

Television Sets (TVs): Recommendations for policy design

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1. Summary

The most energy efficient TVs on today's market are LCD-TVs with LED-backlight. They consume about 25% less electricity than conventional LCD-TVs with CCFL-backlight and 40% less than plasma TVs. The most efficient TV models already reach class A+ of the new energy label.

Despite the fast current technological development, energy consumption by TVs watching keeps increasing. The trends towards two TVs per household and larger screen sizes are mainly responsible for the increasing power consumption by the use of TVs in European households. Total annual electricity consumption of TVs in the EU-27 is estimated to grow to almost 90 TWh by 2020. The EU ecodesign regulation combined with the EU energy label is expected to lead to annual savings of 43 TWh by 2020 – which is less than the expected increase.

In order to realise a higher saving potential, energy saving TVs have to be effectively promoted. Future, stricter steps of minimum efficiency requirements should be announced, guided by the BAT. Integrated receivers for digital TV should be required, rendering settop boxes obsolete. In the mid-term, a revision of the energy label will be necessary.

2. Best available and average Technology

In LCD TVs (LCD = Liquid Crystal Display) the LCD layer produces an image by selectively filtering light from a backlight.

The most efficient television sets on the market are LCD-Television sets with LED-Backlight (LED = Light Emitting Diode). Measurements indicate that they consume about 25% less energy than conventional LCD-Television sets with CCFL-Backlight (CCFL= cold cathode fluorescent lamp), and 40% less than plasma TVs.

These figures are supported by a Swiss study (S.A.L.T., 2009) comparing nine TV sets: four of the five most energy efficient TV sets were LCD TVs with LED backlight (with EEI between 0.29 and 0.46, EEI= energy efficiency index according to the EU regulation on energy labelling of televisions), while the CCFL-LCDs were less efficient (EEI between 0.53 and 0.63). An LCD TV with HCFL-backlight (hot cathode fluorescent lamp) was ranked third in the benchmark (EEI= 0.4) and proved thus to be of higher efficiency than the CCFL-TVs. The least efficient TV was the one with plasma technology (EEI=0.67):

- High efficient: LCD with LED-backlight
- Less efficient: LCD with conventional fluorescent lamp backlight (CCFL, HCFL)
- Inefficient: Plasma

New technologies such as OLED TV (Organic light emitting diode as direct light source) have not reached the break through so far.

3. Market situation in Europe

According to the EuP preparatory study 'Televisions' 31 million TVs were sold in the EU in 2005, with sales increasing by 2% per year. The penetration rate per household was 1.4 in 2005, and is expected to have reached 2.0 by 2010 (Fraunhofer Institute, 2007). CRT-TVs (CRT= cathode ray tube) and small screen sizes are yet dominating the stock of installed TVs in European households (Bertoldi, Atanasiu, 2009):

CRT	LCD	Plasma
60%	30%	10%

Tab.1: Penetration rate of TV display technologies in EU households (Bertoldi, Atanasiu, 2009)

Small (35-66 cm)	Medium (67-99 cm)	Large (> 100 cm)
➤ 50%	33%	12%

Tab. 2: Penetration rate of TV screen sizes in EU households (Bertoldi, Atanasiu, 2009)

Forecasts based on market trends indicate a shift in TV sales towards a higher share of LCDs and larger screen sizes: on the EU market in 2007 for the first time more LCD-TVs (53%) were sold than CRTs (35%) (Fraunhofer Institute, 2007) and screens larger than 66cm reached an estimate market share of 56%. For market sales of TVs by display type and screen size of units see also Figs. 1 and 2.

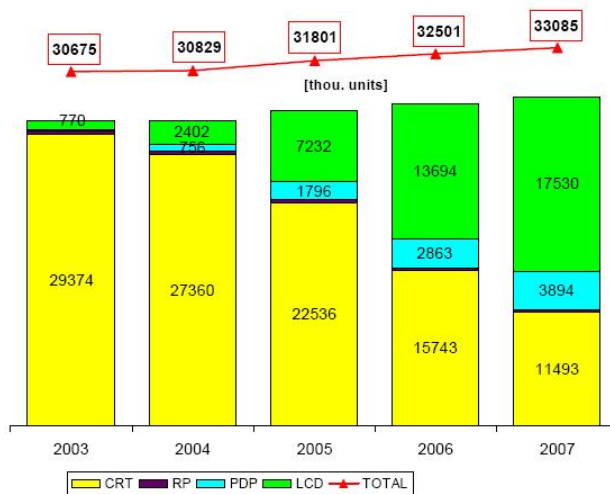


Fig. 1: Market sales by type of TVs (Boyny 2008)

