D2.2 - Topten ACT Criteria Paper

Computer monitors

31. August 2018 (Update)

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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 in August 2018:
- TCO Displays 7 Label
- Max. power in "sleep" mode: 0.5 W (This is 'standby' in EU terminology, but called 'sleep' by TCO)
- Max. power in "on" mode (according to TCO) 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 (August 2018):

screen size	number
17 inch	5
19 inch	7
19.5 inch	3
20 inch	1
21 inch	1
21.3 inch	1
21.5 inch	13
22 inch	9
23 inch	8
23.6 inch	3
23.8 inch	13
24 inch	13
25 inch	1
27 inch	10
29 inches	2
34 inches	1
Total	**91**

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

There are 81 monitor models of 15 different brands on the Topten.eu product list:
Acer, AOC, Asus, BenQ, Dell, EIZO, Fujitsu, HP, Lenovo, LG, NEC, Philips, Samsung, V7, ViewSonic.

2. Expected selection criteria in 2019

If TCO will update their Display Label, Topten will include it in the selection criteria.

Once the regulation for electronic displays will be adopted, the criteria will be adapted to reflect the regulation.

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.
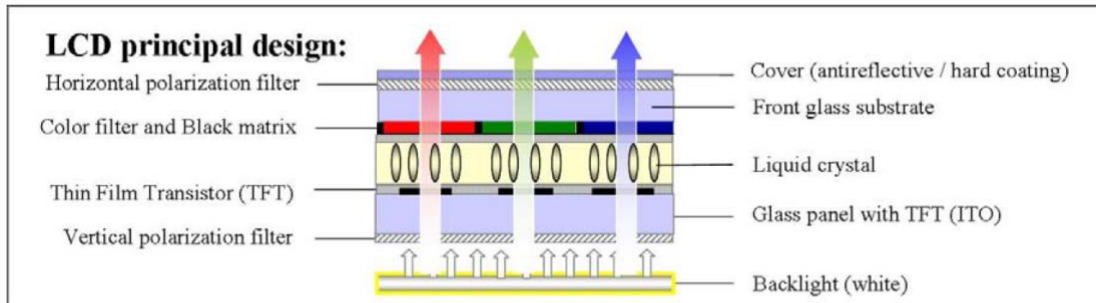

Figure 1: Principle Design of a Liquid Crystal Display (Source: EuP Preparatory Study "Television" (Lot5), Fraunhofer IZM, 2007)

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 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.
- **High Dynamic Range (HDR).** HDR is a feature for 4K TV and 4K content that increasingly more TVs offer. It is a technique to heighten a picture's dynamic range by increasing the contract between the brightest whites and the darkest blacks. Currently this feature is not measured, and some televisions automatically change to HDR mode. HDR mode can consume 70% more energy that the normal on-mode (CLASP, 2017)

4. Policy measures, standards and labels

EU Energy Label and Ecodesign regulations
In 2012, the revision of the Energy Label and Ecodesign regulations for TVs was initiated. It plans to extend the scope of the regulations to 'electronic displays' and include all monitors. Today monitors that have a HDMI port fall into the regulation for televisions No 642/2009. The same requirements as for televisions 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 2016 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 revised Ecodesign regulation is expected to be adopted in the end of 2018/early 2019. Expected savings from the Ecodesign and Labelling regulations on electronic displays are 35 TWh in 2030.

Energy Star (US Energy Label)

The US Energy Star Program requirements for displays cover computer monitors and signage displays (V7.1). 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, versions after that refer to IEC 62087, the international TV measurement standard. Energy Star On-mode values should thus be comparable with declared TV On-mode power.

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 (DE-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. 7.0 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.

In December 2018, TCO will launch their generation 8 criteria for all product categories.

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.

A study based on Swiss market data (Energie-agentur-elektrogeräte et al., 2016) shows, that the stock of computer displays decreased in the last years but the total energy consumption increases (Figure 2). The increase in power per unit could be the consequence of a missing Ecodesign regulation for this display category.
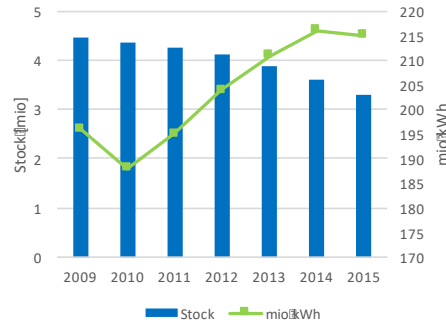
Figure 2: Evolution of the monitor stock and its respective energy consumption in Switzerland

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.

Energie-agentur-elektrogeräte et al. (2016), Verkaufszahlenbasierte Energieeffizienzanalyse von Elektrogeräten 2016. Bundesamt für Energie, Bern, Switzerland.