About Nordic Ecolabelling of Audiovisual equipment

Version 5.0

Background, Final review proposal

2012-12-20

Nordic Ecolabelling

Nordic Ecolabelling - Background

071/v.5.0

Table of Contents

1 Summary 1
2 Basic facts about the criteria 2
Products which can be labelled 2
Motivation for the Nordic Ecolabel 2
3 About the revision 9
Objectives with Criteria/revision 9
About this criteria development/revision 9
4 Motivation of the requirements 10
Energy and power consumption 10
Hazardous materials 13
Noise 20
Design 20
Customer information/life-time extension 24
Code of Conduct 26
Quality and regulatory requirements 27
5 Changes from previous version 29
Removed requirements 31
New requirements that have been added to the criteria document version 5.0 32
Evaluated requirements that were considered to the criteria document version 5.0 32
6 New requirements 34

1 Summary

The criteria revision towards version 5.0 was executed during the autumn of 2012 and spring of 2013 and is expected to be granted in June 2013. The criteria where revised for the 4th time. During the years the product group definition has been altered, being broad with TV-sets in combination with other equipment, Set Top Boxes etc, to a more narrow definition of TV-sets and projectors.

The Relevance/Potential/Steerability (RPS) analysis for this product group shows a high score in energy consumption during the user-phase, flame retardants in plastics, mercury in background light of TV-sets and projector lamps. Medium/high score was found for other additives in plastic parts (phthalates for instance), packaging material and dismantling. All of these topics have requirements coupled to them.

The objective for the revision was to revise the energy requirements in relation to existing energy regulations, to investigate the possibility to form a requirement for nitrogen trifluoride (NF_3) used during the production of displays for visual equipment, revise the requirements for heavy metals and flame retardants, pose requirements for additives in plastic parts, examine the possibility to pose requirements on re-cycled/re-used plastics and bio-plastics, update the packaging requirements and propose electrical safety requirements.

The most important requirements altered from version 4.0 and later modifications where the requirement for energy efficiency and flame retardants. The energy efficiency (for on-mode) refered directly to energy class A+ for all TV-sets regardless screen size. The flame retardant requirement was sharpened with two additional eco-toxicity risk-phrases and with fewer exemptions.

New requirements added to version 5.0 of the criteria where requirements for chlorine-based plastics, phthalates in the final product and the external cables, declaration of NF_3 used during LCD-display/TFT-cell production, recycled material and plastic material in packaging. Removed requirements from version 4.0 and later modifications included the harmonization with the EU Ecolabel, heavy metals and the maximum energy consumption level for a TV in on-mode. Evaluated requirements but not proposed requirements where re-cycled/re-used plastics and bio-based plastics, electrical safety and halogen-free flame retardants.

During the revision process, future requirement and areas in need to be revised in up-coming revision processes where identified. Among other areas for future revision, regulations to minimize the risk of use of "conflict metals" in electronics and a revision of the projector requirements where identified.

2 Basic facts about the criteria

Products which can be labelled

The product group for Audiovisual equipment has in version 5.0 re-formulated the product group definition in relation to version 4.0 and later modifications to:

- Television-sets (TV-sets), and
- Projectors*

The evaluation report for this product group and its criteria 4.0 (and later modifications), written 2011-12-15, and approved by the Nordic Ecolabelling Board, concluded that the criteria until then as a whole had not fulfilled the desired effect of environmental benefits. Other driving factors such as the Directive 2009/125/EC for ErP (Energy-related-Products) and EU:s Ecolabelling scheme have been more successful in the assignment of environmental adaptation for the product group.

In version 4.0 the product group definition also included videoconferencing systems, TV-sets in combination with other equipment such as DVD/ Blu-ray players, DVD / Blu-ray players, stereo systems (including speakers with at least one of the following: radio receivers, CD, DVD, cassette or gramophone) and Set Top Boxes. All of these product types where removed from the product group definition in version 5.0 of the criteria. See below.

In version 5.0 of the criteria the product types TV-sets and projectors where kept. The former was estimated in the evaluation report to continue bring environmental benefits while the latter is interesting based on for example new mercury-free technology still worth encouraging. See further motivations for the modification of the product group definition under chapter 5 – Changes from previous version.

All equipment with CRT-technology are excluded. This is because the market has developed in such a way that CRT-technology hardly is produced or consumed by consumers. Nordic Ecolabelling has therefore taken the decision not to include this product category, as this product category is not relevant.

Motivation for the Nordic Ecolabel

Relevance

The product group belongs to a market where technological development in combination with consumer/user-friendly applications accelerates the consumption through rapid replacement of "old" technology into new such. The TVs display size tend to increase as well as the number of households that owns or consider in purchasing the second or third television set. Obviously the trend of consumption increase rapidly generates increasing amount of electrical and electronic waste as well. Also, the technology develops rapidly like the picture quality (HD-quality) and "smart" functions, which enables the TVs to access the internet and download or stream film or other programs. Another development that might be even more relevant ahead is the development of 3D-televisions which requires full effect, increasing the energy consumption. The criteria are opened for plasma type TV. However this product category is considered to have market percentage of 3-4% with no indication of this being changed in future market development.

EuP, which was the Energy using Products Directive, the framework for Ecodesign regulations, have in their preparatory studies for Televisions (LOT5) in 2007 showed that the power consumption in the user-phase is the single most important environmental impact[1]. This is illustrated by a 32" Liquid crystal display (LCD) Television, se figure 1. The overall conclusion in figure 1 is also valid for a plasma-TV.

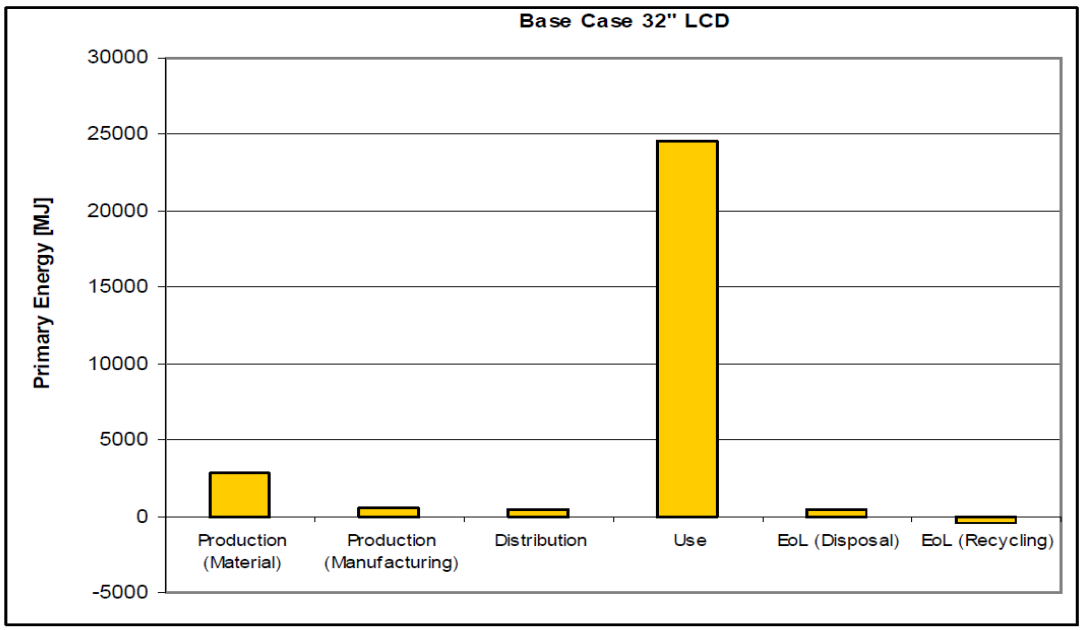

Figure 1 - Total energy consumption of 32" LCD-TV base case over all life cycle phases. EoL stands for "End-of-life"[1].

Production phase

The EuP-studies indicated that the production of LCD displays and other electronic components have a growing impact, see energy consumption related to each module of the same TV-type in figure 2.

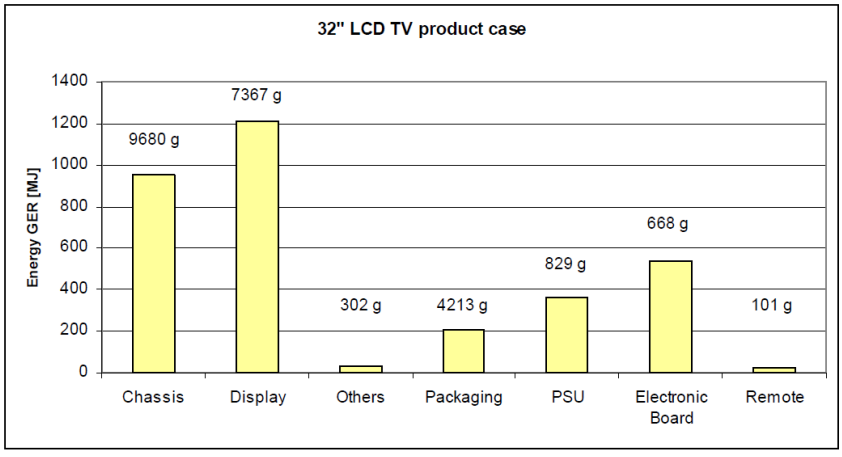

Figure 2 - Total energy consumption related to each module during production phase of 32" LCD-TV base case. PSU stands for Power Supply Unit. The "g" on each column represents the weight of each module[1].