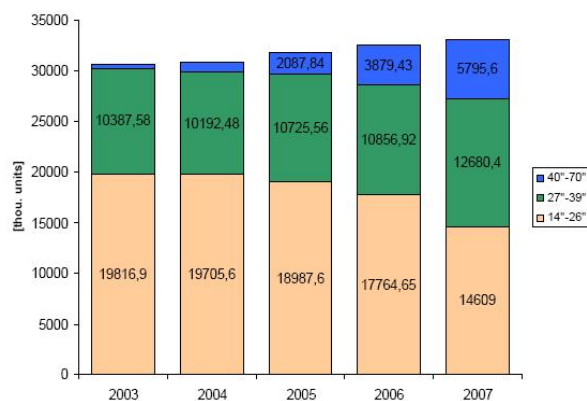


Fig. 2: Market sales by screen size of TVs (Boyny 2008)

The EuP preparatory study (Fraunhofer Institute, 2007) identified four main factors influencing the market development:

- Flat panel displays (flat TVs)
- Larger screen sizes
- Digital television broadcasting
- High-resolution television (HDTV)

The European Commission proposes that by 2012 all member states complete the transition from analogue to digital TV broadcasting (Commission Communication, May 2005). TV sets without integrated digital receiver need a set-top box to decode the digital signals. Thus the development towards digital TV is expected to lead to a considerable increase of set-top boxes.

The announced introduction of the energy label for TVs in January 2011 has already triggered a shift towards more energy efficient TVs on the European market (Fig. 3).

