) End-of-life instructions for the proper disposal of the product at civic amenity sites or through retailer take-back schemes as applicable, which shall comply with Directive 2012/19/EU of the European Parliament and of the Council.

(i) Information that the product has been awarded the EU Ecolabel with a brief explanation as to what this means together with an indication that more information on the Ecolabel can be found at the website address http://www.ecolabel.eu

(j) Any print-versions of instruction/repair manual(s) should contain recycled content and should not contain chlorine bleached paper. To save resources, online versions should be preferred.

Assessment and verification: The applicants shall declare the compliance of the product with these requirements to the competent body and shall provide a link to the online-version or a copy of the user instructions / repair manual to the Competent Body.

Major proposed changes

- Product group changed into “electronic display”
- The information requirements on energy consumption have been adapted to align better with the Draft Ecodesign Regulation on Electronic Displays.
- A requirement on network connectivity has been added.
- The provision of a list of available spare parts with current prices has been deleted as this has not been seen as practicable by stakeholders.
- Sub-criterion (j) has been specified regarding print-versions with additional advice to prefer online versions of repair manuals to save resources.

  The assessment / verification have been amended by the provision of a copy and/or link to the user instructions.

3.7.1.4 Stakeholder feedback following AHWG2 and further evidence

Discussions at the second AHWG meeting and written stakeholder feedback revealed the following points:

- Contradiction pointed out in 7(a) (j). It was suggested to give preference to website as written under (j).
- A stakeholder claimed that it will confuse customers to advise them to pull the power plug if TV is not in use.
- Another stakeholder expressed that repair by users should not be encouraged.

3.7.1.5 Revised proposal for user instructions criteria

Proposed revised criteria
User instructions The electronic display shall be sold with relevant user information that provides advice on its proper environmental use. The information shall be located in a single, easy-to-find place in the user instructions as well as on the manufacturer’s website. The information shall include in particular: (a) Energy consumption: (i) The maximum power demand in each operating mode, expressed in Watts.

(ii) Instructions must be provided on how to use the device's energy saving mode (e.g. Automatic Power Down).

(iii) The annual energy consumption in kWh per year, based on the power demand of the electronic display operating 4 hours per day for 365 days. Additional note that the actual energy consumption will depend on how the display is used.

(b) Information that energy efficiency cuts energy consumption and thus saves money by reducing electricity bills;

(c) The following indications on how to reduce power consumption:

(i) Turning the product off at its mains supply, un-plugging it, or using the hard off-switch (where one is fitted) will cut energy use to (near) zero;

(ii) Putting the product into standby mode will reduce energy consumption, but will still draw some power;

(iii) Computer monitors: Note that screen savers can stop displays from powering down into a lower power mode when not in use. Ensuring that screen savers are not activated on displays can therefore reduce energy use;

(iv) Televisions:

- Note that a Quick Start Function might cause increased power consumption;
- Note that integrated functions, such as a receiver for digital signals (e.g. DVB-T) or hard disk recorders may help reducing power consumption if, as a result, an external device becomes redundant.

(d) Network connectivity (if applicable): Information on how to deactivate networking functions

(e) The position of the hard off-switch (where one is fitted).

(f) Information that extension of the product's lifetime reduces the overall environmental impacts.

(g) The following indications on how to prolong the lifetime of the product:

(i) Clear disassembly and repair to enable a non-destructive disassembly of products for the purpose of replacing key components or parts for repairs.

(ii) Information to let the user know where to go to obtain professional repairs and servicing of the product, including contact details as appropriate.

(h) End-of-life instructions for the proper disposal of the product at civic amenity sites or through retailer take-back schemes as applicable, which shall comply with Directive 2012/19/EU of the European Parliament and of the Council.

(i) Information that the product has been awarded the EU Ecolabel with a brief explanation as to what this means together with an indication that more information on the Ecolabel can be found at the website address http://www.ecolabel.eu

(j) Any print-versions of instruction/repair manual(s) should contain recycled content and should not contain chlorine bleached paper. To save resources, online versions should be preferred.

***Assessment and verification*:** *The applicants shall declare the compliance of the product with these requirements to the competent body and shall provide a link to the online-version or a copy of the user instructions / repair manual to the Competent Body.*

Major proposed changes

- g (ii) has been modified by removing reflecting changes in *Repairability* criterion.
- The reference *'the potential saving by using ABC'* has been removed as this feature is requested mandatorily at *Power management* criterion.

3.7.2 Criterion 7.2 – Information appearing on the Ecolabel

Present criteria, Decisions 2009/300 and 2011/337
Televisions: Box 2 of the Ecolabel shall include the following text: '- High energy efficiency, - Reduced CO_2 emissions, - Designed to facilitate repair and recycling.' *Assessment and Verification*: The applicant shall declare the compliance of the product with this requirement, and shall provide a copy of the Ecolabel as it appears on the packaging and/or product and/or accompanying documentation to the awarding competent body.
External computer displays: Optional label with text box shall contain the following text: '- high energy efficiency - designed to facilitate recycling, repair and upgrading - mercury-free backlights (if computer displays)'. *Assessment and verification*: the applicant shall declare the compliance of the product with this requirement, and shall provide a copy of the Ecolabel as it will appear on the packaging and/or product and/or accompanying documentation to the competent body.

