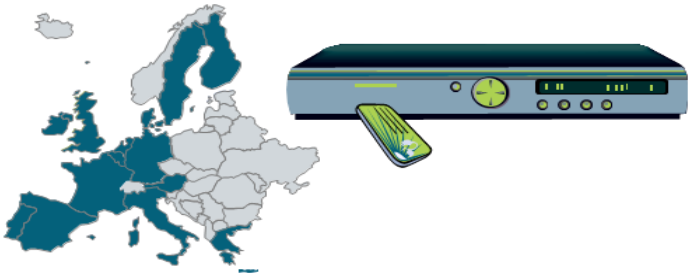
Mapping Document



Country:	European Union*
Technology:	Set Top Boxes
Sub Category:	Simple and Complex

* Data is drawn from the EU voluntary agreement on complex set-top boxes that includes suppliers representing sales across the EU27 countries.

Introduction

The first stage in the Mapping and Benchmarking process is the definition of the products, i.e. clearly setting the boundaries that define the products for use in data collection and analysis. This ensures that comparison between the participating countries is done against a specific and consistent set of products.

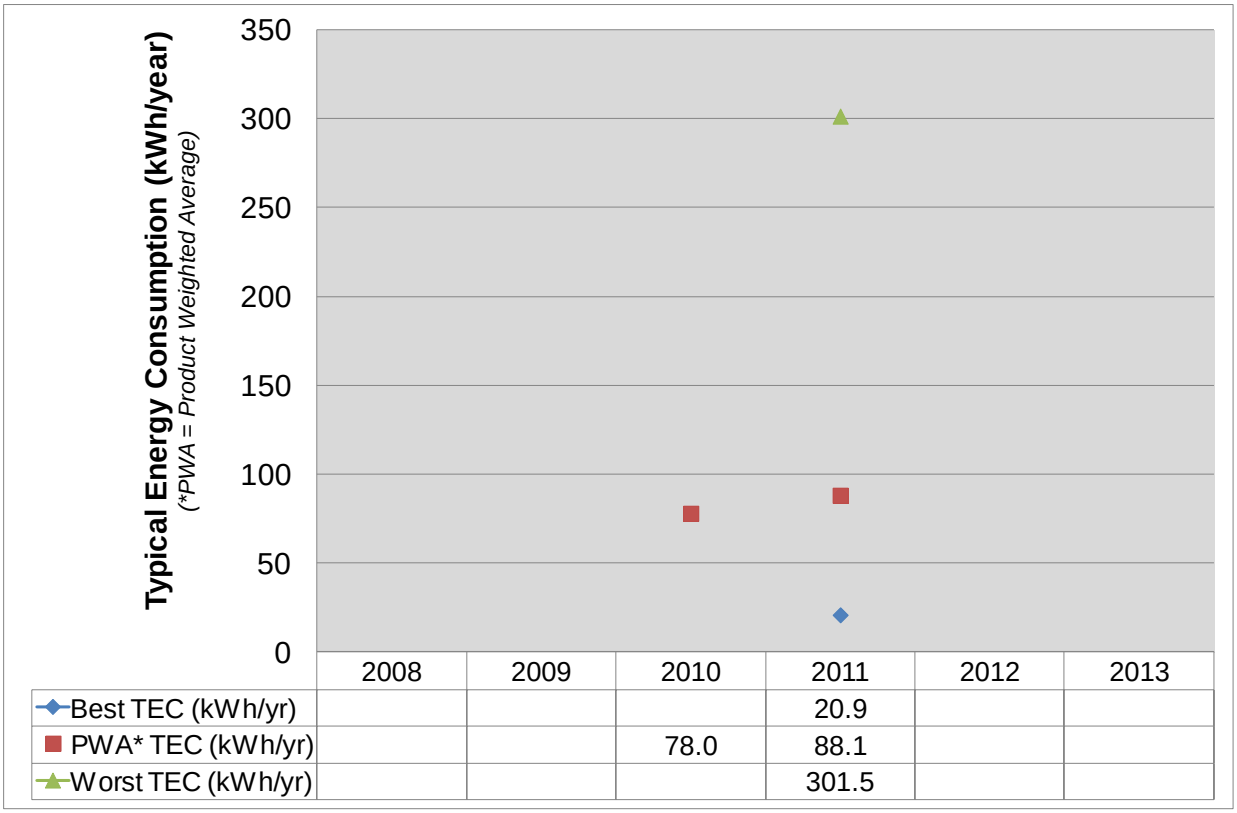
The summary definition for this product is:

M&B Category	Description
Definition and Scope	*Set top boxes as used to convert digital TV signals to a signal compatible with the existing TV receiver and TV monitor technology, including analogue signal, composite video, s-vhs, IP, component video and HDMI. Both Simple STB (free access) and Complex STB (conditional access[1]) are included.* *Note: standalone digital television adapters (digital to analogue converters) are not included.*
Signal Types	Cable STB, Satellite STB, Terrestrial STB, Cable digital transport adapter (DTA), Internet protocol (IP) STB, Thin client / remote STB
Other Characteristics to be Noted	Auto power down , Additional Tuners, Digital Video Recorder, Advanced Video Processing, High Definition Resolution, Removable Media Player or Player/Recorder , Home Network Interface (e.g. WiFi, MoCA), Provision/type of a return path etc.

The detailed product definition can be found at the Annex website:
http://mappingandbenchmarking.iea-4e.org/matrix?type=product&id=14

[1] Conditional access is for receiving subscription services through built-in access control or the use of an access card-key or similar (e.g. CableCard type services)

Annual Typical Energy Consumption (TEC) of Set Top Boxes in the European Union

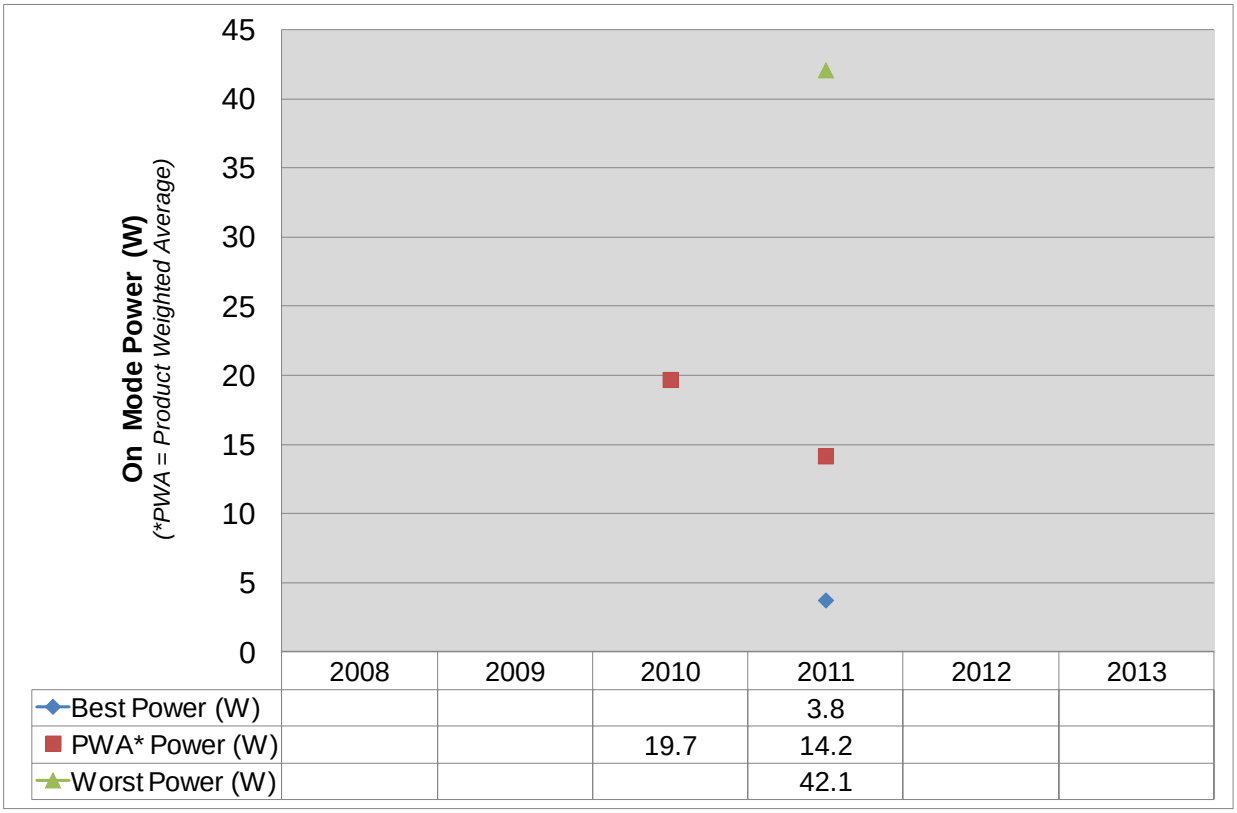


	2008	2009	2010	2011	2012	2013
Best TEC (kWh/yr)				20.9		
PWA* TEC (kWh/yr)			78.0	88.1		
Worst TEC (kWh/yr)				301.5		

Key notes on Graph (see notes section 1)

- EU data for 2011 was provided by those organising the EU voluntary agreement and consisted of performance data for individual set top boxes but unattributed to specific manufacturers or products (to protect commercial confidentiality). Whilst this is not a mandatory agreement, manufacturers and service providers that are signatories account for the vast majority of complex STBs made available to the EU market.
- EU data for 2010 shown above is derived from market average figures reported in an annual review of progress on the EU voluntary agreement for set top boxes that was carried out for the European Commission. Data for previous years was identified but was not of sufficient robustness or scope to plot on these graphs.
- All products in this data set are of the complex type; no data on simple STBs was available.
- Typical Energy Consumption, in kWh per year, is calculated according to the method described in the voluntary agreement document, using only the power in *on* and *sleep* modes: 9 hours in on mode and 15 hours in sleep mode per day.
- The count of products in the dataset for which TEC could be calculated was 306 in 2011, the only year for which data was made available. Data for 2010 is a market average calculated by the independent inspector working for the European Commission and is based on data for 212 products from 16 different suppliers.

On mode power of Set Top Boxes in the European Union



Key notes on Graph (see notes section 1)