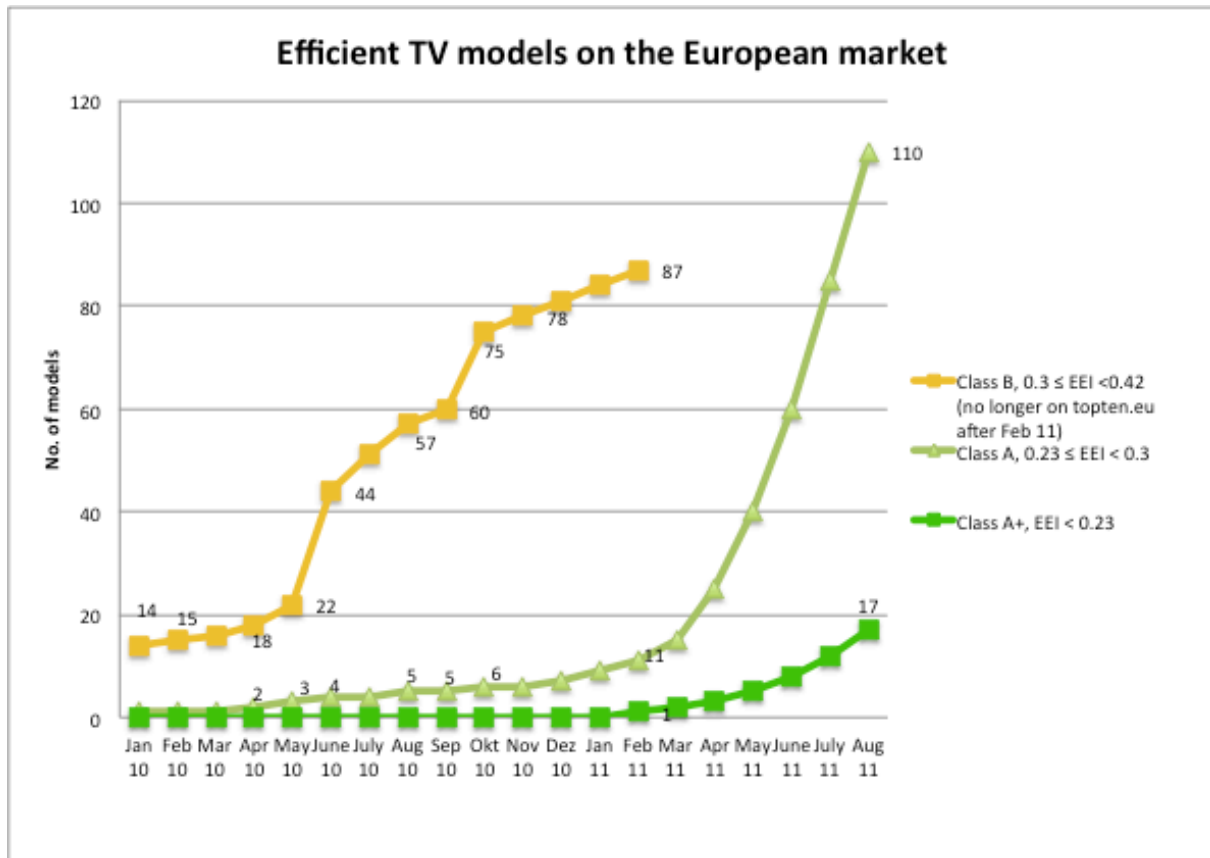


Fig. 3: Energy efficient TVs: market development before and since the beginning of the introduction of the energy label (January 2011). The label will be mandatory from January 2012. Data source: Topten.eu.

In August 2011 Topten listed 117 TV models of class A or better (EEI < 0.3), 17 of these have an EEI below 0.23 and reach class A+. One year earlier, before the energy label regulation for TVs was adopted, only 5 models had reached class A and none class A+. Before March 2011 also class B models were listed on topten.eu, then the criteria were adapted to the market development. Since August Topten.eu lists only TV models of class A, for TVs larger than 100cm of A+.

4. Energy consumption and saving potentials

An average TV (EEI = 1.15) consumes close to 400 kWh per year; an efficient LCD TV with an EEI of 0.4 uses two thirds less than that.

Energy consumption by the use of TVs in European households has been increasing over the past years (Fraunhofer Institute, 2007). Higher penetration, increasing screen sizes, new display technologies with higher resolution and better picture quality are main reasons. Total electricity consumption of TVs in the EU-27 is estimated at 60 TWh for 2007, of which 54 TWh are allocated to On mode and 6 TWh to Standby and Off mode power consumption. With an estimated stock of

installed TVs of 310 million units, the resulting penetration rate of 150% reflects the market tendency towards 2 TVs per household (Fraunhofer Institute, 2007).

EU-27 residential electricity consumption	[TWh]
Cold appliances (refrigerators & freezers)	122,0
Washing machines	51,0
Dishwashers	21,5
Electric ovens & hobs	60,0
Air-conditioning	17,0
Ventilation	22,0
Water heaters	68,8
Heating systems/electric boilers	150,0
Lighting	84,0
Television	54,0
Set-top boxes	9,3
Computers	22,0
External power supplies	15,5
Home appliances stand-by	43,0
Others	60,6
Residential electricity consumption	800,72

Tab. 3: Breakdown of residential electricity consumption in EU-27 in 2007 (source: JRC)

Even if the standby consumption is excluded – as in Table 3 (Bertoldi, Atanasiu, 2009) – with 54 TWh per year TVs in European households account for a higher electricity consumption than washing machines do. Adding the power consumption of Settop boxes and standby consumption, TV watching is responsible for more than 70 TWh annually.

Settop boxes consume up to 10W when in standby mode and have typical annual power consumption values of around 70 kWh – about 50% of the power consumption of an efficient TV. A sharp increase in electricity consumption by digitalisation can be avoided with TV sets with integrated receivers. TV sets with integrated digital receivers don't need an additional settop box and thus allow for TV watching without extra power consumption.

With a so-called 'Best practice'-strategy with an EEI of 0.64 as minimum efficiency requirement, energy consumption by TVs are estimated to remain at around 70 TWh annually by 2020 (Fraunhofer Institute, 2007). The tier 2 ecodesign requirements in force from 2012 allow an EEI of 0.8. This measure is not expected to make up for the increase in electricity consumption, even in combination with the energy label. (European Commission Impact Assessment, 2009). Without additional or stronger measures, the annual power consumption by TVs is thus expected to go on increasing to around 87TWh by 2020.

5. Political instruments and initiatives

Ecodesign of EuP

- The Commission regulation on ecodesign requirements for televisions is in force since August 2010. It requires TVs to have a certain maximum energy consumption when in On mode, depending on the screen area. This first Tier requirement corresponds to the energy label class F for normal resolution, while Full HD TVs can have a higher power consumption. In April 2012 these On mode requirements will be tightened for all resolutions to what corresponds to an EEI of 0.8, corresponding to class D.
The Standby regulation requirements (1 or 2W standby, 1W off mode) will be replaced by tighter requirements in August 2011: TVs in Off mode must consume no more than a maximum of 0.3 or 0.5W (if the product can be switched down to 0.01W consumption with a well visible switch) and 0.5 or 1W when in standby mode. TVs will need to be automatically switched to standby or off mode after maximally 4 hours of inactivity.
- Commission regulation on Standby and off mode power consumption:
The standby regulation requires all electrical and electronic household and office equipment - including TVs - to have an off mode and standby mode consumption of no more than 1W and 1 or 2W (with information and status display) respectively, since January 2010.