3.7.2.1 Major proposed changes (first proposal)

Proposed revised criterion (first proposal)
Optional label with text box shall contain the following text: '- high energy efficiency - mercury-free backlights - designed to facilitate extended lifetime - designed to facilitate recycling.' *Assessment and verification*: the applicant shall declare the compliance of the product with this requirement, and shall provide a copy of the Ecolabel as it will appear on the packaging and/or product and/or accompanying documentation to the competent body.

- Explicit focus on extended lifetime (formerly repair and upgrading) and distinguishing between the aspects on lifetime and recycling.
- For televisions: addition of mercury-free backlights.

3.7.2.2 Stakeholder feedback and further evidence

Written stakeholder feedback following the first AHWG meeting proposes that responsible sourcing (related to 5.2) and social responsibility (related to 5.1) could also be mentioned in the optional statements.

3.7.2.3 *Second proposal for information appearing on the Ecolabel*

Proposed revised criterion (second proposal)
The optional label with text box shall contain the following texts: - high energy efficiency - mercury-free backlights (if the product contains an LED display) - designed to facilitate longer lifetime - designed to facilitate recycling - contains xy% post-consumer recyclates (only when being higher than 25%) The guidelines for the use of the optional label with text box can be found in the "Guidelines for use of the Ecolabel logo" on the website: http://ec.europa.eu/environment/ecolabel/documents/logo_guidelines.pdf *Assessment and verification*: The applicant shall provide a sample of the product label or an artwork of the packaging where the EU Ecolabel is placed, together with a signed declaration of compliance.

3.7.2.4 *Stakeholder feedback following AHWG2 and further evidence*

Discussions at the second AHWG meeting and written stakeholder feedback revealed the following points:

- Threshold for “mercury free” was requested to be specified. (Digital Europe defines “mercury free” as containing less than 0.1%)

- Concern about saying “high energy efficiency “if the energy label is not the highest class.

- Strong opposition from one stakeholder to the sentence “mecury-free backlights” as it might lead to confusion. They claimed the following: *"If you have 3 TV’s, one containing mercury, one LED without EU Ecolabel and one with EU Ecolabel. You would have 1 TV indicating it contains mercury, 1 TV that doesn’t claim anything, one that claims it has mercury free backlight. This only results in confusion of the consumer. It could even be considered as greenwashing, more precisely the “Sin of irrelevance: committed by making an environmental claim that may be truthful but is unimportant or unhelpful for consumers seeking environmentally preferable products”".*

3.7.2.5 Revised proposal for information appearing on the Ecolabel criteria

Proposed revised criterion
Information appearing on the Ecolabel The optional label with text box shall contain the following texts: (a) High energy efficiency (b) Designed to have a longer lifetime (c) Avoidance of hazardous chemicals (d) Designed to be easy to recycle (e) Contains xy% post-consumer recycled plastic (only when greater than 25%) The guidelines for the use of the optional label with text box can be found in the "Guidelines for use of the Ecolabel logo" on the website: http://ec.europa.eu/environment/ecolabel/documents/logo_guidelines.pdf **Assessment and verification**: *The applicant shall provide a sample of the product label or an artwork of the packaging where the EU Ecolabel is placed, together with a declaration of compliance with this criterion.*

Major proposed changes

- 'Mercury free' claim has been deleted and a more general claim in accordance to criteria on hazardous substances has been introduced.

Annex I. Calculations of Energy labelling classes (draft Regulation) of best appliances selected by Topten (updated database 21/05/2014).

