

Television Sets (TVs): Recommendations for policy design

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 trends towards two TVs per household and larger screen sizes however contribute to an increasing power consumption by the use of TVs in European households. Total electricity consumption of TVs in the EU-27 is estimated at 60 TWh for 2007. The EU regulation on televisions under the Ecodesign directive combined with the EU energy labelling 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. A future energy label should guide consumers to the most efficient TV sets by labelling only the very best TVs class 'A'. The current labelling proposal from April 2010 is designed according to today's best TVs and should be adopted.

Additional measures include stricter minimum efficiency requirements and integrated receivers for digital TV.

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 recent 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 draft directive 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.

Topten.info lists all TV models with an EEI (energy efficiency index) below 0.5: totally 52 TVs reach this efficiency level (Tab. 1). The three best TV models have an efficiency index below 0.3 and reach class A according to the energy labelling proposal from April 2010. By the time the label has been introduced, more models are expected to reach class A. The 19 TV models with an EEI between 0.3 and 0.4 reach class B according to the current proposal, while the 30 models with an EEI between 0.4 and 0.5 are labelled with a C.

Many high efficiency TVs that have been presented at consumer electronics fairs will appear on the market and soon more models will reach the requirements of the classes B, A and even the better classes A+ (EEI < 0.23) and A++ (EEI < 0.16).

| EEI | Number of Topten models |
|-----------------------|-------------------------|
| <0.3 | 3 |
| 0.3 – 0.4 | 19 |
| 0.4 – 0.5 | 30 |
| Total < 0.5 | 52 |

Tab. 1: EEI (energy efficiency index) of TV models on Topten.info

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.2: 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. 3: 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.

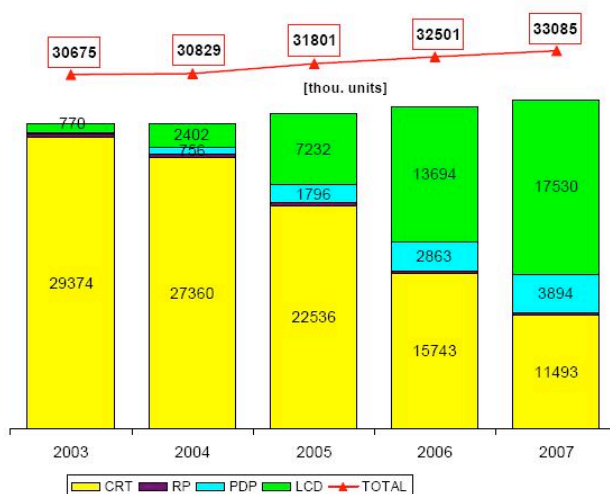


Fig. 1: Market sales by type of TVs (Boyny 2008)

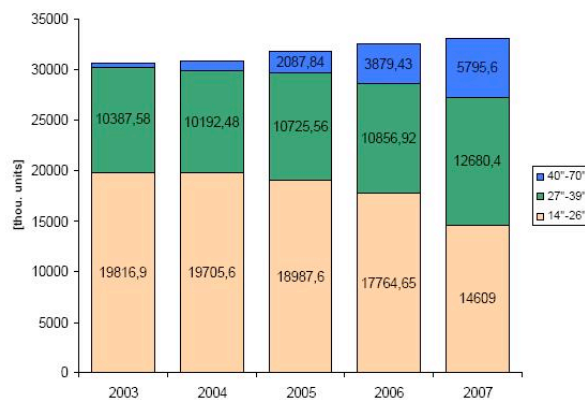


Fig. 2: Market sales by screen size of TVs (Boyny 2008)

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.

On mid-term, some promising “disruptive” display technologies might enter the TV market, some sources indicating the LED technology as the most market-challenging one after 2010 (White et al., 2006).

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

Even if the standby consumption is excluded – as in Table 4 (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 Set-top boxes and standby consumption, TV watching is responsible for more than 70 TWh annually.

Set top 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 set top box and thus allow for TV watching without extra power consumption.

| Scenario | Energy consumption savings 2020 | Annual energy consumption 2020 |
|--|--|---------------------------------------|
| 'Business as usual' | 0 TWh /year | 130 TWh/year |
| Ecodesign requirements (EEI=0.8) combined with EU Energy labelling | 43 TWh/year | 87 TWh/year |
| 'Best practice' (EEI=0.64 required)* combined with EU Energy labelling | >61 TWh/year | <69 TWh/year |

Tab. 5: Energy consumption by TVs and savings in the EU-27 by 2020 under different scenarios (*for EU-25)

The 'business-as-usual'-scenario for the EU-27 predicts an increase in energy consumption by TVs only to 130 TWh per year by 2020 (European Commission Impact Assessment, 2009). Energy consumption savings by a so-called 'Best practice'-strategy with an EEI of 0.64 as minimum efficiency requirement for TVs are estimated at more than 46 TWh annually for 2020 (Fraunhofer Institute, 2007). The tier 2 ecodesign requirements in force from 2012 allow an EEI of 0.8. The resulting savings of this measure are estimated at 28 TWh/year by 2020, the EU energy labelling of TVs is expected to add savings of 15 TWh/year (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

- Commission regulation No 1275/2008 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, starting from January 2010.
- Commission regulation No 642/2009 with regard to ecodesign requirements for televisions: Additionally to the horizontal Standby and Off mode regulation, the ecodesign regulation specifically for TVs will be in force from August 2010. It requires TVs to have a certain maximum energy consumption when in On mode, depending on the screen area. This first Tier corresponds to the proposed class D for normal resolution, while Full HD TVs can have a higher power consumption. In April 2012 these On mode requirements will be somewhat tightened for all resolutions to what corresponds to an EEI of 0.8 or, according to the draft labelling directive, class C.
The Standby regulation requirements 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.