Energy label

The label for TVs can be used since January 2011; from January 2012 it will be mandatory. At the moment mainly efficient TV models are being labelled.

Energy Efficiency Class	Energy Efficiency Index
A+++ (most efficient)	EEI < 0.10
A++	0.10 ≤ EEI < 0.16
A+	0.16 ≤ EEI < 0.23
A	0.23 ≤ EEI < 0.30
B	0.30 ≤ EEI < 0.42
C	0.42 ≤ EEI < 0.60
D	0.60 ≤ EEI < 0.80
E	0.80 ≤ EEI < 0.90
F	0.89 ≤ EEI < 1.00
G (least efficient)	1.00 ≤ EEI

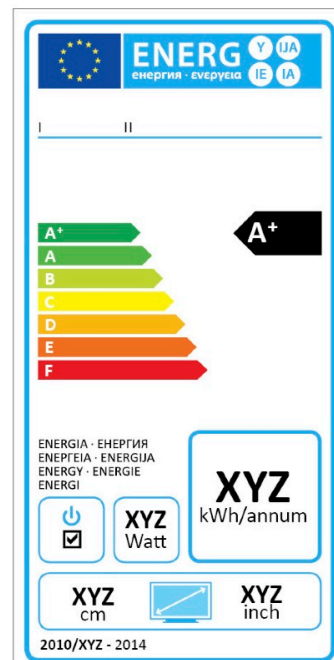


Fig. 4: classification scheme and layout of the energy label for TVs

When the labelling scheme was adopted in November 2010, only six TV models reached the EEI required for class A. Since then, more high efficiency TVs entered the market: in August 2011, 127 TV models reach class A or better requirements (see also chapter 3).

EU Eco label

Since 1. November 2009, new criteria are in force for the EU Ecolabel for TVs. Main requirements concern energy consumption, content of dangerous substances, durability and recyclability. The passive standby requirement is identical with the Tier 2 ecodesign requirement for off mode. The maximum On mode power consumption depends on the screen area. This requirement is getting stricter every year till 2013, when ecolabelled TVs will have to consume no more than 50% of what is allowed by the ecodesign regulation. Additionally the Ecolabel requires a maximum energy consumption of 200W.

Standards and Labels from overseas

- **Californian** Tier 2 On mode requirements for TVs, valid from 2013, will be the stricter than class B of the EU energy label and stricter than all EU requirements. For many TV models (from a screen area of about 45dm² upwards, see Fig.3) even the Californian Tier 1 On mode limits, valid from 2011, are stricter than the Tier 2 requirements of the Ecodesign regulation. Californian Tier 1 requirements are essentially identical to Energy Star Version 4.0 specifications. So far the Californian standard covers TVs up to a screen size of 1400 square inches (about 90 dm²) only, future rules will concern larger TVs as well (California Energy Commission, 2009).
- The voluntary label **Energy Star** version 4.0 for TVs, in effect from May 2010 in the U.S., is somewhat stricter than class B of the EU energy label. Version 5.0, which will be effective from May 2012, is one of the first progressive efficiency specifications ever adopted for a consumer product: for TVs above 69 dm² no greater power input is allowed with increasing size (Calwell and Borg, 2009).
- **Australia** has introduced efficiency requirements for TVs in October 2009. These are slightly less strict than the EU requirements valid since August 2010. From October 2012, the Australian Tier 2 standards will be effective: these will be stricter than the second stage requirements of the EU and the Californian Tier 1 standards (Horowitz, 2009).