Table 31: Overview of Energy Labelling Classes of Televisions

	Model 1 (2)	Model 2	Model 3 (13)	Model 4 (2)	Model 5	Model 6	Model 7	Model 8	Model 9 (7)	Model 10 (2)
Screen diagonal [cm]	47	47	55	55	56	56	60	60	60	60
Screen diagonal [inch]	18.5	18.5	21.5	21.5	22	22	23.7	23.7	23.7	23.7
Power demand on-mode Pm [W]	17	18	20	22.5	24	22	17	24	23	25
EEI (Energy Label)	0.27	0.3	0.26	0.3	0.29	0.27	0.18	0.26	0.27	0.27
Energy Label Classification	A	B	A	B	A	A	A+	A	A	A
	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16 (2)	Model 17	Model 18	Model 19	Model 20
Screen diagonal [cm]	61	61	70	80	80	80	80	80	80	81
Screen diagonal [inch]	24	24	27.5	31.5	31.5	31.5	31.5	31.5	31.5	32
Power demand on-mode Pm [W]	18	24	25	30	30	31	30	32	34	24
EEI (Energy Label)	0.19	0.26	0.23	0.21	0.21	0.21	0.22	0.22	0.23	0.16
Energy Label Classification	A+	A	A	A+	A+	A+	A+	A+	A	A+
	Model 21	Model 22	Model 23 (2)	Model 24	Model 25	Model 26 (2)	Model 27 (3)	Model 28 (2)	Model 29(2)	Model 30
Screen diagonal [cm]	81	81	81	81	81	81	82	82	98	98
Screen diagonal [inch]	32	32	32	32	32	32	32.3	32.3	38.6	38.6
Power demand on-mode Pm [W]	25	27	29	30	32	31	31	34	34	41
EEI (Energy Label)	0.17	0.18	0.2	0.21	0.22	0.22	0.2	0.22	0.16	0.19
Energy Label Classification	A+	A+	A+	A+	A+	A+	A+	A+	A+	A+
	Model 31	Model 32(3)	Model 33	Model 34(5)	Model 35(2)	Model 36(3)	Model 37	Model 38	Model 39	Model 40
Screen diagonal [cm]	98	98	98	98	98	98	102	102	102	102
Screen diagonal [inch]	38.6	38.6	38.6	38.6	38.6	38.6	40	40	40	40
Power demand on-mode Pm [W]	41	45	45	47	48	48	35	36	37	37
EEI (Energy Label)	0.19	0.21	0.22	0.22	0.22	0.23	0.16	0.16	0.17	0.17
Energy Label Classification	A+	A+	A+	A+	A+	A	A+	A+	A+	A+
	Model 41	Model 40	Model 43(2)	Model 44(8)	Model 45(2)	Model 46	Model 47(2)	Model 48	Model 49	Model 50
Screen diagonal [cm]	102	102	102	102	102	102	102	106	106	106
Screen diagonal [inch]	40	40	40	40	40	40	40	41.7	41.7	41.7
Power demand on-mode Pm [W]	40	40	44	48	47	47	48	47	46	49
EEI (Energy Label)	0.18	0.18	0.21	0.21	0.21	0.21	0.23	0.19	0.19	0.2
Energy Label Classification	A+	A+	A+	A+	A+	A+	A	A+	A+	A+
	Model 51 (6)	Model 52	Model 53 (13)	Model 54 (2)	Model 55 (5)	Model 56	Model 57	Model 58 (2)	Model 59	Model 60 (4)
Screen diagonal [cm]	106	106	106	106	106	106	107	107	107	107
Screen diagonal [inch]	41.7	41.7	41.7	41.7	41.7	41.7	42	42	42	42
Power demand on-mode Pm [W]	48	51	53	55	54	56	33	39	40	42
EEI (Energy Label)	0.2	0.21	0.22	0.23	0.23	0.23	0.14	0.16	0.16	0.17
Energy Label Classification	A+	A+	A+	A	A	A	A+	A+	A+	A+

Table 32: Overview of Energy Labelling Classes of Televisions.

	Model 61 (6)	Model 62 (3)	Model 63 (2)	Model 64	Model 65	Model 66 (3)	Model 67 (5)	Model 68 (2)	Model 69	Model 70
Screen diagonal [cm]	107	107	107	107	107	107	107	107	116	117
Screen diagonal [inch]	42	42	42	42	42	42	42	42	45.7	46
Power demand on-mode Pm [W]	44	46	50	48	53	50	54	54	60	37
EEI (Energy Label)	0.18	0.19	0.2	0.2	0.22	0.22	0.22	0.22	0.21	0.13
Energy Label Classification	A+	A+	A+	A+	A+	A+	A+	A+	A+	A+
	Model 71	Model 72 (2)	Model 73 (4)	Model 74	Model 75	Model 76	Model 77 (2)	Model 78	Model 79 (2)	Model 80
Screen diagonal [cm]	117	117	117	117	117	117	117	117	117	117
Screen diagonal [inch]	46	46	46	46	46	46	46	46	46	46
Power demand on-mode Pm [W]	43	42	46	47	51	51	54	58	61	64
EEI (Energy Label)	0.15	0.15	0.16	0.17	0.18	0.18	0.2	0.2	0.22	0.22
Energy Label Classification	A+	A+	A+	A+	A+	A+	A+	A+	A+	A+
	Model 81 (2)	Model 82 (2)	Model 83 (7)	Model 84 (6)	Model 85 (3)	Model 86 (2)	Model 87 (5)	Model 88(14)	Model 89 (2)	Model 90
Screen diagonal [cm]	117	117	117	119	119	119	119	119	119	122
Screen diagonal [inch]	46	46	46	47	47	47	47	47	47	48
Power demand on-mode Pm [W]	59	60	62	48	47	59	59	64	63	43
EEI (Energy Label)	0.22	0.22	0.23	0.16	0.16	0.2	0.2	0.22	0.22	0.14
Energy Label Classification	A+	A+	A	A+	A+	A+	A+	A+	A+	A+
	Model 91 (2)	Model 92 (2)	Model 93 (5)	Model 94	Model 95	Model 96 (3)	Model 97	Model 98	Model 99	Model 100 (4)
Screen diagonal [cm]	122	126	126	126	127	127	139	139	139	139
Screen diagonal [inch]	48	49.6	49.6	49.6	50	50	54.7	54.7	54.7	54.7
Power demand on-mode Pm [W]	42	51	53	52	43	52	45	48	47	46
EEI (Energy Label)	0.14	0.15	0.16	0.16	0.13	0.15	0.11	0.12	0.12	0.12
Energy Label Classification	A+	A+	A+	A+	A+	A+	A++	A++	A++	A++
	Model 101	Model 102 (2)	Model 103	Model 104 (6)	Model 105	Model 106	Model 107 (2)	Model 108(2)	Model 109(5)	
Screen diagonal [cm]	139	139	139	139	139	140	140	140	140	
Screen diagonal [inch]	54.7	54.7	54.7	54.7	54.7	55	55	55	55	
Power demand on-mode Pm [W]	53	50	53	63	64	52	64	63	63	
EEI (Energy Label)	0.13	0.13	0.13	0.16	0.16	0.13	0.16	0.16	0.16	
Energy Label Classification	A+	A+	A+	A+	A+	A+	A+	A+	A+	