- The graph shows the manufacturer's declared on mode power.
- EU data for 2011 was provided by those organising the EU voluntary agreement and consisted of performance data for individual set top boxes but unattributed to specific manufacturers or products (to protect commercial confidentiality). Whilst this is not a mandatory agreement, manufacturers and service providers that are signatories account for the vast majority of complex STBs made available to the EU market.
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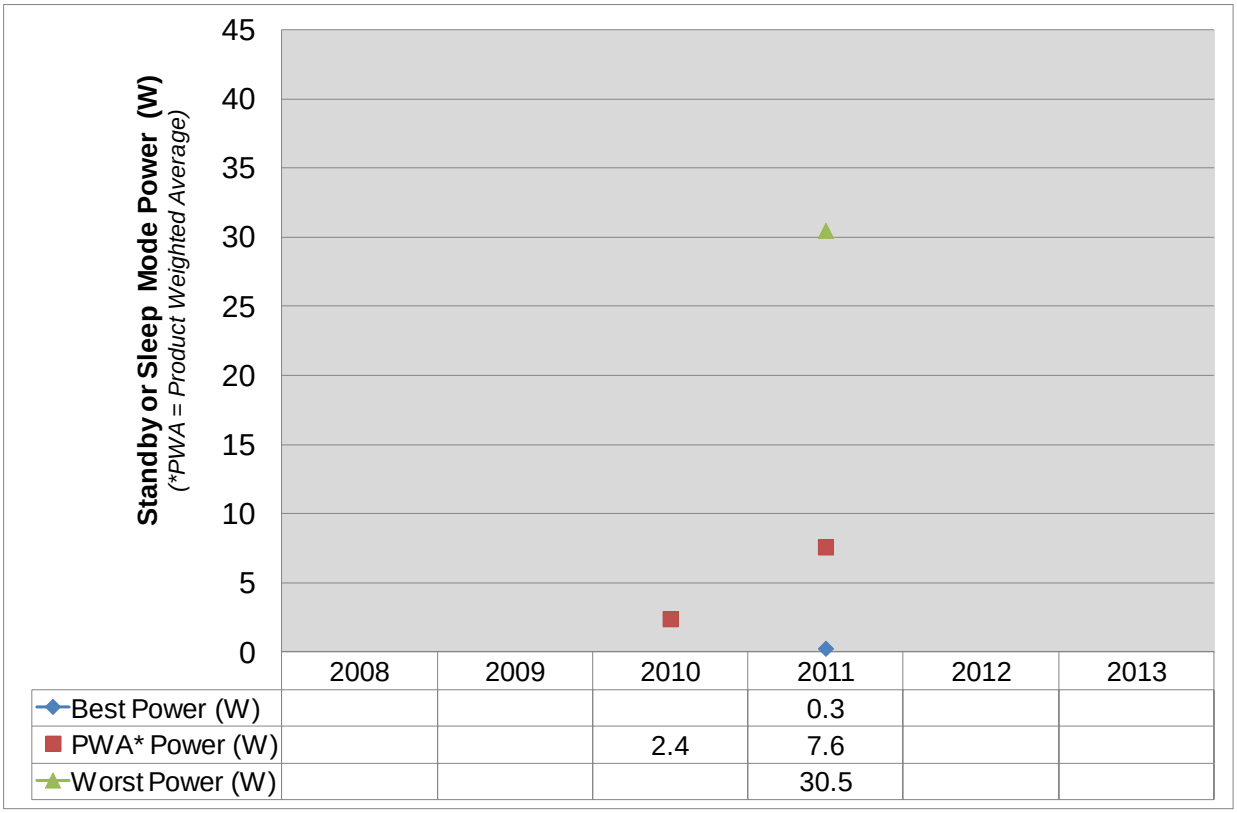
- All products in this data set are of the complex type; no data on simple STBs was available.

Standby (Sleep) mode power of Set Top Boxes in the European Union



	2008	2009	2010	2011	2012	2013
Best Power (W)				0.3		
PWA* Power (W)			2.4	7.6		
Worst Power (W)				30.5		

Key notes on Graph (see notes section 1)