[1] [EuP Televisions, LOT5] EuP Preparatory Studies "Televisions" (Lot 5) Final Report on Task 5 "Definition of Base Cases" Fraunhofer Institute for Reliability and Microintegration, IZM, Berlin, 2007

The energy consumption in the production of the hardware is less than the user phase but is still quite significant for the overall environmental impact, see figure 1. From the production of the hardware, it is especially the energy for the production and eco-toxicity impacts from heavy metals (arising during the extraction of materials for the components used in the final TV and during the production of the TV-sets hardware - e.g. emissions of Copper, Zinc, Nickel, Mercury, Chromium, Lead, Arsenic, Cadmium and Cobalt)[2].

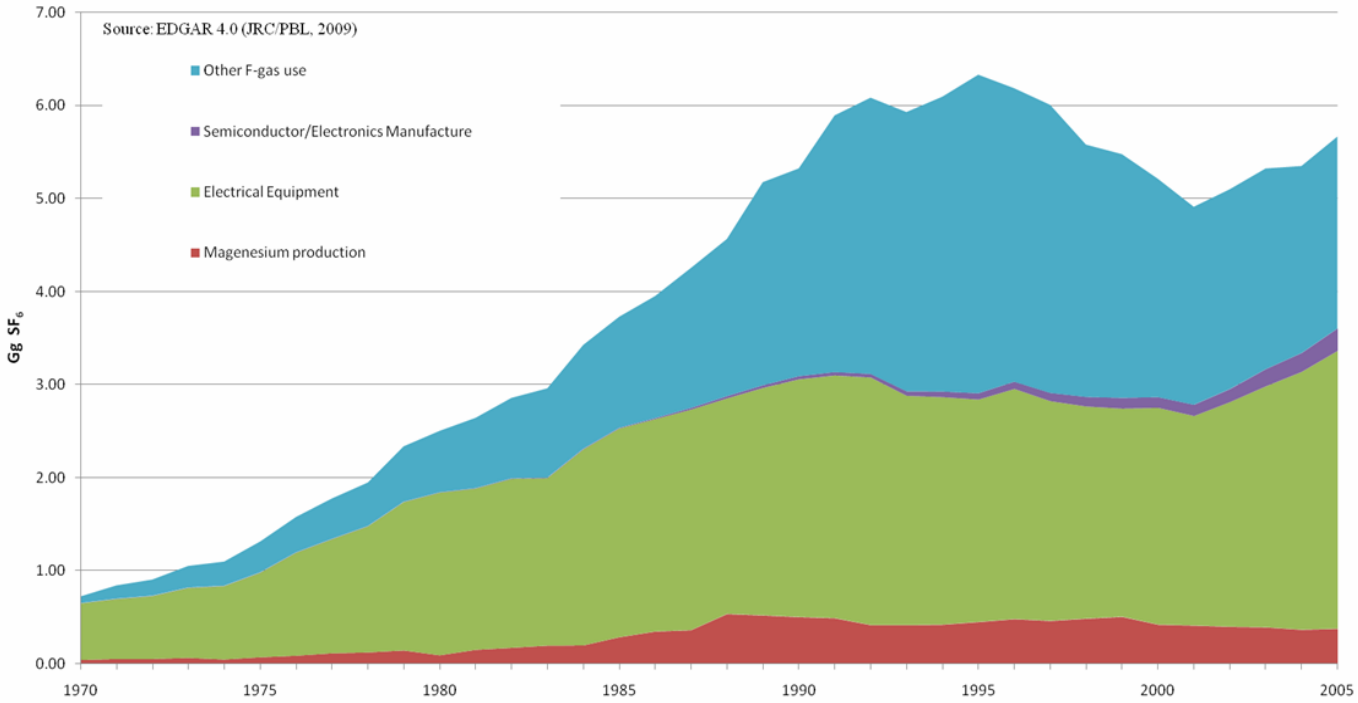

Figure 3 - Trends in global emissions of sulfur hexafluoride by major source category (1970-2005) in Gg SF_6[4].

In recent years, environmental and working condition problems associated with certain gases used during the production phase of certain display types have been highlighted. Again the conclusion for desktops, laptops and LCD-screen is that the energy consumption during the user phase is the most important.

The LCD module manufacturing emits sulfur hexafluoride (SF_6), a gas with a very high global warming potential (GWP) which partly explains the GWP_{100} difference between CRT (Cathode Ray Tube, i.e. the older type of monitor with a tube instead of a flat panel) and LCD manufacturing[3]. The same report also suggested that, although LCD manufacturing uses less energy than for CRTs, it may produce much higher levels of greenhouse gas emissions. Figure 3 above shows the global emission of SF_6 by major source categories[4]. The major part comes from manufacturing of electrical equipment, and that part is increasing.

---

[2] [EPA, 2009] Environmental Project No. 1308 2009. Environmental Screening and Evaluation of Energy-using Products (EuP) Final Report. Marianne Wesnæs, 2.-0 LCA consultants ApS, Jesper Thestrup In-JeT ApS, Arne Remmen Aalborg University.

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

[4] EDGAR, Emission database for global atmospheric research, 4.0 (JRC/PBL, 2009), http://edgar.jrc.ec.europa.eu/part_SF6.php#2difference

According to the Intergovernmental Panel on Climate Change, SF_6 is the most potent greenhouse gas that it has evaluated, with a global warming potential of 23,900 times that of CO_2 when compared over a 100 year period. It is also inert in the troposphere and stratosphere and therefore has an estimated atmospheric lifetime of 800-3,200 years[3].

A 10 year old US-EPA (the American Environmental Protection Agency) study on desktop computer monitors found that the greatest global warming impact for LCDs is from SF_6 in the LCD monitor/module manufacturing process, although CO_2 from the use stage and the materials processing stage also contributed significantly to the global warming impacts. LCD manufacturing also uses nitrogen trifluoride (NF_3) which has a similar GWP to SF_6 but which is not covered by international climate change negotiations, such as the Kyoto protocol. The reason is that when the Kyoto protocol first was drafted, the emission of NF_3 was insignificant, but has now increased dramatically mostly due to the extremely rapid production of flat screens and displays[5]. Overall, the GWP_{100} for desktops using LCD screens becomes 140 % higher compared to CRT desktops[3].

A 2008 report by DEFRA (Department for Environment, Food and Rural Affairs, UK) on televisions acknowledged that the environmental impacts of manufacturing LCDs cannot be readily quantified, but that the use of SF_6, along with NF_3, in LCDs and monitors could be significant in terms of global warming potential. Some manufacturers are aware about the need to reduce the use of these gases. One large manufacturer of LCD's has obtained the world's first CMD (Clean Development Mechanism) project approval from the UN designed to destroy and decompose the SF_6 gas emitted from the LCD manufacturing process[3].

As for plastics, audiovisual equipment's plastic parts need to be flame resistant. Although the extension of brominated flame retardants has diminished, such flame retardants can still be used. The brominated flame retardants pose a threat to human health and ecosystems. They are persistent and do not break down in natural systems and they can be converted into brominated dioxins which are extremely toxic. Many of the brominated flame retardants studied have been shown to have serious health effects.

User phase

It is estimated that stand-by power use accounts for about 3 to 10 % of home and office total electricity use[6]. The same report points out that around 1 % of global carbon dioxide emissions can be reduced by reducing stand-by power usage.

The main contributions to the overall environmental impacts of a TV according to figure 1 derives from the electricity consumption during the use of the television. The electricity consumption is the main contributor to all the environmental impacts[2].

End phase

The waste management of such products in general is also of crucial importance. The likely presence of dangerous substances such as heavy metals and brominated flame retardants poses a challenge. If the waste is not managed in a proper manner, serious

---

[5] Article in Environmental News Network, July 10, 2008 "LCD Chemical Found to have 17 000 times the Climate Impact of CO2", http://www.enn.com/pollution/article/37622

[6] Bertoldi P et al., "Standby Power Use: How Big is the Problem? What Policies and Technical Solutions Can Address It?", Proceedings of the ACEEE 2002 Summer Study on Energy Efficiency in Buildings, 18-23 August 2002, Pacific Grove, Cal.

environmental problems could be generated. Likely, if material re-cycling or material re-use is improved for products containing electrical or electronic parts, resources such as energy and materials could be saved – see figure 1 showing a negative primary energy usage in the re-cycling phase, indicating a positive life-cycle post in the overall TV energy life-cycle.

Potential

The analysis in the EuP-study suggested that the improvement potential should primarily focus on technologies and technical measures that reduce the power consumption of the TV in the user-phase. The second focus should be placed on applied materials and electronic components in the TV-design, particularly the reduction of weight and the support of efficient re-cycling. In that respect should the analysis of best available technology also focus on toxic or otherwise harmful materials in the design and manufacturing of TVs.

Likewise, the potential to pose strict requirements for heavy metals and flame retardants used as additives in plastic parts is considered possible and important. Today there are substitutes to brominated flame retardants for many applications within the product group. Improvement options regarding life-time extension are important, such as designing televisions for easy change of important parts and disassembly purposes. Design for re-use of components and re-cycling of materials from televisions should be highly prioritized.

The end of life of televisions will be influenced by the Waste Electrical and Electronic Equipment (WEEE)-directive, 2012/19/EU, which set requirements of the handling of TV and also on the possibility to identify and remove hazardous substances.

Steerability

Through requirements on energy consumption, flame retardants and other additives in plastic parts, gas use during production and requirements on disassembly of the product, the Nordic Ecolabellings requirements can steer producers or license holders towards higher energy savings, less hazardous material usage, lower greenhouse gas emissions and increasing possibilities for re-cycling of plastic parts or decreasing waste management problems.

However, abovementioned potentials must be placed into the context of the globalized market these products exist within. The success of the Nordic Ecolabelling requirements is much dependent on the formulation of energy consumption requirements. Home electronics are produced at a few locations for a global market. This means that if it is to be practically possible to live up to the requirements, the limit values and test methods must be as standardized as possible. Moreover, the requirements must be based on the whole European market rather than only the Nordic market.