Table 33: Overview of Energy Labelling Classes of Computer monitors.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6 (2)	Model 7	Model 8	Model 9 (2)	Model 10
Screen diagonal [cm]	43	43	48	48	48	48	48	48	48	48
Screen diagonal [inch]	17	17	19	19	19	19	19	19	19	19
Power demand on-mode Pm [W]	16	18	13	15.8	15.4	15.6	15.8	11	17	14
EEI (Energy Label)	0.13	0.14	0.1	0.12	0.12	0.12	0.12	0.08	0.13	0.11
Energy Label Classification	A+	A+	A++	A++	A++	A++	A++	A++	A+	A++
	Model 11	Model 12 (2)	Model 13	Model 14 (2)	Model 15	Model 16	Model 17	Model 18	Model 19 (2)	Model 20 (2)
Screen diagonal [cm]	51	51	53	55	55	55	55	56	56	56
Screen diagonal [inch]	20	20	21	21.5	21.5	21.5	21.5	22	22	22
Power demand on-mode Pm [W]	15.4	17	13	18	19.5	18	19.5	12	15.8	16
EEI (Energy Label)	0.11	0.12	0.09	0.12	0.13	0.12	0.13	0.08	0.11	0.11
Energy Label Classification	A++	A++	A++	A++	A+	A++	A+	A++	A++	A++
	Model 21	Model 22	Model 23	Model 24	Model 25 (2)	Model 26	Model 27	Model 28	Model 29	Model 30
Screen diagonal [cm]	56	56	56	56	56	56	56	56	58	58
Screen diagonal [inch]	22	22	22	22	22	22	22	22	23	23
Power demand on-mode Pm [W]	17.2	17	18	20	21	20	22	22	14	15
EEI (Energy Label)	0.12	0.12	0.12	0.13	0.14	0.14	0.15	0.15	0.09	0.1
Energy Label Classification	A++	A++	A++	A+	A+	A+	A+	A+	A++	A++
	Model 31	Model 32	Model 33	Model 34 (2)	Model 35 (2)	Model 36	Model 37	Model 38	Model 39	Model 40 (2)
Screen diagonal [cm]	58	58	61	61	61	61	61	61	61	61
Screen diagonal [inch]	23	23	24	24	24	24	24	24	24	24
Power demand on-mode Pm [W]	22	21	11	13.4	17.1	19	19	19	20.9	21
EEI (Energy Label)	0.15	0.14	0.07	0.09	0.11	0.13	0.12	0.12	0.13	0.13
Energy Label Classification	A+	A+	A++	A++	A++	A+	A++	A++	A+	A+
	Model 41 (2)	Model 42 (2)	Model 43	Model 44	Model 45	Model 46	Model 47	Model 48 (2)	Model 49	Model 50 (2)
Screen diagonal [cm]	61	61	61	61	61	69	69	69	69	69
Screen diagonal [inch]	24	24	24	24	24	27	27	27	27	27
Power demand on-mode Pm [W]	21	21.5	21.6	20.9	21.8	19.6	20.3	20.4	21.3	22
EEI (Energy Label)	0.13	0.14	0.14	0.13	0.14	0.11	0.11	0.11	0.12	0.12
Energy Label Classification	A+	A+	A+	A+	A+	A++	A++	A++	A++	A++

Annex 2.Bill of materials of a LCD monitor (source: Teehan and Kandlikar (2013))

This product is Samsung Syncmaster 2243 21.5" LCD monitor.

Sub-assemblies	Description	Mass (g)	C2(a) SVHC	A1(a) Substitutes	A1(b) Substance restrictions	A1(c) Specific derogations
LCD module 50x29cm (48x27cm)		2350				
	LCD Module sub-total	2350				
Casing	Stand: ABS plastic pieces	331				
	Stand: metal pieces (magnetic)	332				
	Stand: metal screws	9				
	Plastic front frame: ABS + PMMA	130				
	Housing - ABS plastic	42				
	Backplate plastic high-impact polystyrene (HIPS)	600				
	Metal frame (magnetic)	650				
	HIPS plastic piece	50				
	metal screws	7				
	small steel piece	5.5				
	Casing sub-total	2157				
Mainboard	2-layer PCB, 6.5 x 8.5 cm	18				
	VGA port	6				
	DVI port	5.5				
	misc. connectors	2.2				
	20x14mm Samsung QFP chip 136-pin	1.7				
	Silicon die, by area ratio	22				
	Small IC's and bits	2				
	ribbon cable	4.7				
	Mainboard sub-total	40				
Power supply	2-layer PCB 16x13cm	18				
	caps large electrolytic	24				
	coils large cylindrical wound	77				
	caps ceramic	6.3				
	caps polyester film	6.8				
	diodes large	5.1				
	power MOSFETs	4.3				
	AC power plug	8.3				
	metal heatsink aluminum	18				
	connectors	5.6				