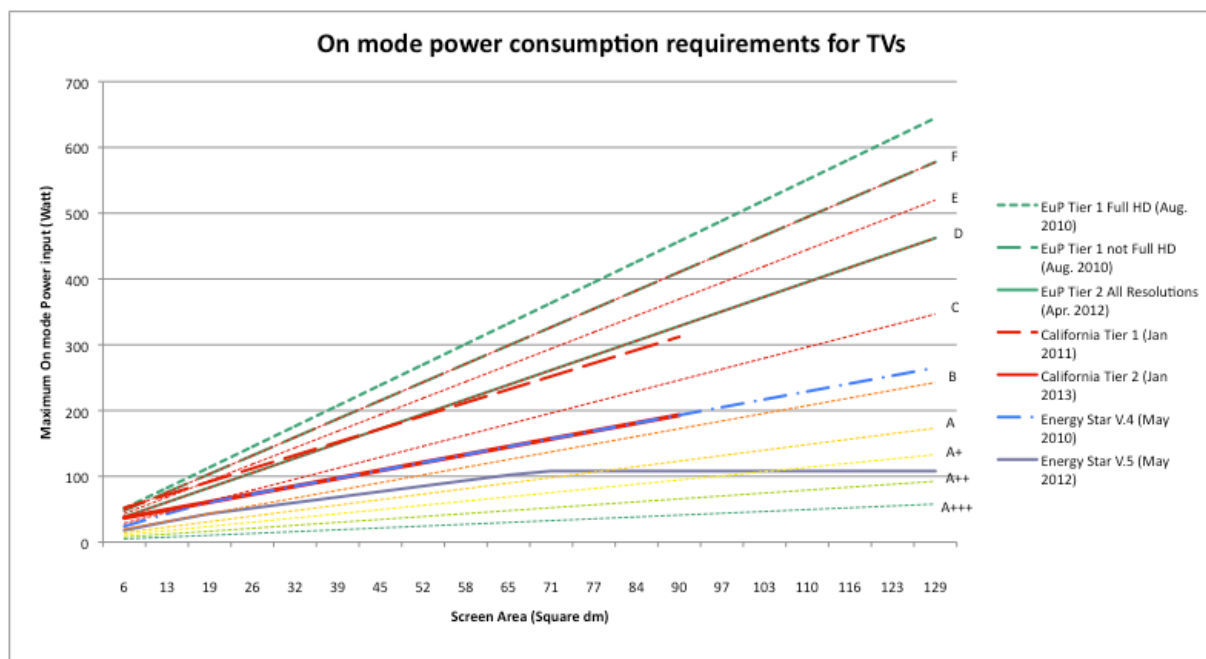


Fig. 5: Comparison of EU On mode requirements with the Californian Standard and Energy Star Specifications

6. Recommendations regarding policy design

The penetration rate of TVs is growing in European households, and digital TV is replacing analogue signals. The EU-regulation on ecodesign of TVs is expected to lower the increase in power consumption, but not to prevent it. Since the publication of the preparatory study of the ecodesign regulation in 2007, technology development has led to vast changes on the market of high efficiency TVs. A strong motor behind the market drive was the development of the LED technology as efficient backlight source in LCD-televitions. The enforcement of an EEI of 0.64 as minimum efficiency requirement was yet considered as ‘not realistic’ in the preparatory study (Fraunhofer Institute, 2007). As today however there is a considerable number of models with an EEI below 0.42 and even 0.3, adequately strict minimum efficiency requirements can be aimed at. In order to achieve higher savings in TV energy consumption, energy saving products should be effectively promoted:

- **Effective minimum efficiency requirements:** The minimum efficiency requirements of the ecodesign regulation should be revised and a next, stricter step should be introduced. Tier 2 valid from 2012 will set an EEI of 0.8 as minimum efficiency requirement. Soon after 0.42 should be introduced as more effective requirement and 0.23, today’s BAT should be announced as future requirement. Already today, the market provides a vast range of efficient TV models, and the EU requirements are limping behind standards from California and Australia. For these future requirements, progressive efficiency requirements introducing tougher limits for larger TVs should be considered – similar to the Energy Star V. 5.0 specifications.
- **Energy label with appropriate class determination:** Once the energy label is mandatory, it will speed up the market dynamics even more – more A+ and even A++ TV models will emerge on the market. Accordingly a label revision should be envisaged in mid-term. An energy label should guide consumers unambiguously to the most efficient products, which is not achieved when class A does not stand for the best.
As for minimum efficiency requirements, also for the Energy label a progressive system with stricter requirements for larger TVs should be introduced in the future.
- **Integrated digital receivers:** From 2012, when most EU member states will have completed the transition from analogue to digital TV, TV sets should be required to have an integrated receiver for digital TV. TV sets with integrated receiver don’t need a settop box in order to receive digital TV. TV models on today’s market have up to three receivers integrated (for DVB-T (terrestrial), DVB-C (cable) and DVB-S (satellite)). Terrestrial analogue programmes are the first to be switched off. TV sets could thus be required to have at least a DVB-T and a DVB-S receiver integrated.