The primary driving force for the home electronics sector is the introduction of new technology on the mass market. In order for Nordic Ecolabelling to be meaningful in this context, so that producers want to license their product and consumers can choose labeled products, the criteria must be adjusted to this driving force.

Table 1 – RPS-analysis of individual environmental parameters

Environmental parameter	Relevance	Potential	Steerability	Assessment of RPS
Power consumption	Very high	High[1)]	High	+++
Plastics	Low	High[2)]	Good	+
Flame retardants in plastics	Very high	High[2)]	Good	+++
Other additives in plastics	High	High[2)]	Good	++
Mercury content in TV-set background lighting and projector lamp	Very high	Very High[3)]	Very High	+++
Heavy metals	Indifferent	Indifferent	Indifferent[4)]	0
Environmental impact of production (use or raw materials and energy, transport, GWP-gases)	High	High	Poor/Good[5)]	0
Design (dismantling)	High	High	Good	++
Packaging	Low[6)]	High	High	++

1) *Power consumption per unit decreases as product development continues*

2) *Alternatives are available*

3) *LED-technology is available*

4) *Controlling the chain of suppliers is difficult. RoHS restricts the use of heavy metals*

5) *Poor controllability so far down the production chain, although attempt is made with declaration of NF_3*

6) *Low relevance in relation to the final products overall environmental impact*

Criteria version and validity

The criteria document was first approved as version 1.0 on 2 December 1999. Version 1 was valid until 1 December 2002. The product group comprised television sets, video recorders (VHS and DVD), and television sets in combination with video recorders, DVD players or personal computers, and complete stereo systems. Thereafter the criteria have undergone three major revisions with the revision to version 4.0 of the criteria being the latest major revision. During that criteria revision in 2009, video conferencing systems were added to the product group definition. Computers have acquired their own criteria document from 1996.

The last modification of the criteria document was to version 4.2 in June 2011. The modification contained a product group definition change, with projectors inserted as a product type.

In the criteria revision towards version 5.0, the product group definition was altered so that only TV-sets and projectors where included, see more 2.1 and under chapter 5 – Changes from previous version. The validity period was suggested to be shorter than usual, due to that, in the time of this criteria revision process both the Ecodesign and Energy Labelling regulations for TV-sets where undergoing a revision. In order to pursue the harmonization ambition with the upcoming legislation and the EU Ecolabel criteria, the above shorter validity period was suggested.

The Nordic market

Development of products within this product category is predominately done in Asia whereas the production (both components and final composition of the product) is carried out in many different parts of the world. The products are sold in the Nordic market usually through special retailers or through internet. The special retails chains have plenty of power in the market which makes them capable of lowering prices. Other smaller dealers work with other values than predominately price such as service, quality and proximity to customers.

Nordic Ecolabelling licenses

The product group has one license holder in the Nordic region, Samsung with 85 series of their LCD-televisions.

Other labels and legislation

Other labels (type 1 environmental labels) within this product category include:

- EU Ecolabels criteria for TV-sets (2009/300/EC)[7],
- Blue Angels criteria for TV-sets (RAL-UZ 145) from 2012[8], and
- TCOs criteria for projectors[9] (v.1.2 from 2011)

In particular EU Ecolabel is considered to have had a much broad impact on environmental market adjustment for TV-set than Nordic Ecolabelling due to a larger quantity of licenses. Except for type I environmental labels, the Directive for Energy related Products (ErP) 2009/125/EC and its Ecodesign requirements, has also been very important so as to bring up the general level of environmental performance for energy using and energy related products, such as TV-sets. Other legislation important to improve the product types environmental prestanda include also the WEEE-directive and the Restriction of Hazardous Substances Directive (RoHS-directive), 2011/65/EU.

[7] EU Ecolabel, Product groups and criteria: http://ec.europa.eu/environment/ecolabel/products-groups-and-criteria.html

[8] Blue Angel, Television Sets: http://www.blauer-engel.de/en/products_brands/vergabegrundlage.php?id=254

[9] TCO Development for Projectors: http://tcodevelopment.com/manufacturer-resources/product-categories-2/projectors/

3 About the revision

Objectives with Criteria/revision

The objective for this criteria development was to revise the criteria for Audiovisual equipment version 4.2, and construct a proposal for a new criteria document. The goals were specifically to:

- sharpen the energy requirements,
- investigate the possibility to form a requirement for NF3 used during the production of displays for visual equipment,
- revise the requirements for heavy metals and flame retardants,
- pose requirements for additives in plastic parts,
- examine whether the possibility to pose requirements on re-cycled/re-used plastics and bio-plastics,
- update the packaging requirements, and
- propose electrical safety requirements.

Requirements for flame retardants, additives in plastic parts, re-cycled/re-used/bio-plastic parts, packaging and electrical safety where predominately assessed in a parallel revision project within Nordic Ecolabelling, that of Computers to version 7.0. In order to revise the energy requirements, the ErP-directive was benchmarked. Televisions, Lot 5 in the ErP-directive was subject to a revision during the autumn of 2012 which also was considered in this criteria revision.

About this criteria development/revision

The revision for criteria version 5.0 was undertaken during the autumn of 2012 and spring of 2013. During the process of the criteria revision license holders as well as other stakeholders such as other environmental label organizations, environmental organizations, producers, retailers and industrial organizations where consulted.

The referral period was set from December 2012 – February 2013 during which the proposal for the new criteria document version 5.0 was published in the website of the Nordic Ecolabelling.

The project team within the Nordic Ecolabel for this project was:

Project leader:	Jimmy Yoler
Denmark:	Jacob Wegener Waidtløw
Norway:	Marianne B Eskeland
Sweden:	Björn Simons

4 Motivation of the requirements

For version 4.0 of the criteria, the majority of requirements where harmonized with the revised EU Ecolabel criteria for television sets. The full backgrounds to the harmonized requirements are described in the background document of the EU Ecolabel criteria "Revising the EU Ecolabel criteria for televisions 2009, Discussion papers to the working group". During the modification of the criteria document to version 4.2, projectors were inserted as a product type in the product group definition through a harmonization with the Japanese Eco Mark and their criteria for Projectors version 1.3.

In this version 5.0 of the criteria, important harmonized background descriptions still valid from the criteria revision to version 4.0 and later modifications are described summarized under each requirement in this background document.

Energy and power consumption

For the energy and power consumption requirements in this chapter the Energy Related Products Directive was examined to reveal whether or not the Nordic Ecolabelling can pose requirements that are stricter than the EU regulation. During the revision process for criteria version 5.0 of these criteria, a parallel process was carried out in the EU; a revision of the Ecodesign regulation for televisions, Lot 5 in the ErP-directive. A discussion paper on the review of the Ecodesign and Energy Labelling Regulations for TVs[10], including computer monitors, was considered in this criteria revision.

The discussion paper above suggested a merging between televisions and other electronical monitors to one product group, with common Ecodesign and Energy labelling requirements. The reason is that these product groups are increasingly converging and are therefore difficult to separate them with clear definition boundaries. Traditionally, these product groups have been separated based on their respective type of input signal. The discussion paper included a new requirement proposal based on the product supply in the market 2012. Based on over 400 TV-models, energy equations where created, adapted to the available market supply in 2012.

One of the conclusions during the ErP TV-revision process was that the transition to a more energy-efficient backlight, in the form of LED, has been implemented faster than expected in the market. Even the LED-technology has developed faster than expected towards more energy efficient solutions. However, an increase in energy consumption is expected related to the upcoming increasing use of 3D-technology and the supply of 3D broadcasting content. In order to achieve good image quality for 3D, usually a higher brightness than 2D is required, hence increasing the energy consumption.

The requirements for energy efficiency in the criteria version 4.0 and later modifications relied on the principles of Ecodesign regulations for TV-sets without referring to the Energy labelling regulation. The requirements in the criteria version 4.0 and later modifycations (after 31 December 2012) corresponded at best to the energy efficiency class B according to the Energy labelling of televisions, (EU) No 1062/2010. Because the

[10] Discussion paper of the review of the Ecodesign and Energy Labelling Regulations for televisions and on the draft Regulation on electronic displays, including computer monitors, 2012.

revision of the Ecodesign directive for TV-sets, which during late 2012 was fully ongoing in the EU, the Nordic Ecolabelling decided in the criteria version 5.0 to continue referring to the current Ecodesign Directive (EC) No 642/2009. Also a shorter validity period of the criteria version 5.0 was suggested, in order to harmonize the criteria with the new legislation, when the revision of the energy regulations for TV is accomplished.

Based on market energy data available in the above mentioned EU-discussion paper for TV-sets from 2012 Nordic Ecolabelling concluded that a tightening of the energy efficiency requirement was possible. The proposed requirement for energy efficiency suggests a requirement level tightening from the current level of energy efficiency corresponding to B to the level A+ for all displays, calculated according to current Ecodesign regulation for TV sets. The discussion paper reveals that 27% of the over 400 examined TV-models were able to fulfill level A+. That figure corresponds well with Nordic Ecolabelles overall ambition of constructing criteria that around 30% of the market segment can adhere to.

Nordic Ecolabel also concluded that the passive stand-by energy requirement is not meaningful to tighten, although market energy data indicates that such potential exist. The motivation for this is mainly that passive stand-by energy consumption is marginal in relation to energy consumption related to on-mode. It is also clear that the product development by itself continuously pushes passive stand-by energy consumption down. However, the requirement formulation was changed during the revision to version 5.0 of the criteria. From explicit limit values in passive stand-by mode, the requirement refers to the Ecodesign directive for TV-sets. In practice, the requirement for passive stand-by energy consumption, the level is in line with current legislation (autumn 2012).