	Power supply sub-total	173				
Extra parts	Power cable	150				
	VGA cable	90				
	DVI cable	110				
	Power supply sub-total	350				
	Total	5070				
	Criteria coverage sub-totals					
	C2(a) SVHC	96.2%				
	A1(a) Substitutes	30.6%				
	A1(b) Substance restrictions	76.2%				
	A1(c) Specific derogations	46.8%				

Annex 3. Determination of hazard profiles for substitute flame retardants and plasticisers

Substance	CAS No	EU CLP and REACH systems		Supplementary evidence	Determination of hazard profile
		C&L Inventory	REACH Register		
Flame retardants used in *Printed Wiring Boards*					
Tetrabromobisphenol (TBBPA)	79-94-7	CLP harmonised classification H400, H410	Registered, conclusive with no data gaps	n/a	Group 2: H400, H410
Brominated Bisphenol A type Epoxy Resin Phenol, 4,4'-(1-methylethylidene)bis[2,6-dibromo-, polymer with 2-(chloromethyl)oxirane and 4,4'-(1-methylethylidene)bis[phenol]	26265-08-7	Divergent self-classifications H315, H317, H318	Pre-registered	US EPA PCB study: Moderate Reproductive effects, Developmental effects, and carcinogenity with data gaps.	Not possible to determine
2,2',6,6'-Tetrabromo-4,4'-isopropylidenediphenol, oligomeric reaction products with 1-chloro-2,3-epoxypropane	0039-93-8	REACH Joint Entry: Not classified	Registered, conclusive no classifications. Data gaps: Reproductive toxicity	n/a	Not possible to determine

Dihydrooxaphosphaphenanthrene (DOPO) CAS No	35948-25-5	REACH Joint Entry: Not classified	Registered, conclusive with data gaps. *Data gaps:* Acute toxicity (dermal, inhalation), Reproductive, Carcinogenicity.	US EPA PCB study: Aquatic toxicity, medium (H411, H412)	Group 3: H411, H412
Aluminium hydroxide (ATH)	21645-51-2	REACH Joint Entry: Not classified	Registered, conclusive with no data gaps.	n/a	Not classified
Fyrol PMP (Aryl Alkylphosphinate)	63747-58-0	No entries	Not registered	US EPA PCB study: Persistent, high (P)	Group 3: H413
Aluminium salts of diethylphosphinic acid (AlPi)	225789-38-8	No entries	Not registered	US EPA DecaBDE study: Developmental, medium (H361d), Aquatic toxicity, medium (H411, H412); Repeated dose, medium (H371/H373); Persistent, high (P)	Group 2: P, H411, H412, H361d, H371, H373

Melamine Polyphosphinate synergist	15541-60-3	Grouped notifications, not classified	Not registered	US EPA DecaBDE study: Persistent, high (P); Carcinogenicity, medium (H351), Mutagenicity (H341); Repeated dose, medium (H371/H373)	Group 2: P, H351, H341, H371, H373
Flame retardants used in *connectors and sockets*					
Ethane bis (pentabromophenyl) (EBP)	84852-53-9	REACH Joint Entry: Not classified	Registered, conclusive no classifications. *Data gaps:* Carcinogenicity	US EPA DecaBDE study: Carcinogenicity, medium hazard (H351)	Group 2: H351
Antimony Trioxide synergist	1309-64-4	CLP harmonised classification H351	Registered, conclusive with no data gaps	n/a	Group 2: H351
Ethylene 1,2 bis(tetrabromophthalimide) (EBTBP)	32588-76-4	REACH Joint Entry: Not classified	Registered, conclusive no classifications. *Data gaps:* Carcinogenicity, Reproductive (lactation)	No Peer Agency studies identified	*Not possible to determine*

Melamine cyanurate *with phosphorus synergist*	15541-60-3	Grouped notification, not classified	Not registered	US EPA DecaBDE study: Persistence, very high (vP); Carcinogenicity, medium (H351); Genotoxicity, medium (H341); reproductive, medium (H361f); Developmental, medium (H361d), Repeated dose, high (H370, H372)	Group 1: vP with H370, H372
Aluminium salts of diethylphosphinic acid (AlPi) *with Melamine Polyphosphinate synergist*	225789-38-8	No entries	Not registered	US EPA DecaBDE study: Developmental, medium (H361d), Aquatic toxicity, medium (H411, H412); Repeated dose, medium (H371/H373); Persistent, high (P)	Group 2: P, H411, H412, H361d, H371, H373
Magnesium hydroxide (MDH)	1309-42-8	REACH Joint Entry: Not classified	Registered, conclusive no classifications.	US EPA DecaBDE study: Persistence, high (P)	Group 3: H413

Flame retardants used in *external power cables and power packs*					
Ethane bis (pentabromophenyl) (EBP) *with antimony or zinc synergist*	84852-53-9	REACH Joint Entry: Not classified	Registered, conclusive no classifications. *Data gaps:* Carcinogenicity	US EPA DecaBDE study: Carcinogenicity, medium hazard (H351)	Group 2: H351
Ethylene 1,2 bis(tetrabromophthalimide) (EBTBP) with antimony or zinc synergist	32588-76-4	REACH Joint Entry: Not classified	Registered, conclusive no classifications. *Data gaps:* Carcinogenicity, Reproductive (lactation)	No Peer Agency studies identified	*Not possible to determine*
Triaryl phosphate (TXP) plasticiser	25155-23-1	Harmonised classification H360f REACH Joint entry: H373, H400, H410	Registered, conclusive with no data gaps	n/a	Group 1: H360f
Triaryl phosphate (TCP) plasticiser	1330-78-5	REACH Joint Entry, H361, H400, H410	Registered, conclusive with no data gaps	n/a	Group 2: H361, H400, H410
Aluminium hydroxide (ATH) *with zinc synergist*	21645-51-2	REACH Joint Entry: Not classified	Registered, conclusive with no data gaps.	n/a	Not classified

