Topten ACT Criteria Paper

Computer monitors

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Topten ACT aims at transforming the European market of energy-using products towards higher energy efficiency.

Topten ACT identifies the top energy-efficient products in 16 European countries, and makes this information available to consumers and large buyers on tailored national websites. The most energy efficient models in different product categories (such as household appliances, lighting, office equipment, consumer electronics, cars) are presented with comprehensive product information based on official labels and standardized declarations. Topten works with manufacturers and thus increases both market offer and consumer demand of high energy efficiency products. Topten is strictly neutral and independent from manufacturers and retailers, its selection criteria are always published online.

Topten ACT is supported by the European Commission's research and innovation programme Horizon 2020, and many national organisations (energy agencies, environmental and consumer organisations, research institutes). The Topten ACT project involves 17 partners in 16 European countries. It is coordinated by ADEME (Agence de l'Environnement et de la Maîtrise de l'Energie).

More information and access to all national websites on the European site: www.topten.eu

1. Topten.eu: Monitors - current selection criteria and products selected

Topten.eu selection criteria since June 2015:
- Energy Star 6.0 or 5.1
- TCO
- Max. power in "sleep" mode: 0.5W (This is 'standby' in EU terminology, but called 'sleep' by Energy Star)
- Max. power in "on" mode (according to Energy Star) depending on screen size (diagonal in inches):
  - $15 \leq d < 17$: 13W
  - $17 \leq d < 20$: 18W
  - $20 \leq d < 22$: 20W
  - $d \geq 22$: 22W

Numbers of monitor models currently on Topten.eu according to screen size (last update: June 2015):

screen size	number
17 inch	3
19 inch	8
20 inch	2
21 inch	1
21.5 inch	4
22 inch	10
23 inch	4
23.6 inch	1
24 inch	14
27 inch	5
Total	**52**

Similar models have not been counted if from the same brand.

There are 52 monitor models of 7 different brands on the Topten.eu product list:
Acer, EIZO, Fujitsu, Lenovo, Philips, Samsung, TERRA.

2. Expected selection criteria in 2016

In 2016 Topten will accept only monitors that are meeting the Energy Star Version 6.0 program requirements. The power of monitors up to 24 inches could be reduced to 20W.

- Energy Star 6.0
- TCO
- Max. power in "sleep" mode: 0.5W
- Max. power in "on" mode (according to Energy Star) depending on screen size (diagonal in inches):
  - $15 \leq d < 17$: 13W
  - $17 \leq d < 20$: 18W
  - $20 \leq d < 24$: 20W
  - $d \geq 24$: 22W

Another possibility is to align the future Topten.eu selection criteria to the Ecodesign requirements for electronic displays, which will presumably apply from late 2016 and be

based on a bent reference line, requiring larger models to be relatively more efficient than smaller ones. With this we might be able to support a future Energy Label that is also based on the same digressive reference line.

As soon as the energy consumption of monitors will be declared based on the Ecodesign regulation (and thus on the amended TV test method IEC or EN 62087) we will base our selection criteria on these values instead of Energy Star. In the future, the distinction between 'TVs' and 'monitors' might disappear (also identical requirements will apply), so also we might fuse these two product categories into one.

3. Technical background

As TVs, also today's monitors are Liquid Crystal Displays (LCD) with Light Emitting Diodes (LED) as backlight source. LCD is made up of any number of pixels consisting of materials (liquid crystals) that can alter their crystalline structure or orientation when voltage is applied. The transparency is changing through this principle. The light from the light source first passes through a polarization filter, gets then modulated by the liquid crystals, and creates a blue, red or green pixel after passing through another polarization and colour filter.
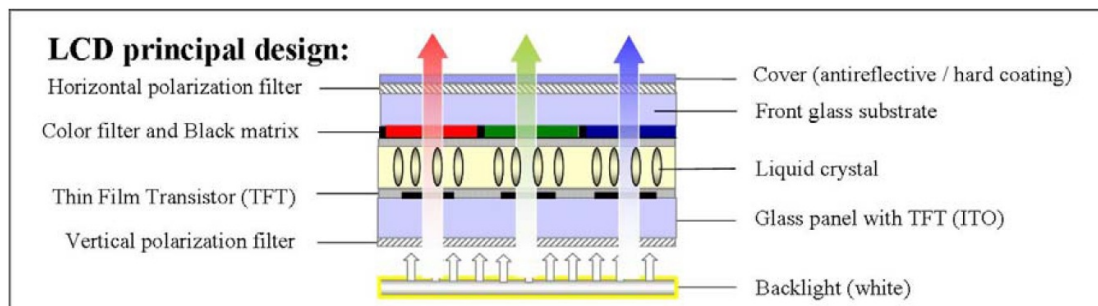

Figure 2: Principle Design of a Liquid Crystal Display (Source: EuP Preparatory Study "Television" (Lot5), Fraunhofer IZM, 2007)

The energy consumption of LCD displays is defined by the energy use of the backlight: if there are more LEDs (larger screen) and they emit more light (brighter screen), consumption goes up. In some displays the power can be independent of the actual image brightness: because the image brightness is only produced by the LCD layer (the 'shutter'), while the backlight emits at constant brightness. Newer displays have a dynamic backlight: they create black sections by switching off specific LEDs and can save energy and create darker black at the same time. In TVs, dynamic backlight has become standard.