The specific requirement for televisions makes it easier for a user to switch off the power when the television is not being used, and remember to shut down the television, through a clearly visible on/off switch. The requirement was partly kept from the criteria version of 4.0 and later modifications; the visible on-off switch requirement was removed due to potential material efficiency benefits in allowing the on-off switch to be incorporated into the televisions frame´s backside or body instead of an addition of a separate unit to the televisions frame. The difference between hard and soft switches is that the former cuts the current in the equipment while the latter electronically puts the equipment in a stand-by mode with lower energy usage level than on-mode. Stand-by is therefore a more energy using mode in relation to off-mode because the "readiness" for the equipment is higher. However, nowadays hardly any device is produced with hard switches, making televisions having at best passive (stand-by) mode as the lower energy level.

The maximum energy consumption was also removed for version 5.0 of the criteria. The motivation for this is found in chapter 5 – Changes from previous version.

Suggested requirement:

R1 **Specific requirements for Televisions**

All products shall have a hard or soft on-off switch.

✉ Declaration from the manufacturer of the audiovisual equipment, that the requirement is fulfilled.

✉ Photographic or descript evidence regarding the on-off switch.

R2 Passive Standby for Televisions

The product shall meet the requirements for power consumption in standby and off mode according to current Ecodesign regulation (EC) No 642/2009.

✉ Test report and calculations according to (EC) No 642/2009, Ecodesign requirement regulation for televisions.

R3 Energy efficiency

The product shall meet the requirement for Energy Efficiency Class A+ in the current Energy Labelling Regulations (EU) No 1062/2010 for all screen sizes.

✉ Test report and calculations according to (EU) No 1062/2010, Energy Labelling of televisions that verifies Energy Efficiency Index (EEI).

Specific requirements Projectors

This requirement is harmonized with the Japanese Eco Mark (criteria published 2010) and partly with TCO Development. It was decided during older criteria revisions in Nordic Ecolabelling to use the unit energy use per lumen (W/lm) instead of energy per square meter (W/m^2).

During the modification to version 4.2 of these criteria, Nordic Ecolabelling chose to use the unit "ANSI lumen" instead of the unit "lumen", measuring brightness of projectors. It was considered to be more accurate than the unit for projectors lumens.

Suggested requirement:

R4 Specific requirement for Projectors

- The projector shall have a "Eco Mode".
- It must be possible to set the projector to automatically go into Standby mode after a specified period of time when the video or computer interface is disabled.
- Standby power consumption shall be 0,5 W or less for every model. However, this item is not applicable on the network latency.
- Power consumption in use shall conform to the criteria in the table below.

Effective Flux (Brightness) x[lm*]	Power consumption [W]	Reference Model
x<2500	≤0.085[W/lm]×x[lm]+ 80[W]	2000lm:250W
2500≤x<3000	≤0.077[W/lm]×x[lm]+ 80[W]	2500lm:272W
3000≤x<3500	≤0.070[W/lm]×x[lm]+ 80[W]	3000lm:290W
3500≤x<4000	≤0.060[W/lm]×x[lm]+ 90[W]	3500lm:300W
4000≤x<5000	≤0.060[W/lm]×x[lm]+110[W]	4000lm:350W
5000≤x<6000	≤0.060[W/lm]×x[lm]+160[W]	5000lm:460W
x≥6000	≤0.060[W/lm]×x[lm]+220[W]	6000lm:580W

** lm = ANSI Lumen according to IEC 61947-1 and IEC 61947-2*

Note that in the case of a wide projector, short focus projector or products using 2 or more lamps on the light source, a reference value of power consumption shall be calculated by multiplying a coefficient per brightness [lm] by each of the following values:

A value to multiply for the wide projector α:1.1

A value to multiply for the short focus projector β:1/cosθ (β shall be up to 1.3).

θ=Injection angle: Angle of a horizontal line passing through the center of a projector lens (mirror) and the center of a project screen

A value to multiply for products using 2 or more lamps on the light source γ:1.5

Power consumption shall be measured in a normal mode (with maximum brightness) with no other function such as voice, etc. set.

(Example) Conversion expression when brightness is 6000 ≥ lm and functions of both a wide projector and short focus projector are equipped and using 2 lamp as a light source:

≤0.060[W/lm]×x[lm]×α×β×**γ**+ 220[W]

Standby power consumption shall be 0,5W or less for every model. However, this item is not applicable on the network latency.

☒ Declaration from the projector manufacturer showing that the requirement of "Eco-mode" and automatic stand-by mode is fulfilled.

☒ A test report shall be provided by the applicant to demonstrate that the product meets the requirement. The product shall be tested for its power consumption in its condition as delivered to the customer, according to the latest version of IEC62087. Test institute/analysis laboratory shall fulfill the requirements in appendix 2.

Hazardous materials

Flame retardants

Plastic parts in TV-sets contain flame retardants in order to protect them from taking fire. According to the Swedish Environmental Protection Agency, in 2009 the total amount of plastics considered to contain flame retardants from collected electrical and electronical waste was around 1 400-3 600 tones[11]. The use of some flame retardants are regulated by RoHS-Directive from the 1 July 2006. Those are PBB (polybrominated biphenyls) and PBDE (polybrominated diphenyl ethers). The directive has been revised 2011/65/EU (also called RoHS 2) and takes effect in the beginning of 2013. No new substances have been subjected to prohibition or limitations[12].

It is important to have strict requirements in place applicable to those flame retardants which still are used even though halogenated flame retardants are prohibited. The Nordic Ecolabelling has in the criteria revision version 4.0 and later modifications harmonized its criteria with Blue Angel and permitted only flame retardants which had not been assigned any of specified risk phrases at the time of application:

- R45 (may cause cancer),
- R46 (may cause heritable genetic damage),
- R60 (may impair fertility),

[11] Swedish Environmental Protection Agency, report 6482 (2012), "Collect, re-cycle!, a follow-up of the producer responsibility" – in Swedish
http://www.naturvardsverket.se/Documents/publikationer6400/978-91-620-6482-2.pdf

[12] Electric and electronic equipment – RoHS Directive – in Swedish http://www.kemi.se/rohs

- R61 (may cause harm to unborn child),

This harmonization continues during the criteria revision for version 5.0. Based on data retrieved from licensing processes, the Nordic Ecolabel assess that it now is possible to sharpen the requirement on flame retardant in plastics used. It is therefore suggested that two risk phrase combinations addressing eco-toxicity in combination with long term effects on aquatic environment are listed in the requirement. By listing these risk phrases, the risks associated with the use of such plastic products in imaging equipment are minimized throughout the audiovisual equipment´s life cycle.

These additional risk phrases are H400, H410 and H411 corresponding to R50/53 (very toxic to aquatic organisms, my cause long-term adverse effects in the aquatic environment) and R51/53 (toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment).

Limit values for impurity concentrations of halogenated flame retardant are mentioned in the requirement in accordance with the permissible concentrations in the RoHS-Directive – at the limit of 0,1 % by weight.

The knowledge about flame retardants that are used in printed circuit boards is still limited to us. Today TBBPA is the most used flame retardants in printed circuit boards. TBBPA has been assessed by EU and found "acceptable" regarding human health. Regarding aquatic and terrestrial ecosystems EU has concluded that there is a need for further investigation[13]. TBBPA is currently used in over 90 % of the printed circuit boards on the market according to a report from US Environmental Protection Agency[14]. The market situation when revising these criteria in 2012 motivates the exception for printed circuit boards from halogenated flame retardant prohibition requirement. This exception is also valid for plastic parts lighter than 25g. However PBB, PBDE, decaBDE or chlorinated paraffins are not exempted for use in printed circuit boards, lighter plastic parts than 25g or re-used and marked plastic parts.

In the revision to version 5.0 of the criteria, cables are excluded from this requirement, as they are in version 4.0 and later modifications. Also, in this criteria revision to version 5.0 of the criteria, the requirement has been altered in such a way that requirements on heavy metals are removed. Heavy metals are regulated by the RoHS Directive motivating the requirement to be a pure flame retardant requirement.

[13] Communication from the Commission on the results of the risk evaluation and the risk reduction strategies for the substances: sodium chromate, sodium dichromate and 2,2',6,6'-tetrabromo-4,4'-isopropylidenediphenol (tetrabromobisphenol A), (2008/C 152/02) http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2008:152:0011:0020:EN:PDF

[14] Design for the Environment, An EPA Partnership Program, "Flame retardants in Printed Circuit Boards", (2007) http://www.epa.gov/dfe/pubs/projects/pcb/index.htm

Suggested **modification** of the requirement:

R5 Flame retardants

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

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

- H350 (R45) (may cause cancer)
- H340 (R46) (may cause heritable genetic damage)
- H360F (R60) (may impair fertility)
- H360D (R61) (may cause harm to the unborn child).
- H400 and H410 (R50/53) (Very Toxic To Aquatic Organisms, May Cause Long-Term Adverse Effects In The Aquatic Environment)
- H411 (R51/53) (Toxic To Aquatic Organisms, May Cause Long-Term Adverse Effects In The Aquatic Environment)

Plastic parts must not contain halogenated organic flame retardants.

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

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

Exempted from the requirement are:

- Printed circuit boards. These parts must not, however, contain any PBB (polybrominated biphenyls), PBDE (polybrominated diphenyl ethers), decaBDE or chlorinated paraffins (maximum permitted concentration for impurities is 0.1 % by weight in homogenous material).