Magnesium hydroxide (MDH) *with zinc synergist*	1309-42-8	REACH Joint Entry: Not classified	Registered, conclusive no classifications.	US EPA DecaBDE study: Persistence, high (P)	Group 3: H413
Zinc borate synergist	1332-07-6	Grouped notifications	Not registered	US EPA DecaBDE study: genotoxicity, high (H340); reproductive, medium (H361f); developmental, medium (H361d); Aquatic toxicity, high (H400, H410); Persistence, high (P)	Group 1: H340, H400, H410
Bisphenol A Bis (diphenyl Phosphate)	5945-33-5	REACH Joint Entry: Not classified	Registered, conclusive no classifications.	Green Screen assessment: Unclassified, data gaps for carcinogenicity, reproductive toxicity.	Not classified
Cresyl diphenyl phosphate	26444-49-5	Grouped notifications, self-classifications	Not registered	No Peer Agency studies identified	*Not possible to determine*

Ammonium polyphosphonate	68333-79-9	Grouped notifications, self-classifications	Not registered	US EPA DecaBDE study: persistence, very high (vP)	Group 3: H413
Aluminium salts of diethylphosphinic acid (AlPi) *with Melamine Polyphosphinate synergist*	225789-38-8	No entries	Not registered	US EPA DecaBDE study: Developmental, medium (H361d), Aquatic toxicity, medium (H411, H412); Repeated dose, medium (H371/H373); Persistent, high (P)	Group 2: P, H411, H412, H361d, H371, H373
Melamine Polyphosphinate synergist	15541-60-3	Grouped notifications, not classified	Not registered	US EPA DecaBDE study: Persistent, high (P); Carcinogenicity, medium (H351), Mutagenicity (H341); Repeated dose, medium (H371/H373)	Group 2: P, H351, H341, H371, H373
Flame retardants used in *plastic casings and bezels*					

Ethane bis (pentabromophenyl) (EBP)	84852-53-9	REACH Joint Entry: Not classified	Registered, conclusive no classifications. *Data gaps:* Carcinogenicity	US EPA DecaBDE study: Carcinogenicity, medium hazard (H351)	Group 2: H351
Antimony Trioxide synergist	1309-64-4	CLP harmonised classification H351	Registered, conclusive with no data gaps	n/a	Group 2: H351
Triphenyl phosphate	115-86-6	REACH Joint Entry: H400, H411	Registered, conclusive with no data gaps	n/a	Group 2: H400, H411
Resorcinol Bis (Diphenyl Phosphate)	125997-21-9	Self-classifications, H400, H412	Not registered	US EPA DecaBDE study: Aquatic toxicity, very high hazard (H400, H410), high bioaccumulation (B)	Group 2: B, H400, H410
Bisphenol A Bis (diphenyl Phosphate)	5945-33-5	REACH Joint Entry: Not classified	Registered, conclusive no classifications.	Green Screen assessment: Unclassified, data gaps for carcinogenicity, reproductive toxicity.	Not classified

RDX: Resorcinol bis(2,6-dixylenyl phosphate)	139189-30-3	CLP harmonised classification H413	Registered, conclusive with data gaps. *Data gaps:* Acute toxicity (inhalation), Aspiration, Reproductive (lactation), Carcinogenicity.	n/a	*Not possible to determine*
Octadecyl 3-(3,5-di-tert-butyl-4-hydroxyphenyl)propionate	2082-79-3	REACH Joint Entry Not Classified	Registered, conclusive no classifications. Data gaps: Respiratory sensitization data lacking	n/a	Not possible to determine
N,N'-ethylenedi(stearamide) ; 2',3-bis[[3-[3,5-di-tert-butyl-4-hydroxyphenyl]propionyl]]propionohydrazide	110-30-5	Divergent self-classifications (866 non-classifications, H317,H412, H413)	Not Registered	n/a	Not possible to determine
Plasticisers used in *external power cables and power packs*					
DEHP	117-81-7	REACH Joint Entry, H360fd	Candidate List, H360fd	n/a	Group 1: H360fd

DIDP	26761-40-0	Divergent self-classifications (100 non-classifications, H400, H400/410, H411)	Not registered	No Peer Agency studies identified	*Not possible to determine, but noting that EU risk assessments have been carried out.*
DNOP	117-84-0	Divergent self-classifications (100 non-classifications, H413, H317, H361)	Not registered	n/a	Not possible to determine
DINP	28553-12-0	REACH joint entry: Not classified	Registered: conclusive not classified.	Green Screen assessment: Benchmark 1 based on reproductive and developmental toxicity.	Not classified, EU risk assessments have been carried out.
Trioctyl trimetallate (TOM/TOTM)	3319-31-1	REACH joint entry: Not classified	Registered: conclusive not classified.	Green Screen assessment: Unclassified based on gaps for carcinogenicity. It may be Benchmark 1 or 2.	Not classified