Features relevant for energy consumption are basically the same as for TVs:
- **The Automatic Brightness Control (ABC)** saves energy by reducing the screen brightness if the ambient brightness in the room is low (around 100 lux). Energy Star grants a 10% On mode power allowance for displays with ABC enabled by default. For the future testing of displays it is planned to include an ABC test, which would allow for more precise consideration of this function.
- **Presence or gesture detection** are other enhanced reactivation functions. These may also have a higher low-power mode consumption, but can also help to switch off the display if no one is around.
- **Ultra High Definition (UHD) displays** have screen resolutions higher than Full High Definition (also known as FHD, Full HD or 1080p; 1080 vertical pixels; 1920x1080 pixels in the usual 16:9 widescreen aspect ratio): 4K (or UHD-4K) means approximately 4000 horizontal pixels (4096 x 2160 pixels). According to findings from CLASP, the high resolution *per se* does not lead to a higher power.

4. Policy measures, standards and labels

Energy Star (US Energy Label)
The US Energy Star Program requirements for displays cover computer monitors, signage displays and digital picture frames with screen diagonals up to 61 inches. Energy Star V. 6.0 is very stringent for small monitors. For monitors up to 22" the max. Energy Star On mode power is up to 30% lower than the Topten selection criteria. For large monitors on the other hand, Topten is more stringent. The Energy Star calculation formula is quite complicated, consisting of five or more different formulas (even 14 formulas when including signage displays, displays with high resolution and enhanced-performance displays). The max. On mode power depends on the screen area and the resolution (and models with an automatic brightness control (ABC) receive an allowance).
While Energy Star up to V. 5.1 was based on an own test method, V. 6.0 refers to IEC 62087, the international TV measurement standard. Energy Star On mode values should thus be comparable with declared TV On mode power. However, we have some doubts if monitors are really tested in a different way now: where manufacturers did provide On mode power both according to V. 5.1 as well as V. 6.0, the values have been identical.
The EU has an agreement with the US so that monitors meeting Energy Star requirements can be marketed as such in Europe. The EU Energy Star for displays is also based on the V. 6.0 specifications (Commission decision 2014/202/EU), and models should be listed on www.eu-energystar.org/ .

EU Energy Label and Ecodesign regulations
In 2012 the revision of the Energy Label and Ecodesign regulations for TVs was started. It is planned to extend the scope of these regulations to 'electronic displays' in general, i.e. TVs, computer monitors and digital picture frames. The same requirements should apply for these products, because their functionalities are more and more overlapping: TVs have internet connectivity and are used for looking at pictures, while monitors are designed to also show dynamic content, i.e. videos.
The last proposal from December 2014 suggested to introduce a digressive reference line for the Ecodesign requirements: the suggested curve resembles the one Energy Star applies for TVs (including a hyperbolic tangent function 'tanh') and would demand higher relative efficiency from larger displays then from smaller ones. The proposal suggested to remain with today's linear reference line for the Energy Label, but to make the A++ and A+++ class thresholds more stringent (A++: 0.13 instead of 0.16, A+++: 0.05 instead of 0.1).
The revised Ecodesign regulation is expected to be adopted in the second half of 2015. The Labelling regulation however has been put on hold, to wait for the revised framework Labelling Directive to be adopted.
Expected savings from the Ecodesign and Labelling regulations on electronic displays are 35 TWh in 2030.

Standby and Off mode
The text of the standby regulations ('normal' standby 1275/2008 and networked standby 801/2013) implies that for PC monitors the max. power in standby mode is the 6W that are currently applying for 'networked equipment without high network availability (HiNA)'. However we're having some doubts, since so many monitors easily meet the 0.5W applying for non-networked equipment. At the moment we therefore recommend to also set a criterion for power in standby or sleep mode (max. 0.5W). We will clarify what actually applies.

Measurement standard
Up to now the only standardised energy declaration for monitors have been based on Energy Star and the Energy Star test method (up to Energy Star V. 5.1). Version 6.0 refers to the international TV test method IEC 62087 for the On mode power test. It is however unclear if manufacturers have really changed their declaration.