- The graph shows the manufacturer's declared standby mode power. *Standby mode* is also referred to as *sleep mode*, or as *standby active mode* in some countries. These three were assumed equivalent for this analysis.
- EU data for 2011 was provided by those organising the EU voluntary agreement and consisted of performance data for individual set top boxes but unattributed to specific manufacturers or products (to protect commercial confidentiality). Whilst this is not a mandatory agreement, manufacturers and service providers that are signatories account for the vast majority of complex STBs made available to the EU market.
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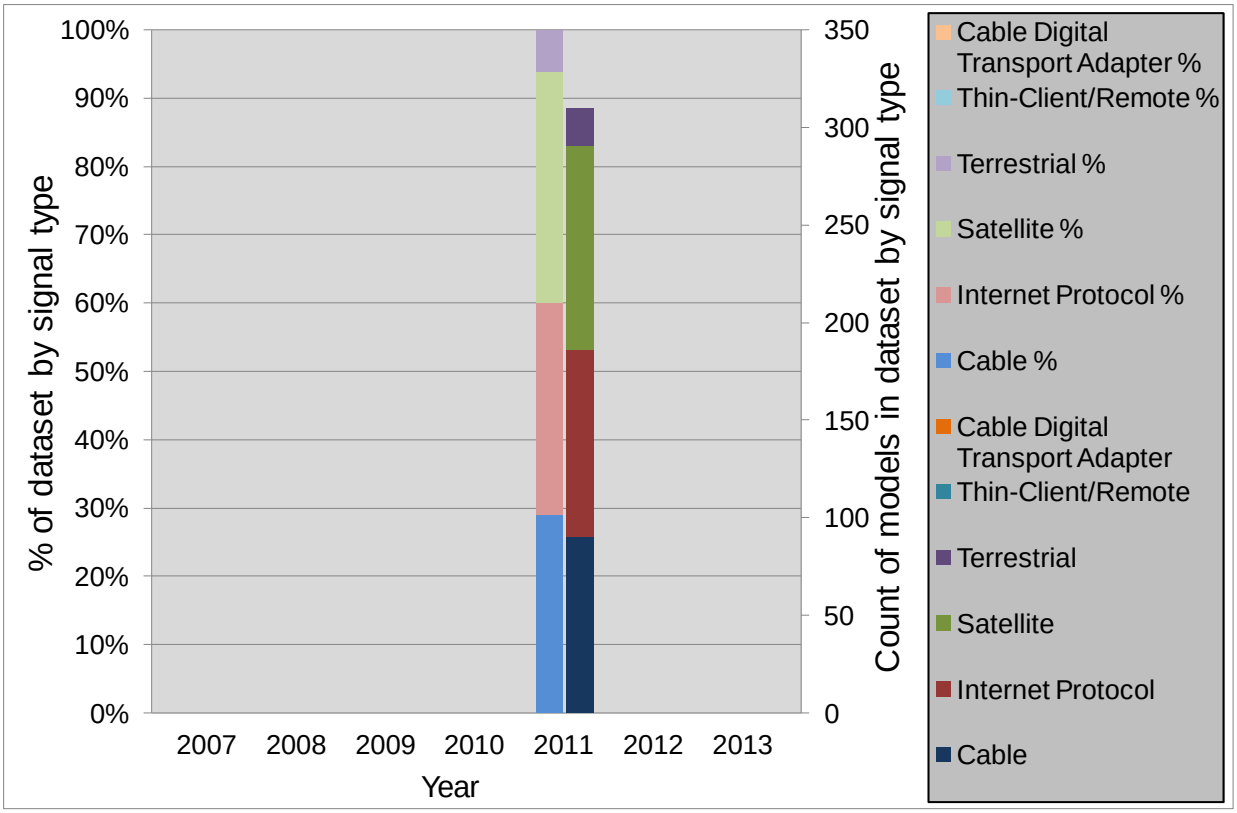
Share of set top box dataset by signal type in the European Union



Key notes on Graph (see notes section 2)

- The graph shows the breakdown of the EU set top box dataset by input signal type for 2011. Data identified for previous years did not include the product details to enable signal type analysis.
- Results are shown in two formats: as a percentage of the count for that year (pale colours, left hand column of each pair) and as a count of individual products (darker colours, right hand column of each pair).
- Cable, Internet Protocol and satellite types together account for around for nearly 95% of the data set with around one third of that total each; terrestrial account for around 5%.
- Products in this dataset account for the vast majority of complex STBs made available to the EU market. All products in this data set are of the complex type; no data on simple STBs was available.

Major Policy Interventions (*see notes section 3)*

Mandatory performance requirements

Simple set top boxes in the EU became subject to minimum requirements for standby power when the horizontal eco-design regulation regarding standby power came into effect in January 2009.

An EU regulation under the ecodesign framework directive established maximum power limits for simple set-top boxes from March 2012 covering both standby and active modes. Additional allowances were included for standby mode with a retained display function and for active mode with a hard disk, second tuner and functionality to decode high-definition signals. It was also a requirement that the unit must automatically revert to the lowest power consumption state less than three hours after the last user interaction in active mode.

No mandatory requirements for complex set top boxes have been brought forward in the EU. Instead a code of conduct followed by a voluntary agreement have been developed, see below.

Energy label

There is no energy labelling requirement applicable to STBs in the EU.