- Plastic parts <25 g. These parts must not, however, contain any PBB (polybrominated biphenyls), PBDE (polybrominated diphenyl ethers), decaBDE or chlorinated paraffins (maximum permitted concentration for impurities is 0.1 % by weight in homogenous material).

✉ The manufacturer must provide a list of plastics used in plastic parts >25 g in the product signed by the manufacturer of the final product. Appendix 3 – Plastics in audio visual equipment, Applicant´s/Manufacturer´s Declaration, must be used.

The plastic manufacturer must provide a list with flame retardants used in plastic parts >25g, by filling out Appendix 4 – Flame retardants in plastics, Plastic manufacturer´s declaration.

The manufacturer of flame retardants**,** used in plastic parts >25g, must certify that the requirements are fulfilled by filling out Appendix 5 –Flame retardant manufacturer´s declaration and submit an MSDS for each flame retardant. The manufacturer of the flame retardant must also certify that there are reasonable grounds for concluding that the flame retardant used cannot be considered to have the health and environmental effects as specified above.

Confidential information can be sent directly to the Nordic Ecolabel.

NEW: Chlorine based plastics

PVC (polyvinyl chloride) plastics above 25 g are excluded from use in imaging equipment. The presence of chlorine atoms in materials affords a number of technically desirable properties, but there are adverse environmental impacts coupled to the disposal of PVC plastics as they usually contain additives with undesirable health effects. When PVC ends up in the waste stream for incineration, this means effectively more chlorine in the waste stream. Chlorine is a prerequisite for the formation of the highly toxic dioxins in the flue gas, but since there are several other sources of chlorine than PVC, an increased incineration of PVC will not necessarily lead to an increased amount of dioxin, as chlorine is not the limiting factor for the formation of dioxins in incinerator[15, 16]. The extra amount of PVC will, however, increase the formation of acidic gases and consequently will increase the need for gas cleaning with gas cleaning equipment.

Combustion of 1 kg of PVC produces up to 1.7 kg of salt in flue gas cleaning[17]. In practice, it means that more waste is generated than the amount of waste that was sent into the incinerator. This is due to the neutralizing process carried out in order to avoid hydrochloric acid to be formed and create a corrosive environment in the incinerator. Not all waste incineration facilities are able to incinerate PVC-products in the Nordic region. Old fractions of PVC have a high probability of containing hazardous additives such as lead and cadmium creating rest materials that need to be taken care of. In the case of incinerators that cannot incinerate PVC waste, the stream is usually landfilled. In the case of incinerators being able of incinerating such PVC waste, the rest products (the fly ash and bottom slag) are treated specially; the fly ash being landfilled in special landfills, and the bottom slag also landfilled or used as construction material for landfills.

Proposed **new** requirement:

R6 **Chlorine-based plastics**

Plastic parts >25g must not contain chlorinated polymers.

✉ Declaration from the manufacturer of the audiovisual equipment, showing that the requirement has been met.

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

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

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

NEW: Phthalates in external power cable

Phthalates are commonly used in cables. Power cables and cables as part of the AC-adapter of the TV-set are cables that the user gets in contact with.

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

The phthalates DEHP, dibutyl phthalate (DBP) and benzyl butyl phthalate (BBP) are classified as toxic and may impair fertility and cause birth defects. DBP is also classified as environmentally hazardous and highly toxic to aquatic organisms. The three most dangerous phthalates (DEHP, DBP and BBP) are banned for use in toys and childcare articles above the concentration of 0,1 % of the plasticized material. The three less hazardous phthalates (DINP, DIDP and DNOP) are banned above the concentration of 0,1 % of the plasticized material in toys and childcare articles that can be placed in the mouth[18]. The regulation of phthalates in toys and childcare articles for the abovementioned six phthalates can be found in REACH regulation 1907/2006, in its appendix XVII.

In June 2011 two new phthalates were added to the EU Candidate list by the European Chemical Agency, ECHA. These new phthalates are to be found as plasticizers in floor coverings, cables etc. All together there was seven phthalates in the EU Candidate list in June 2012 and they were:

Table 2 – REACH Candidate list of phthalates in June 2012.

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

About 25 % of all plasticized PVC is used by the wire, cable and electrical industries. PVC's ability to be bent and twisted without cracking is a safety feature which makes it suitable for a wide range of applications.

When it comes to the computing market for instance, it seems that not all suppliers to computer manufacturers and not all computer manufacturers seem to yet have started to plan for the future restriction regarding phthalates. Nordic Ecolabelling assesses therefore the controllability in this area to be relatively low at the moment. However, Nordic Ecolabelling reasons that the effect of a limited requirement on the use of phthalates would be valuable in order to set focus on problems associated with the use of phthalates ahead. The suggestion here therefore is to only focus on the power cable used to connect

[18] The Swedish Chemicals Agency, Phthalates in toys (2009) – in Swedish http://www.kemi.se/Documents/Publikationer/Trycksaker/Faktablad/FbFtalaterileksakerNov2011.pdf

the audio visual equipment to the mains. Only cables with male/female connector to connect to the TV set or AC-adapter are addressed, not cables that are hardwired to the equipment.

The motivation for the requirement is that the volume of the plastic in a "normal" power cable to a TV is considerably high in relation to the volume of the plastic in other cables inside the TV, making the requirement relevant. Cables used internally in a TV are limited to short distances and are of a lower diameter compared to external power cables due to the lower voltage levels inside the TV. The power cable is also exposed more for human contact and mechanical stress.

Alternatives such as halogen-free cables are available on the market today. If not halogen free alternatives would be preferred phthalates, others than those listed in the REACH candidate list still can be used in cables, such as PINP and DIDP. In the coming revisions we will investigate if a more comprehensive requirement will be possible to introduce.

Proposed **new** requirement:

R7 Phthalates in the external power cable

The external power cable delivered with the audiovisual equipment should be free from the phthalates listed in the following table:

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

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

✉ Declaration from the manufacturer of the cable showing that the requirement is fulfilled.

Mercury content in LCD displays and projector lamp

For TV-set screens it is prohibited to use mercury in the background light. In the criteria version 3.0 and later modifications of the criteria document there was a threshold for how much mercury could be used in a TV-screen. In version 4.0 this was turned into a prohibition. The argument for this was that the market was mature enough for such a requirement.

The latest development regarding projectors indicates that projector lamps are switching technology where mercury is not being used. It is believed that around 95% of the projectors sold in the market have a mercury-based lamp. The substitute technology in this case is LED or LED in combination with laser technology. The technological development is applied on both projectors for smaller office purposes but also in larger and more powerful projectors. However, the new lamp technology is in a development stage.

Suggested requirement:

R8 **Mercury content in back-lit LCD displays and projector lamp**

The background light in the TV-screen must not have any mercury (Hg) content.

The lamp for projectors cannot contain mercury (Hg).

The producer shall describe the technique used.

✉ A declaration from the manufacturer of the audiovisual equipment showing that the requirement is fulfilled.

✉ The manufacturer of the audiovisual equipment shall also describe the technique used.

NEW: NF3-emission during TFT-cell production

Nitrogen trifluoride (NF_3) is used during assembly of the so called Thin Film Transistor (TFT-cell), a type of LCD-display. The gas is used in order to achieve a very sterile and clean environment in order to avoid impurities being built into the TFT-cell[19]. The gas is 17 000 times more potent than CO_2 and is not regulated by the Kyoto protocol as its use was low when the Protocol was drafted. The effect of the global emissions of NF_3 is equal to entire nation's emissions in CO_2-equivalents.

The gas is found in LCD-panels of cell phones, televisions and computer monitors, semiconductors and synthetic diamonds. However, the extremely rapid production of LCD-panels of digital televisions is believed to be the major contributor for its emission [Environmental news network, 2008], making a requirement in this field very relevant for the Nordic Ecolabelling.

As Nordic Ecolabelling is the first environmental labelling organization suggesting such a requirement, the first logical step is to require from the producer of the TFT-cell a declaration of how much kg of the gas is purchased per annum in relation to how many m^2 of displays are produced. Nordic Ecolabelling can then in the next revision have a relevant picture of where to aim a potential limit value.

Nordic Ecolabelling is aware that this requirement is coupled to some difficulties regarding the sub suppliers declaring data and understands that the requirement is not formulated as an absolute requirement with limit values. Therefore, there is a big interest to receive plenty of review comments for this proposed requirement.

Proposed **new** requirement:

R9 **Declaration of nitrogen trifluoride (NF_3) emission during TFT-cell production**

The manufacturer of the TFT-cell shall declare the amount of NF_3 purchased in relation to amount of TFT-cell (m^2) produced over one year.

✉ Declaration from the manufacturer(s) of the TFT-cell, declared by production site.

Confidential information can be sent directly to the Nordic Ecolabel.

[19] Swedish Radio, "Sales record of flat-panel televisions with dangerous green house gas" (2010) http://sverigesradio.se/sida/artikel.aspx?programid=406&artikel=3727370

Noise

Noise limit for Projectors

In the background documents for the product groups of Imaging Equipment and Computers are descriptions regarding the problems with noise, especially in office environments. As this product group and its specific requirement on projectors have similarity with imaging equipment and computers, Nordic Ecolabelling considers it of equal importance to continue in having noise requirements.

Noise is primarily a health issue. The main indoor noise sources are usually ventilation systems, office machines, home appliances and neighbours. In contrast to many other environmental problems, noise pollutant continues to grow and it is accompanied by an increasing number of complaints from people exposed to it.

The growth in noise pollution is unsustainable because it involves direct, as well as cumulative, adverse health effects. Noise can cause noise-induced hearing impairment, disturbances of rest and sleep, psychophysiological mental- and health and performance problems. Research in recent years has shown that exposure to constant noise can cause an increase of the stress hormones like adrenaline, noradrenalin, and cortisol in the body. Stress, as we know can cause heart failure, immunity problems, hypertension, and strokes according to another WHO report[20].