Energy label

In November 2009, the EU institutions agreed on a revised energy labelling system with additional 'super-A' classes up to A+++ . The proposal to introduce an energy label for TVs had been rejected by the European Parliament in May 2009 – a new proposal has now been elaborated, corresponding to the labelling directive. According to the class determination of the current proposal from April 2010, the three best TVs models on today's market would be labelled 'A'. By the time the label will appear in the shops – mid-2011 – more high efficiency TVs will have entered the market.

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 draft EU labelling directive 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 according to the EU labelling draft from February 2010. 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 from 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).

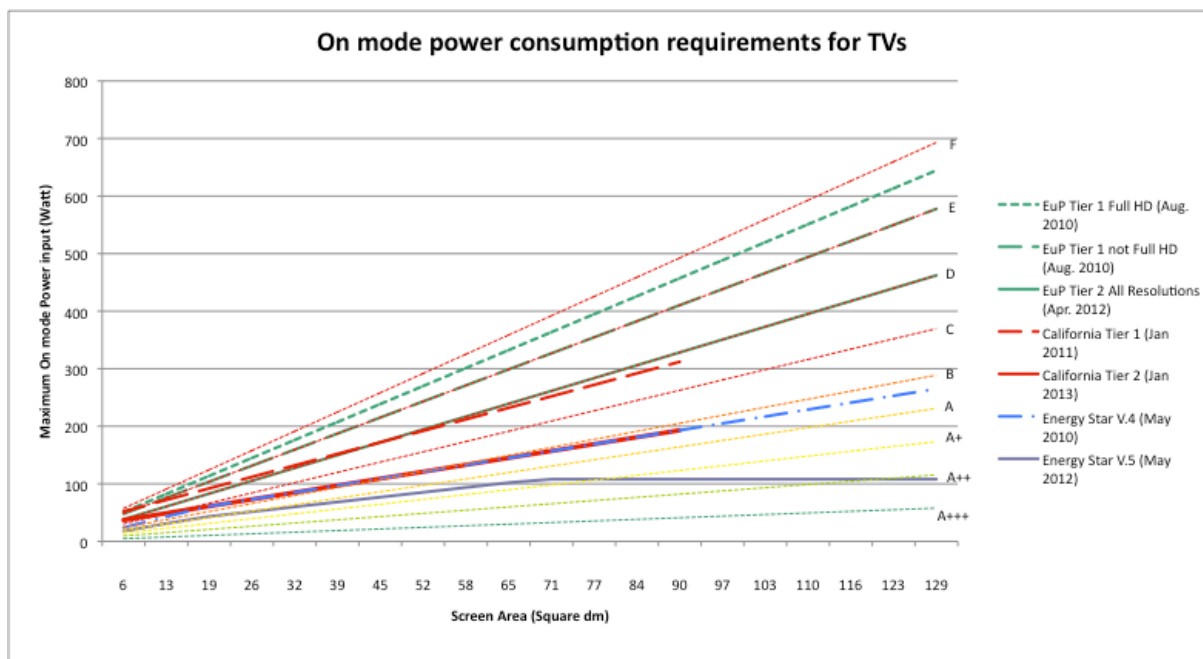


Fig. 3: Comparison of EU On mode requirements with the Californian Standard and Energy Star Specifications

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 0.5, 0.4 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 0.64 should be set as more effective 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 future requirements, progressive efficiency requirements introducing tougher limits for larger TVs should be considered – similar to Energy Star V. 5.0 specifications.

- **Energy label with appropriate class determination:** An energy label should guide consumers to the most efficient TV sets. The energy label classes should be adequately determined, in a way that only the best TVs are labelled 'A'. The current energy labelling proposal for TVs from April 2010 determines the classes so that today only the three best TV models would be labelled class A. This is a pragmatic compromise and the proposal should be adopted and put into force as soon as possible. Market dynamics and technological development will make sure that soon more TVs reach class A and better classes.

| Energy Efficiency Class | Energy Efficiency Index |
|-------------------------|-------------------------|
| A+++ (most efficient) | $EEI < 0.10$ |
| A++ | $0.10 \leq EEI < 0.16$ |
| A+ | $0.16 \leq EEI < 0.23$ |
| A | $0.23 \leq EEI < 0.30$ |
| B | $0.30 \leq EEI < 0.40$ |
| C | $0.40 \leq EEI < 0.50$ |
| D | $0.50 \leq EEI < 0.64$ |
| E | $0.64 \leq EEI < 0.80$ |
| F | $0.80 \leq EEI < 1.00$ |
| G (least efficient) | $1.00 \leq EEI$ |

Tab.6: Efficiency class determination according to the labelling proposal from April 2010

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 set-top 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 receiver integrated.

7. References and Links

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WORKING DOCUMENT: COMMISSION DELEGATED REGULATION (EU) implementing Directive 2010/...../EU of the European Parliament and of the Council with regard to energy labelling of televisions
http://www.topten.info/uploads/File/TV_label_04_10.pdf

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<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:339:0045:0052:EN:PDF>

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Most efficient products of Europe:

www.topten.info

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:

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