Code of Conduct with suppliers (complex STBs, 2009)

A code of conduct between manufacturers and the European Commission and applicable to complex set-top boxes was agreed in 2009[2]; Tier 1 came into force in January 2010 with a maximum annual energy allowance (kWh per year) calculated depending upon the signal type and additional functionalities present.

Ecodesign measure: voluntary agreement with suppliers of complex STBs, 2010)

Following policy research work seeking to develop minimum requirements under the eco-design directive, it was decided that a voluntary scheme proposed by the industry would achieve the policy objectives more quickly and with lesser expense than mandatory requirements[3]. Consequently a voluntary agreement was developed that came into force in July 2010[4]. This establishes voluntary levels of maximum total energy consumption per year, similarly depending upon the signal type and additional functionalities present. A Tier 2 requirement became effective in July 2013 under V9 of the agreement[5].

[2] See http://re.jrc.ec.europa.eu/energyefficiency/pdf/CoC_Digital_TV-version%208_2009.pdf
[3] REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the voluntary ecodesign scheme for complex set-top boxes, Brussels, 22.11.2012 COM(2012) 684 final.
[4] Voluntary Industry Agreement to improve the energy consumption of Complex Set Top Boxes within the EU Proposal from the industry group, Version 3.0 2nd September 2011.
[5] Code of Conduct on Energy Efficiency of Digital TV Service Systems, Version 9, 1 July 2013, EUROPEAN COMMISSION DG JRC Institute for Energy and Transport, Ispra. Details at http://iet.jrc.ec.europa.eu/energyefficiency/ict-codes-conduct/code-conduct-digital-tv-services.

Cultural Issues (*see notes section 4)*

The EU has a very mixed market for set top boxes and digital TV services with cable, satellite, IP and a smaller proportion of terrestrial types. Anecdotal evidence as well as projections published in the EU Ecodesign preparatory Study (Lot 18) imply that around 70% of STB systems in the EU are complex (subscription type) units.

Notes Section 1. Typical Energy Consumption and Power Graphics

1.1 Test methodologies, Performance Standards and Labelling Requirements

1.1.1 Test Methodology

The harmonised test methodology for determining off and standby passive power would be EN/IEC 62301 *Household electrical appliances - measurement of standby power*.

On mode is determined according to IEC 62087 ed3.0 (2011) *Methods of measurement for the power consumption of audio, video and related equipment*.

To determine typical energy consumption (TEC), the Voluntary Agreement in its Annex E has a detailed description of the calculation methodology, with the usage cycle (hours in each various mode per day) carefully defined for the various functionalities present in any product.

1.1.2 Performance Metrics

Typical Energy Consumption (TEC) provides a valuable way to present performance of a product in several modes in a single figure for comparison. This figure can also provide a reasonable indicator of annual consumption in the home (dependent of course on the accuracy of the assumed hours in each mode). TEC was adopted for use in this mapping and benchmarking analysis.

TEC is calculated assuming a certain number of hours per day in each relevant mode of operation: the daily usage profile. This profile is defined in various ways under different policies and schemes and also according to the functionality available in the device.

For the purposes of the analysis in this EU mapping report, the approach described under the EU Voluntary Agreement was adopted, wherever the available data makes that calculation possible. This includes an assumption of 9 hours per day spent in on mode and 15 hours in standby.

Insufficient data was available across all regions to make it worthwhile to calculate an alternative typical energy consumption involving auto power down. Similarly, no calculation was made involving typical energy consumption for player/recorder mode operation.

1.2 Product Classifications

All set-top boxes on the EU market have to meet the horizontal standby requirement where applicable (this mainly applies to simple set-top boxes). Signatories to the voluntary

agreement on Complex STBs noted on the Digital Interoperability Forum website[6]. No further product classifications or labels are applicable in the EU.

1.3 Data sources and limitations

Data was supplied by the organisers of the EU Voluntary Agreement and by 2011 was estimated by participants to cover at least 80% of EU sales of complex set-top boxes.