Taking all these potential adverse health effects into account makes it plausible to continue having a noise requirement for projectors. The requirement level is harmonized with the Japanese EcoMarks projectors criteria version 1.3. In the revision process for version 5.0 of this criteria document it was not prioritized to sharpen these criteria. It is worth pointing out that the requirement in the Nordic Ecolabelling scheme is compulsory, in contrast to EcoMark where it is a recommendation.

Suggested requirement:

R10 Noise limit for Projectors

The noise emission at normal mode shall satisfy the following levels:

Effective Flux (Brightness) x[lm*] and Weight of Product Main Body [kg]	Noise [dB]
x <5000 and y≤2	≤42
x<5000 and y>2	≤37
x≥5000	≤48

** lm = ANSI Lumen according to IEC 61947-1 and IEC 61947-2*

The sound power level must be measured in accordance with ISO 7779 and declared in accordance with ISO 9296. If the sound power level measurement is carried out on one appliance only the factor K = 3,0 dB(A) shall be added to the measured value. The factor K allows for measurement errors when the same device is tested using the same method at different conditions and for deviations in production.

✉ A test report shall be provided by the applicant to demonstrate that the product meets the requirement. Test institute/analysis laboratory shall fulfill the requirements in appendix 2.

[20] WHO Study, Noise pollution triggers heart disease (2012), http://www.cardioblog.org/entry/noise-pollution-triggers-heart-disease-who-study/

Design

Dismantling

Audiovisual equipment represents a large amount of material that is of interest to recycle as efficiently as possible. El-kretsen, Sweden´s business sectors Service Company for the collection and recycling of electrical and electronic products show in their statistics the re-cycling frequency of home electronic waste (TV, audio and video equipment) per year 2009, 2010 and 2011. 33 151 tones, 30 626 tones and 31 082 tons of home electronic waste were recycled respectively[21]. For TV and other screens, the different waste fractions can be seen in the figure below.

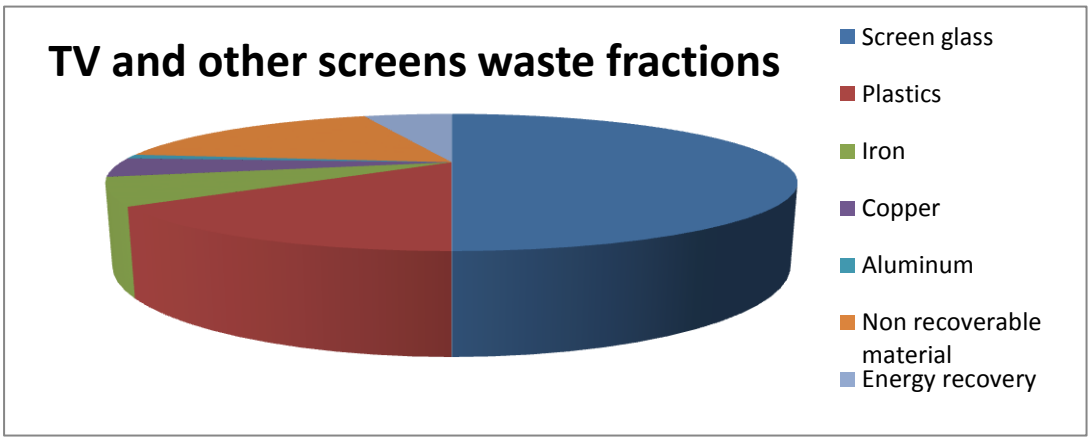

Figure 4 - TV and other screens waste composition in Sweden for 2011.[21]

The amount of waste generated from only home electronic waste motivates the requirement on dismantling so that recycling can be made. This is especially important regarding expensive and critical metals, such as gold, palladium and silver.

This requirement is fully harmonized with EU Ecolabel. In order for desirable parts of the worn-out product to be accessed it is good to ensure that audiovisual products can be dismantled, with easy-to-identify connections using the tools usually available to re-cyclers. It is also important that information has to be available from the manufacturer, such as labeling of components, should a re-cycler require it.

During the revision processes of the EU Ecolabel criteria for televisions in 2009 there was concern that a television should not be easy to disassemble by a member of the public due to health and safety issues. Therefore it was proposed that the requirement refers to a professional trained technician or re-cycler to undertake the work. Furthermore, to insure the product´s lifetime, it was decided that worn out parts should be easily accessible and easy to remove and swap by a trained technician or re-cycler.

[21] El-kretsen, Sweden´s business sectors service company for the collection and recycling of electrical and electronical products, Annual report 2011 – In Swedish
http://www.el-kretsen.se/sitespecific/elkretsen/files/arsrapport2011/elk_0066_arsrapport_2011_webb.pdf

Suggested requirement:

R11 Dismantling

The manufacturer shall demonstrate that the product can be easily dismantled by professionally trained recyclers, using the tools usually available to them, for the purpose of:

- undertaking of repairs and replacements of worn-out parts
- upgrading older or obsolete parts
- 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.
- Plastic parts shall be of one polymer or be of compatible polymers for re-cycling and have the relevant ISO11469 marking if >25g in mass.
- Metal inlays that cannot be separated shall not be used.
- Data on the nature and amount of hazardous substances in the television will be gathered in accordance with the Dangerous Substances Directive 67/548/EEC and its subsequent amendments and the Globally Harmonised System of Classification and Labelling of Chemicals (GHS).

✉ An exploded diagram of the product labelling the main components as well as identifying any hazardous substances in components. This can be in written or audio-visual format. Information regarding hazardous substances shall be provided in the form of a bill of materials identifying material type, quantity used and location, by filling out Appendix 6.

NEW: Packaging

Packaging constitutes for some products a significant part of the volume and weight. For other products, the packaging is secondary. Packaging components may consist of materials that have harmful effects on the environment and/or health such as PVC or other halogenated plastics, which can cause environmental problems during disposal. Another important aspect is the recycling of the materials used in the packaging. Recycling of the packaging material is mandatory in the Nordic countries. Producers and retailers have to be joined to a recycling solution. In Sweden producers have joined REPA to fulfil their obligations regarding the recycling of packaging material. Corresponding systems in Norway and Finland are Grønt Punkt and PYR. In Denmark the Danish Ministry of the Environment is managing the producer responsibility for packaging waste.

According to the European Commission Green Public Procurement Training Toolkit, module 3 of Purchasing Recommendations, a brief environmental life cycle of packaging equipment of packaging includes resource consumption, primary energy consumption whilst making the packaging, environmental effects of chemicals used in the packaging (particularly chlorinated plastics) and the process of making it and waste generation[22]. In

[22] European Commission Green Public Procurement (GPP) Training Toolkit – Module 3: Purchasing Recommendations – Office IT Equipment, Backgrund Product Report (2008) http://ec.europa.eu/environment/gpp/pdf/toolkit/office_IT_equipment_GPP_background_report.pdf

the same Green Public Procurement Toolkit it is assessed that packaging material contribute little of the total environmental impact of, in the report, office IT equipment. However it is important to consider packaging although their overall environmental impact is low, mostly because it is manageable for procurers to put simple requirements in place when tendering packaging products. Important parameters which can be influenced are for instance quantity, type of packaging and opportunities for re-cycling.

During the revision project of the Nordic Ecolabelling´s Computer criteria document during 2012 it was concluded that manufacturers of IT equipment have a clear interest to use recycled material in their packaging. Regarding cardboard the optimum level of recycled content in a packaging box has not been possible to find. One producer required the usage of more than 50% recycled material in the cardboard box. Another manufacturer claimed that the quality/function of the box deteriorates when that portion of recycled cardboard becomes too high lowering the stability and strength quality of the packaging. Recycling cardboard requires only 75% of the energy required to make new cardboard[23]. Weak packaging can also result in damaged products in the end which in turn can lead to production of replacement products. The optimum level of recycled material depends on the weight and volume of the good contained in the packaging.

New packaging solutions are available and are also being developed. Some of these solutions will surely be adopted in a large scale in the future. The traditional packaging materials will still be very much used and is actually increasing more in volume in relation to the global economic growth according to EC Nova Institute on behalf of EU[24]. The expansion depends mostly on plastic material packaging.

Nordic Ecolabelling finds it most reasonable according to the context of packaging materials described above, to focus on cardboard material regarding recycled content and limit the use of halogenated plastics. An introduction of two new requirement where introduced in version 5.0 of the criteria:

- the use of re-cycled material in packaging in order to reduce energy and material flows for production of virgin packaging material, and
- prohibition of halogenated organic substances in packaging, intended to prevent the use of chlorinated plastic materials in packaging and consequently the formation of dioxins and other persistent organic pollutants in their production and disposal phase.

Proposed **new** requirements

R12 Re-cycled material in packaging

When cardboard boxes are used, they shall be made of at least 80 % post-consumer re-cycled material. Only primary packaging, as defined in Directive 94/62/EC, is subject to the requirement.

✉ Declaration from audiovisual equipment manufacturer showing that the requirement is fulfilled.

[23] Bureau of International Recycling – The Industry, Paper http://www.bir.org/industry/paper/

[24] European Comission, Community Research – Material Change, the world is looking for new materials: industrial crops (2006)
http://ec.europa.eu/research/energy/pdf/gp/gp_events/biorefinery/bs4_05_gahle_en.pdf

R13 Plastic materials in packaging

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

✉ Declaration from audiovisual equipment manufacturer showing that the requirement is fulfilled, by filling out Appendix 7.

✉ Description of the packaging materials used.