7. References and Links

COMMISSION REGULATION (EC) No 642/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for televisions
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:191:0042:0052:EN:PDF>

COMMISSION DELEGATED REGULATION (EU) No 1062/2010 of 28.9.2010 implementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of televisions
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:314:0064:0080:EN:PDF>

COMMISSION REGULATION (EC) No 1275/2008 of 17 December 2008 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:339:0045:0052:EN:PDF>

COMMISSION DECISION of 12 March 2009 establishing the revised ecological criteria for the award of the Community Eco-label to televisions
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:082:0003:0008:EN:PDF>

COMMUNICATION FROM THE COMMISSION TO THE COUNCIL, THE EUROPEAN PARLIAMENT, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on accelerating the transition from analogue to digital broadcasting
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2005:0204:FIN:EN:PDF>

Electricity Consumption and Efficiency Trends in European Union – Status Report 2009. Paolo Bertoldi and Bogdan Atanasiu, 2009. JRC
http://re.jrc.ec.europa.eu/energyefficiency/pdf/EnEff_Report_2009.pdf

Commission Staff Working Document Accompanying document to the Commission Regulation implementing Directive 2005/32/EC with regard to ecodesign requirements for televisions: Impact Assessment Summary. Brussels, 22.7. 2009.
http://ec.europa.eu/energy/efficiency/ecodesign/doc/legislation/sec_2009_1012_en.pdf

J. Boyny: "The Market of Energy efficient CE in Western Europe", GfK Retail and Technology International Consumer Electronics Conference - CEC2008, Munich, June 2008

California Energy Commission: Proposed amendments to appliance efficiency regulations. 18. September 2009.

Chris Calwell and Nils Borg, ecee: New Approaches to Reducing Absolute Energy Consumption: Sufficiency and Progressive Efficiency. EnR working group, Madrid, 24-25 September 2009.

Energy Star Program Requirements for Televisions. Versions 4.0 and 5.0.
http://www.energystar.gov/index.cfm?c=revisions.television_spec

Fraunhofer Institute for Reliability and Microintegration, IZM and Öko-Institut: EuP Preparatory Studies Lot 5: "Televisions", Final Report on Task 2: "Economic and Market Analysis", Berlin, August 2007
http://www.ecotelevision.org/finalised_documents.php

Noah Horowitz: NRDC Summary of Television Energy Efficiency Standards: California, Europe, and Australia. December 2009.

JRC: Joint Research Center of the European Commission.

<http://ec.europa.eu/dgs/jrc/index.cfm>

P. White, M. Armishaw, P. Dolley, R. Harrison, T. Graziano, J. Lindblom: "Environmental, Technical and Market Analysis concerning the Eco-design of Television", Technical Report EUR 22212 EN, 2006

S.A.L.T.: Vergleichstest von Best-Fernsehgeräten. Eric Bush, Armin Braunwalder, Barbara Josephy, Andrea Berger, Toni Venzin, Peter Kühne, René Mosbacher. Zürich, November 2009.

http://www.topten.ch/uploads/images/download-files/091117_Vergleichstest_TV.pdf

S.A.L.T.: Power consumption of TVs: summary in English. Summarising translation of the study 'Vergleichstest von Best-Fernsehgeräten' by Eric Bush, Armin Braunwalder, Barbara Josephy, Andrea Berger, Toni Venzin, Peter Kühne, René Mosbacher, November 2009.

<http://www.topten.eu/uploads/File/S.A.L.T.%20TV%20study%202009%20EN.pdf>

Most efficient products of Europe:

www.topten.eu

Information on the ,ecodesign of EuP' process:

www.coolproducts.eu

eceee (European Council for an Energy Efficient Economy)- overview on the ecodesign of EuP status:

http://www.eceee.org/Eco_design/products/?sort=status

Preparatory study for the ecodesign for TVs regulation:

<http://www.ecotelevision.org>

Ecolabel for TVs:

http://ec.europa.eu/environment/ecolabel/ecolabelled_products/categories/televisions_en.htm

SELINA, Standby and Off mode Energy Losses in New Appliances measured in shops:

<http://www.selina-project.eu/index.cfm>