Dioctyl terephthalate (DOTP)	6422-86-2	REACH joint entry: Not classified	Registered: conclusive not classified.	Green Screen assessment: Benchmark 3	Not classified
Hexamoll DINCH	166412-78-8	REACH Joint Entry: Not classified	Registered, conclusive with data gaps. Data lacking: Acute toxicity (inhalation)	Green Screen assessment: Benchmark 2 based on endocrine activity and persistence (P)	Group 3: H413
Priplast DOZ	103-24-2	REACH Joint Entry: Not classified	Registered, conclusive with data gaps. Data lacking: Carcinogenicity, reproductive (lactation)	Green Screen assessment: Unclassified based on gaps for carcinogenicity. It may be Benchmarks 1 or 3	*Not possible to determine*

Appendix 1. The scope of restrictions on hazardous substances that shall apply to the product

1(a) Hazard derogations that reflect substitutions made by manufacturers

Substance group	Scope of restriction	Concentration limits (where applicable)	Assessment and verification
(i) Flame retardants	Flame retardants that are classified with Group 3 hazards are derogated for use in *Printed Wiring Board*. *Derogation condition:* -Test results shall demonstrate that the motherboard laminate material does not emit carcinogenic PAHs at > 5.0 g/kg, when burnt in conditions simulating improper WEEE disposal. The PAHs to be quantified are listed in Appendix 1(c)(v). -Printed Wiring boards shall be compatible with recycling (see criterion 4(a))	n/a	Declaration by the sub-assembly supplier supported by classification data for the substances used and test reports for the derogation conditions. *Test method:* ISO 19700 or IEC 60695-7-50 using fire type 1b with a heat flux of 50 kW/m^2 as specified by the US EPA. Quantification according to ISO 11338.
	Flame retardants and their synergists classified with Group 3 hazards are derogated for use in *external cables.* *Derogation condition:* -Test results shall demonstrate that the motherboard laminate material does not emit carcinogenic PAHs at > x.x g/kg, when burnt in conditions simulating improper WEEE disposal. The PAHs to be quantified are listed in Appendix	n/a	Declaration by the sub-assembly supplier supported by classification data for the substances used. *Test method:* ISO 19700 or IEC 60695-7-50 using fire type 1b with a heat flux of 50 kW/m^2 as specified by the US EPA. Quantification according to ISO 11338.

	1(c)(v).		
	Flame retardants and their synergists classified with Group 2 and 3 hazards are derogated for use in *external plastic housing of the display*. *Derogation condition:* Plastic components containing flame retardants shall be compatible with recycling (see sub-criterion 4.(a))	n/a	Declaration by the sub-assembly supplier supported by classification data for the substances used.
(ii) Plasticisers	Plasticisers that are classified with Group 3 hazards are derogated for use in *external cables, Internal electrical wiring, and External plastic housing of the display*.	n/a	Declaration by the sub-assembly supplier supported by classification data for the substances used.

1(b) Restrictions applying to substances that may be present in the final product

Substance group	**Scope of restriction**	**Concentration limits (where applicable)**	**Assessment and verification**
(i)Flame retardants	PTFE used as a non-dripping agent in *external plastic housing of the display* shall be manufactured without the use of PFOA or its higher homologues.	n/a	Declaration from the PTFE manufacturer to be obtained by the sub-assembly supplier.
(ii) Plasticisers	The following plasticisers that are classified with Group 1 hazards shall not be present in *external cables:* DEHP, BBP, DBP, DIBP, DMEP, DIPP, DPP, DnPP and DnHP.	Sum total concentration limit of 0.1%	Declaration by the sub-assembly supplier supported by a test report. *Test method:* Solvent extraction followed by GC-MS
	The following plasticisers that are classified with Group 1 hazards shall not be present in *external cables:* Medium Chained Chlorinated Paraffins (MCCP's) Alkanes C14-17	Sum total concentration limit of 0.1%	Declaration by the sub-assembly supplier supported by a test report. *Test method:* XRF (non-destructive) as specified by IEC 62321—3-1

(iii) Polymer stabilisers	Lead (H360, H372, H400, H410) shall not be present in *external cables and internal electrical wiring*.	0.1%	Declaration by the sub-assembly supplier supported by a test report. Test method: IEC 62321-3-1
	Organotin compound stabilisers that are classified with Group 1 and 2 hazards shall not be present in *external cables*.	n/a	Declaration to be obtained from the sub-assembly supplier supported by classification data for the substances used.
(iv) Polymer colourants	Colourants used in *external cables*, *external plastic housing of the display* shall not contain lead, chromium VI, cadmium, dyes that may cleave to carcinogenic aryl amines or any other colourant compound or degradation product included in the IEC 62474 declarable substances list.	Lead and chromium VI 0.1% Cadmium 0.01% Other compounds 0.1%	Declaration to be obtained from the sub-assembly supplier. *Test method:* IEC 62321-3-1 for lead, chromium VI and cadmium