Customer information/life-time extension

Requirements regarding life-time extension

When purchasing a ecolabelled television the consumer shall feel that a reasonable guarantee time is attached the product and that there is a possibility for the televisions life-time to be extended. In order to extend the life-time of the product, electronic replacement parts shall be guaranteed for seven years, from the time the production of the particular product ceases.

In version 5.0 of the criteria, this requirement has been stricter in such a way that the life-time extension measures issued by the manufacturers also shall be written in the individual electronic or printed product fact sheet.

Suggested requirement:

R14 Requirements regarding life-time extension

The manufacturer shall offer a commercial guarantee to ensure that the product 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.

This shall be written in the electronic and/or printed product fact sheet.

✉ Declaration from the manufacturer of the audiovisual equipment showing that the requirement is fulfilled.

✉ Enclose written electronic and/or printed product fact sheet.

Operating instructions

This requirement is harmonized with the EU Ecolabel for televisions. Although manufacturers do not want to produce large amount of texts in operating instruction manuals, it was important during the process of revising the EU Ecolabel criteria in 2009 to achieve an energy improvement in the user-phase through the information the ecolabel could provide to consumers via the user manual. With, in the operating instruction manual, highlighted text of information on power consumption and environmental such an achievement could take place.

The requirement for operating instruction for criteria version 5.0 is kept.

Information on the energy saving modes on the television (off-on switch) in the operation instructions should be given priority, so that consumers easily understand the saving modes operations.

Suggested requirement:

R15 Operating instructions

The product 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 instructions for use must be in the official languages in the Nordic country where the Nordic Ecolabelled product is on sale.

The information will include but not be limited to:

1. The product's power consumption information in the various modes; on, off and passive standby.
2. Average annual energy consumption, following EICTA guidelines.

How to reduce power consumption when the product is not being used by being energy efficient, covering at least:

3. Using the on/off-switch will reduce energy use to zero (where one is fitted)
4. Putting the product into a standby mode, (e.g. passive standby or deep sleep) will reduce energy consumption, but will still draw some power
5. Turning the product off at the wall will reduce energy use to zero for all products, and is recommended when the product is not being used for a long time, e.g. when on holiday
6. For television: reducing the brightness of the screen will reduce energy use
7. For projectors: there must be a description that explains how the projector is put in to "Eco mode"
8. Energy efficiency reduces energy consumption and thus saves money by reducing electricity bills
9. Repair information regarding who is qualified to repair products, including contact details as appropriate
10. End-of-life instructions for the proper disposal of televisions at civic amenity sites or through retailer take-back schemes as applicable to be compliant with the WEEE Directive,

Information that the product has been awarded the Nordic 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 web-site address on page 2.

Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC and 2003/108/EC

✉ Declaration from the manufacturer of the audiovisual equipment showing that the requirement is fulfilled.

✉ A copy of the instruction manual.

Code of Conduct

In certain parts of the world the production of heavy metals used in components essential for a TV-set involves heavy manual labour. Some of the constituent substances in components in a TV-set are very harmful to health and are handled manually. Working conditions must accordingly be good in order to avert permanent damage to the health of the workers as a result of this work. At the same time, however, companies using a high proportion of manual labour are often located in countries in which the scope for securing good working conditions and freedom of speech is limited. There are examples of strikes amongst factory workers who have been exposed to high concentrations of toxic substances and whose working conditions are also poor in other respects[25].

Nordic Ecolabelling believes that ecolabelled products should not only be the best choice in terms of the environment, but also in terms of working conditions. For this reason, in the version 5.0 of the criteria, Nordic Ecolabelling chose to impose the requirement that licence holders must have a code of conduct in place and that this code should be communicated to suppliers/subcontractors.

Nordic Ecolabelling appreciates that it may be very difficult to ensure that the working environment at all sub-contractors in all parts of the TV-set production chain is satisfactory. Nevertheless, Nordic Ecolabelling is confident that the more production facilities and raw material suppliers are confronted with a requirement/signal from their customers that a code of conduct must be met, the more the possibility that such conditions in fact will be improved.

Proposed **modification** of requirement.

R16 **Code of conduct**

The license holder must have a code of conduct in place in accordance with the ten principles provided for in the United Nations Global Compact.

The license holder must ensure that the code of conduct is communicated to all suppliers/subcontractors together with a request that these should also comply with a code of conduct that follows the ten principles provided for in the United Nations Global Compact.

NB: The principles embodied in the United Nations Global Compact include the following: human rights, employee rights, environmental protection and anti-corruption safeguards. Further information can be found at http://www.unglobalcompact.org

☒ Copy of the license holder's "Code of Conduct".

☒ Description of the way in which subcontractors and producers are notified of the license holder's code of conduct and of the license holder's request that they have a code of conduct in place that follows the ten principles in the United Nations Global Compact.

[25] International Network on Human Rights and Sustainability in Electronics – JOIN GoodElectronics in its urgent appeal to Gold Peak (2010)
http://goodelectronics.org/news-en/chinese-battery-producer-fails-to-be-a-decent-employer/

Quality and regulatory requirements

The requirements for the quality system are intended to ensure that the license holder fulfills the criteria and that the requirements are verifiable during the period of validity of the license, including the possibility to trace the products. To complement this system, Nordic Ecolabelling needs also to have an appointed contact person at the license holder ensuring that the criteria are fulfilled during the period of validity of the license. The contact person is also responsible to inform Nordic Ecolabelling in case of planned changes or unplanned non-conformities affecting the licenses products. Following requirements are found in all Nordic Ecolabelling criteria document.

Suggested requirement:

R17 Nordic Ecolabel licence contact

The company shall appoint a person responsible for ensuring the fulfilment of Nordic Ecolabel requirements, and a contact person for communications with Nordic Ecolabelling. Preferably, this should be the same person.

✉ A chart of the company's organizational structure detailing who is responsible for the above.

R18 Documentation

The licensee must be able to present a copy of the application, and factual and calculation data supporting the documents submitted on application (including test reports, documents from suppliers and suchlike).

☺ Checked on site.

R19 Quality of the product

The licensee must guarantee that the quality in the production of the Nordic Ecolabelled audiovisual equipment is maintained throughout the validity period of the licence.

✉ Procedures for collating and, where necessary, dealing with claims and complaints regarding the quality of the Nordic Ecolabelled audiovisual equipment.

R20 Service and support

The licensee shall offer the possibility of service and support in the official Nordic language where the Nordic Ecolabelled product is sold.

✉ Describe service and support organisation.

R21 Planned changes

Written notice must be given to Nordic Ecolabelling of planned changes in prodcts and markets that have a bearing on Nordic Ecolabel requirements.

✉ Procedures detailing how planned changesin products and markets are handled.

R22 Unplanned nonconformities

Unplanned nonconformities that have a bearing on Nordic Ecolabel requirements must be reported to Nordic Ecolabelling in writing and in a journal.

✉ Procedures detailing how unplanned nonconformities are handled.

R23 Traceability

The licensee must have a traceability system for the production of the Nordic Ecolabelled audiovisual equipment.

✉ Description of/procedures for the fulfilment of the requirement.

R24 Take-back system

Relevant national producer responsibility regulations, legislation and/or agreements within the sector regarding the recycling systems for products and packaging shall be met in the Nordic countries in which the Nordic Ecolabelled audiovisual equipment are marketed.

✉ Declaration from the applicant regarding adherence to existing recycling/take-back agreements.

Legislation and regulations

The license holder must guarantee adherence to safety regulations, working environment legislation, environmental legislation and conditions/concessions specific to the operations at all sites where the Swan-labeled product is manufactured. No documentation is required when the license is granted, but Nordic Ecolabelling may revoke the license if the requirement is not fulfilled.

Suggested requirement:

R25 Legislation and regulations

The licensee must guarantee adherence to safety and EMC regulations, working environment legislation, environmental legislation and conditions/concessions specific to the operations at all sites where the Nordic Ecolabelled product is manufactured. Additionally the licensee must guarantee adherence to product-specific regulations in all the Nordic countries where the product is sold.

No documentation is required.

Marketing

The requirement as to marketing has been set to ensure that that the ecolabelling criteria are fulfilled and that they are verifiable during the period of validity of the licence. The requirement is common to all Nordic Ecolabelling criteria documents.

Suggested requirement:

R26 Marketing

Marketing of the Nordic Ecolabelled audiovisual equipment must comply with the latest version of "Regulations for Nordic Ecolabelling".

✉ Appendix 1 duly completed.

5 Changes from previous version

Changes from previous criteria version are summarized in this chapter and are divided into:

- requirements kept from previous criteria version and revised, under table 4,
- removed requirements from version 4.0 and later modifications, and
- new requirements in version 5.0 of the criteria.

There is also a part under this chapter concentrating in describing requirements that have been evaluated during the revision process of version 5.0.

The criteria document has changed its product group definition. From a broad product group definition containing TV-sets, videoconferencing systems, televisions in combination with other equipment such as DVD/ Blu-ray players, DVD / Blu-ray players, stereo systems (including speakers with at least one of the following: radio receivers, CD, DVD, cassette or gramophone) and Set Top Boxes, the criteria document version 5.0 has a more limited product group definition containing TV-sets and projectors. The motivation for the difference in the product group definition can be found in the below table 3.

Table 3 - Summary of product group definition change.