The future EU declaration based on Ecodesign and Energy Label will also be based on IEC 62087. This test standard will be updated (the test video) amended (to measure power reduction by ABC).

EU Ecolabel
The current EU Ecolabel criteria for PCs cover also computer monitors: their On mode power must be at least 30% lower than that required by Energy Star V. 5.0 and must not exceed 100W in the maximum brightness settings, Sleep power must not exceed 1W and Off mode power must not exceed 0.5W.
These criteria are currently being revised. They will be aligned with the future Ecodesign and/or Energy Label requirements, and the scope will also be extended to 'electronic displays' in general.

Blauer Engel
The Blauer Engel, the German Environmental Label (which is also applied in other countries) also has award criteria for computer monitors (RAL-UZ 78c). For energy efficiency, the Blauer Engel requires Energy Star V. 6.0. Additionally there are requirements on repairability, recyclability, material, ergonomics and consumer information. Some of the criteria are aligned with TCO Certified Displays.
At the moment there is only one computer monitor with the Blauer Engel Label.

TCO Certified
This Swedish Label puts a focus on health issues, but has a wide range of quality criteria. The current TCO V. 6.0 criteria for displays have requirements regarding visual and workload ergonomics, emissions, electrical safety, environmental requirements and corporate social responsibility. For energy consumption, which is part of the environmental criteria, TCO refers to the most recently published Energy Star specifications.
This will also be the case in the V. 7.0 draft criteria from March 2015.

5. Market analysis

The Lot 3 preparatory study on computers and monitors estimated the European monitors market at around 24 Million units per year, but data is not very reliable.

6. FAQ

How can my monitor save energy?

1. Choose an energy-efficient model from Topten, with low power on On and Standby modes.
2. If your monitor has an automatic brightness control, switch it on. This will optimise the brightness and energy consumption of your monitor to the ambient brightness.
3. Set your energy saving preferences to short times, so that the monitor (and the PC!) switch to standby mode after a few minutes without any activity.
4. Switch your monitor Off when you don't use it. The most effective way to do this is with a multi-way connector: like this you can switch off completely all the devices (e.g. PC, monitor, printer, external HD,..) at once, once you're done.

7. References and links

Useful links

Topten.eu monitor product lists:
http://www.topten.eu/english/office_equipment/computer_monitors/15-17-and-19-inch.html
http://www.topten.eu/english/office_equipment/computer_monitors/20-and-21-5-inch.html
http://www.topten.eu/english/office_equipment/computer_monitors/22-inch.html
http://www.topten.eu/english/office_equipment/computer_monitors/23-and-23-6-inch.html
http://www.topten.eu/english/office_equipment/computer_monitors/24-inch.html
http://www.topten.eu/english/office_equipment/computer_monitors/27-and-more-inch.html

Topten.eu monitor selection criteria:
http://www.topten.eu/english/criteria/selection_criteria_computer_monitors.html&fromid=

References

Energy Star: Labelling for Energy Efficient Office Equipment:
- US Energy Star: http://www.energystar.gov/
- Energy Star Program Requirements for Computer Monitors (Version 6.0):
  http://www.topten.eu/uploads/File/FINAL-6.0-Display-Energy-Star-Requirements.pdf
- EU Energy Star: www.eu-energystar.org/
- EU Energy Star displays database:
  www.eu-energystar.org/database/Select.php?group=display&type=monitor
  The order of the list cannot be changed, and no download is possible.
- EU decision 2014/202 on an agreement with the US government on coordinating the Energy Star Labelling: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014D0202&from=EN

Ecodesign regulation on Standby and Off mode power No 1275/2008:
http://www.topten.eu/uploads/File/Ecodesign%20Regulation_Standby_1208.pdf

Ecodesign regulation No 801/2013 on networked Standby, amending regulation No 1275/2008:
http://www.topten.eu/uploads/File/Networked-Standby_Ecodesign-regu_801-2013.pdf

EU Ecolabel:
http://ec.europa.eu/environment/ecolabel/index_en.htm

Blauer Engel, Berlin (Germany): computers (RAL-UZ 78c):
https://www.blauer-engel.de/en/products/office/monitors-307

TCO, displays:
http://tcodevelopment.com/tco-certified/tco-certified-product-categories/tco-certified-displays/

Review of ecodesign and energy labelling regulations for televisions and draft regulations for electronic displays. Discussion paper. Bob Harrison, Mike Scholand, CLASP, November 2014. http://clasp.ngo/Resources/Resources/PublicationLibrary/2014/EU-Ecodesign-and-Energy-Labeling-of-Electronic-Displays

EuP preparatory studies 'Televisions' (lot 5), Final Report. August 2007, Fraunhofer IZM.