(v) Polymer contaminants	The following Polycyclic Aromatic Hydrocarbons (PAHs) classified with Group 1 hazards shall not be present at concentrations greater than or equal to the individual and sum total concentration limits in: *External cables* *External plastic housing of the remote control* *Rubber parts of the remote control* The non-presence of the following PAHs shall be verified: *PAH's restricted by the REACH Regulation:* Benzo[a]pyrene, Benzo[e]pyrene, Benzo[a]anthracene, Chrysen, Benzo[b]fluoranthene, Benzo[j]fluoranthene, Benzo[k]fluoranthene Dibenzo[a,h]anthracene, *Additional PAH's subject to restriction:* Acenaphthene Acenaphthylene Anthracene Benzo[ghi]perylene Fluoranthene Fluorene Indeno[1,2,3-cd]pyrene Naphthalene Phenanthrene Pyrene	The individual concentrations limit for the eight REACH restricted PAHs shall be 1 ppm The sum total concentration limit for the 18 listed PAHs shall not be greater than 10 ppm	Test report to be provided by the applicant for relevant parts of the identified parts of the product. *Test method*: ZEK 01.4-08.
(vi)Biocides	Biocides intended to provide a hygiene (anti-bacterial) function shall not be added to: *External plastic housing of the remote control* *Rubber parts of the remote control*	n/a	Declaration to be provided by the sub-assembly supplier.

(vii) Metal solder and contacts	RoHS exemption 8b relating to the use of cadmium in *metal contacts* shall not be permitted in ecolabelled products.	0.01%	Declaration to be obtained from the final assembler of the product identifying the alternative contact metal used. *Test method:* IEC 62321-3-1
(viii)Metallic coatings	Hexavalent chromium shall not be present in metallic coatings applied to *any parts of a display*.	0.05%	Declaration to be obtained from the final assembler of the product supported by a test report for the coating or coatings used. *Test method*: IEC 62321-7-1
(ix)Vapour discharge	Mercury shall not be present in the *backlighting*. *Supporting requirement:* Products shall be externally labelled with the mercury free logo as described in Ecodesign Regulation xxxx/xxx/EU.	0.1 mg per lamp	A declaration to be obtained from the screen unit manufacturer. *Test method*: Ecodesign will not require testing
(x) Fining agents	Arsenic and its compounds shall not be used in the manufacturing of *screen glass*.	0.0050%	A declaration to be obtained from the screen glass manufacturer supported by an analytical testing report. *Test method*: to be

			specified
(xi) Cleaning agents and degreasers	The following substances classified with Group 1 and 2 hazards shall not be present in parts of the final product treated in the final assembly plant and, for those specified, shall be controlled in the final assembly process: *Propanal, benzene, isobenzofurandione, n-hexane and chlorinated organic solvents.* *Manufacturing process restrictions:* The manufacturer shall verify that the following 8 hour TWA's occupational exposure limit values are respected: Benzene <1.0 ppm (<3.25 mg/m^3) n-hexane 20 ppm (72 mg/m^3)	0.1% for each individual substance	Declaration supported by monitoring data from the final product assembly plant to be provided by the applicant.

1(c) Derogations applying to specific substances or groups of substances

Substance group	**Scope of restriction**	**Concentration limits (where applicable)**	**Assessment and verification**
Stainless steel	Stainless steel containing nickel classified with H351, H373 and H412 classified with is derogated for use in casings, bolts, nuts, screws and brackets.	Nickel 8 – 13%	Declaration to be obtained from the sub-assembly manufacturer
(ii) Flame retardants	TBBPA classified with the hazards H400 and H410 (Group 2) is derogated for its use in specific Printed Wiring Board to be detailed.	n/a	Declaration by the sub-assembly supplier supported by classification data for the substances used and test reports for the derogation conditions.

(iii) Doping and luminescence	Doping substances classified with H301, H331, H400, H410, H411, H412 and H413 are derogated for use in the chip and diode of LED lamps.	n/a	Declaration to be obtained from the sub-assembly manufacturer supported by classification data.
	Luminescent substances classified with H350, H351, H361f, H372 and H373 are derogated for use in OLED screen units.		

Appendix 2. Outline procedure for a product disassembly test

Terms and definitions

- Target parts and components: Parts and/or components that are targeted for the extraction process.
- Disassembly step: An operation that finishes with the removal of a part or with a change of tool.

Operating conditions for the extraction

- Personnel: The test shall be carried out by one person.
- Test sample: The sample product to be used for the test shall be undamaged.
- Tools for extraction: The extraction operations shall be performed using manual or power-driven standard commercially available tools (i.e. pliers, screw-drivers, cutters and hammers as defined by ISO 5742, ISO 1174, ISO 15601).
- Extraction sequence: The extraction sequence shall be documented and, where the test is to be carried out by a third party, information provided to those carrying out the extraction.

Recording of the test conditions and steps

- Documentation of steps: The individual steps in the extraction sequence shall be documented and the tools associated with each step shall be specified.
- Recording media: The applicant shall provide a video showing the extraction of the target components and the compliance to the time thresholds.

Appendix 3. Information to be requested from LCD suppliers

The applicant shall gather the following information from their display suppliers:

(a) Specification which of the F-GHGs are used and which are being reduced.

(b) Estimated annual F-GHGs emissions intensity (in kg CO_{2eq} per m^2 of flat panel displays (array glass) produced) across manufacturing fabs for the most recent year.

(c) Indication of the destruction or removal efficiencies (DREs) of installed abatement systems for each of the F-GHGs used.