Product	Summary	Recommendation
TV-sets	The only product type that Nordic Ecolabelling today has licensed products within. Only mercury-free TV sets can licensed. Within the EU Ecolabel scheme, several producers have licensed products.	Keep the product type. The possibility of adhering more manufacturers and their mercury-free products to the Nordic Ecolabelling is assessed as relatively high.
Videoconferencing systems	The criteria were expanded with videoconferencing systems during the revision to version 3.0. The expansion of the product group definition has not led any new licensed products within the category. The main reason is a software industry shift, premiering programs such as Skype and Microsoft.	Remove this product type. Focus on the criteria should be consistent on large volume products with significant environmental benefit potentials.
TV-sets in combination with other equipment such as DVD / Blu-Ray players	Nordic Ecolabelling has not experienced any demand for this product type.	Remove this product type. Focus on the criteria should be consistent on large volume products with significant environmental benefit potentials.
DVD-/ Blu-Ray players	Within this type of products there have been a few indications of interest. However, no continuation of the interests has been made. Moreover, the market trend points to a decline in sales of DVD-players.	Remove this product type. Focus on the criteria should be consistent on large volume products with significant environmental benefit potentials.
Complete stereo systems, ie systems including stereo speakers with one or more of the following: radio, CD, DVD, cassette or record player.	Within this type of products there have been a few indications of interest. However, no continuation of the interests has been made. Moreover, the market trend points to a decline in sales of DVD-players.	Remove this product type. Focus on the criteria should be consistent on large volume products with significant environmental benefit potentials.

Product	Summary	Recommendation
Set-Top Boxes	There has, within this product type in previous criteria versions been licensed products. Interest has also been shown to introduce criteria for new types of set-top boxes. However, interest has not yet led to any new licensed products.	Remove this product type. Focus on the criteria should be consistent on large volume products with significant environmental benefit potentials.
Projectors	Version 4.2 of the criteria expanded the product group definition with projectors in June 2011. The aim was primarily to highlight mercury-free products in the market. Interest has been shown by two manufacturers of mercury-free products.	Keep the product type The possibility of adhering manufacturers and their mercury-free products to the Nordic Ecolabelling is assessed as relatively high.

Due to the alteration of the product group definition of the criteria document, requirements belonging to version 4.0 and later modifications such as R6, R7 and R8 in the criteria version 4.0 and later modifications have been removed.

All changes in the revision of the criteria from version 4.0 with later modifications to version 5.0 are summarized in the following table. The most important ones are considered to be requirements for energy consumption, flame retardants, halogenated plastic parts and packaging.

Table 4 – Summary of the differences between criteria version 4.0 with later modification and version 5.0

Requirement Title in version 4.0 and later modifications	Chapter in version 4.0 and later modifications	Correspond with chapter in version 5.0	Change
Specific req. for TV/TV in combination with other equipment	R2	R1	Requirement definition changed to "Specific requirements for Televisions" only
Passive Standby for TV/TV in combination with other equipment	R3	R2	Requirement definition changed to "Specific requirements for Televisions" only. Re-formulation of requirement referring directly to Ecodesign regulation.
Energy efficiency	R5	R3	Requirement changed. The requirement refers directly to the energy labelling requirement. A+ is required for all TV-sets regardless of screen size.
Specific requirements for Projectors	R9	R4	-
Heavy metals and flame retardants	R10	R5	Requirement only posed on flame retardants as heavy metals are regulated by the Directive 2002/95/EC. New risk-phrases added: H400 and H410 (R50/53) and H411 (R51/53).
Mercury content in LCD displays	R11	R8	Requirement title re-formulated: "Mercury content in back-lit LCD displays and projector lamp".
Requirements regarding life-time extension	R14	R14	The life-time extension written explicitly in the product fact sheet.
Code of Conduct	R16	R16	Reformulated requirement.

Removed requirements

Harmonization with EU Ecolabel

The requirement was meant to simplify the application process for a producer and was a result of a mutual recognition harmonizing the application process between the EU Ecolabel scheme and the Nordic Ecolabel scheme concerning material requirements, except the requirement for flame retardants. Nordic Ecolabel had in addition to this its own quality requirements.

During the criteria revision to version 5.0 of these criteria, a harmonization was not considered to be realistic due to that Nordic Ecolabel moved forward with the revision of the criteria whilst EU Ecolabel just begun revising their criteria for televisions which created a too large difference between the two schemes to consider a harmonization.

The criteria version 5.0 is suggested to have a shorter validity period due to, during the time of revision, a revision of the ErP-directive and Ecodesign requirements for televisions. The shorter validity period also facilities a future harmonization with a revised version of the EU Ecolabel criteria for televisions.

Heavy metals

The scope of the requirement for heavy metals covered all parts, also plastic parts < 25 grams. The main reason was that cadmium could be found in for instance "old" products, PVC-products and that lead stabilizers represent approximately 70 % of total stabilizer use in Europe. The stabilizers are for instance persistence and bio accumulative. Their effects are toxic to waterborne organisms, harmful to reproductive systems, toxic to the immune system and carcinogen.

The requirement on heavy metals was removed for version 5.0 of the requirement with the motivation that the directive RoHS (2002/95/EC) captures the problem with use of heavy metals in electrical and electronic equipment. The RoHS-directive poses both absolute requirements, points out limit values and exceptions of use in certain areas. As such legislation works effectively, making producers generally to comply with its requirement, the motivation for Nordic Ecolabelling having own requirements in this area is not supported by relevance.

Maximum energy requirement

Nordic Ecolabelling assessed during the revision that a maximum energy level is not required in relation to energy efficiency of televisions. In version 4.0 and later modifications of the criteria a limit value of 200 W was valid. That limit value has played its part in preventing televisions with very high energy levels. There are indications that very large televisions, over 50” have energy consumptions in on-mode little over 100 W.

There is also another argument to why such a limitation is unnecessary. In order to include and regulate big screens via voluntary ecolabelling schemes, such a limit is an obstacle, effectively preventing producers wanting to label their products and consumers willing to buy such products.

New requirements that have been added to the criteria document version 5.0

R6 - Chlorine-based plastics
R7 – Phthalates in the external power cable
R9 - Declaration of nitrogen trifluoride (NF_3) emission during TFT-cell production
R12 – Recycled material in packaging
R13 – Plastic material in packaging

Evaluated requirements that were considered to the criteria document version 5.0

Recycled/Re-used plastics and bio-based plastics

Positive initiatives from close related computer manufactures can be seen regarding use of post-consumer recycled plastic. For instance monitors with 65 % recycled content. Also TV-sets are found to contain an environmentally interesting plastic produced from recycled DVDs and TV screens with an efficient sodium sulphate based flame retardant which has led to a 80 % lower CO_2-emission than for conventional plastics in the manufacturing phase, according to this manufacturer.

Although the development is positive, and it is in line with Nordic Ecolabellings ambition to promote post-consumer recycled plastic, there are two central challenges connected with post-consumer plastics. The first challenge is the content of post-consumer plastic parts and the second challenge is the availability of post-consumer plastic parts with good enough quality aspects. The low availability of good enough post-consumer recycled plastic parts has a consequence that manufacturers demanded volumes of such plastic parts cannot always be guaranteed, making volume-products vulnerable for large-scale production due to raw material insufficiency.

When it comes to bio-based plastics, The Nordic Ecolabel is looking very positive on the development of using more bio-plastics in manufacturing, but is also aware of some problem connected with the use of bio-based plastics that have to be investigated further. These are for instance health and safety hazards in production, land-use and GMO as well as cultivation methods. Similarly with the use of recycled plastic we see that the availability to use bio-based plastic in products is limited for only some niche products.

According to resent research at EU level[26], there are also questions that bio-based plastics are not as sustainable as they seem. Although in some aspects bio-based plastics are more sustainable than traditional plastics, the analysis identified several environmental and occupational health and safety hazards in their respective production. Some bio-based plastics are preferable from a health and safety perspective. These include poly-hydroxyalkanoates (PHAs), poly-lactic acid (PLA) and starch. However, also they have

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

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

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

Therefore, in this criteria revision Nordic Ecolabelling is not ready to introduce a general requirement posing a certain level of post-consumer or bio-based plastic parts. The consequence of doing so would be that only some few niche products would be able to get acquire a license. However, developing this kind of requirements to increase the use of post-consumer plastic is something that Nordic Ecolabelling would like to do in the future.

Electrical safety

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

It is the manufacturer who is responsible for ensuring that a product is safe. In order to assess the safety of products, the authorities together with the industry have compiled standards for different product groups. The manufacturer always has the possibility to use an independent test body to test the product. A number of test bodies are accredited to certify products.

In the Nordic countries there are governmental organizations conducting inspections of electrical safety, especially in the form of market surveillance. In Sweden the Swedish National Electrical Safety Board has this responsibility.

The Nordic Ecolabelling does not find any reasons to develop a new requirement for electronic safety. Nordic Ecolabelling has been in contact with the Swedish National Electrical Safety Board. They agree that there are no reasons to have specific requirements for electric safety. The CE-label still covers electrical safety and there are well-developed market controls done by governmental organizations in the Nordic countries and the EU. Nordic Ecolabelling concludes therefore that there is no need of requirements of electrical safety in the criteria document.

Halogen-free flame retardants

Halogen-free alternatives are becoming more available on the market. Products with PCBs with halogen free flame retardants can be found on the market now. However, our knowledge about the properties of the new flame retardants used in printed circuit boards is very limited so it is not possible for the Nordic Ecolabelling at this revision to sharpen the requirement when it comes to halogen-free flame retardants.

6 New requirements

In the upcoming revision of the criteria for Audiovisual equipment the following requirements will be revised:

- Limit value for NF_3 used in LCD-display/TFT-cell production
- Regulations to minimize the risk of use of "conflict metals" in electronics
- Evaluate the feasibility in a "white list"-approach for plastics additive approval
- Ban of PVC and phthalates in all plastic parts
- Revision of projectors requirement (energy and noise)
- Requirements for halogen-free cables