A comprehensive data set including performance data on 310 products was received for 2011; no individual product data was available for prior to that. However, historical reports were used to derive market average TEC for 2010 and, as shown in Table 1 below, average TEC for STBs of *satellite input signal type only* for 2002 to 2006. This mapping document only has graphs of overall market average performance for all signal types of STB and so this data is not used here, but shown for information.

Table 1. Satellite type STB averages for the EU derived from historical reports.

	2002	2003	2004	2005	2006
Active standby, W	18	11	9	13	11
On mode, W	21	17	13	17	15
TEC_{EU} (mapping)	167	116	92	127	118
$TEC_{ENERGY\ STAR}$ (benchmarking)	173	127	99	134	122

Derivation of this data is explained in Appendix 1.The report of the independent inspector to the voluntary agreement also includes some sales weighted data about market average performance. No specific limitations to the data regarding complex set-top boxes have been noted.

1.4 Data manipulations and specific limitations

No normalisation adjustments were required for the power data in any mode; this was assumed to be directly comparable within and between regions without adjustment.

Figures for the total energy consumption (TEC) were calculated from the reported on mode and sleep mode performance figures; any reported TEC figures were ignored.

For analysis of all countries, in order to avoid misleading averages from very weak data bins, only calculated averages for any one year based on seven or more products were used in the graphics and analysis. Years with six or less products were ignored. No exclusions were necessary for the EU dataset.

Only the simple TEC using on mode and sleep mode were used, auto power down and other low power data were not used due to lack of similar data within this and all other datasets.

The data manipulation process introduced no additional limitations or uncertainties.

[6] See http://www.difgroup.eu/key-topics/greening-of-ict.

Notes Section 2. Signal type graphic

2.1 Data sources and limitations

Signal type is reported in the data set and used as declared.

Notes Section 3. Major Policy Interventions

No additional notes.

Notes Section 4. Cultural Issues

No additional notes.

Annex 1: Derivation of historical data

Summary of historical data

Using two historical published sources about data from signatories to the EU Code of Conduct and voluntary agreement for complex set top boxes, the data points below have been determined for the EU; all are *ILLUSTRATIVE* due to uncertainties in the derivation methodology.

- EU average TEC in 2010 for *mapping* purposes (i.e. calculated according to the EU TEC formula): 78 kWh per year, with active standby of 2.4W and on mode of 19.7W.
- EU average TEC in 2010 for *benchmarking* purposes (i.e. calculated according to the ENERGY STAR TEC formula): 109 kWh per year
- EU average TEC in 2006 for satellite signal type only for *mapping* purposes (i.e. calculated according to the EU TEC formula): 118 kWh per year
- EU average TEC in 2006 for satellite signal type only for *benchmarking* purposes (i.e. calculated according to the ENERGY STAR TEC formula): 122 kWh per year

Data for 2006 and prior is summarised in table 1.

Data for 2010

This was inferred from the 2010/2011 report of the EU voluntary agreement:

> *Report of the Independent Inspector to the VA on CSTBs - 2010 - 2011*, Edith Molenbroek, Joris van Doorn, Sina Wartmann of Ecofys, May 23rd 2012 (Project number: BESNL10982)

The report shows average of 78 kWh per year for all models - this is calculated according to the EU methodology, so can be used as is in the Mapping document but needs adjustment for benchmarking.

This is assumed to represent products from 2010 (spans 2010/2011 - but most is 2010). Unfortunately no data is given on split by input type. The Report (page 6) states that data was derived from 212 different products from 15 different suppliers.

Figure A1. Extract from *Report of the Independent Inspector to the VA on CSTBs - 2010 - 2011, Ecofys*.

Table 4.III Individual compliance rates of 15 out of 16 Signatories who submitted data

Energy consumption	kWh/yr
Average over all models	78
Average allowance per model	150
Minimum consumption	~ 20
Maximum consumption	~ 220

Some differences are found between the average consumption per box reported by manufacturers and by service providers, as reported in table 4.IV. Table 4.IV is sales weighted – Edith 31/1/2013

Table 4.IV Average yearly energy consumption for various selections of CSTBs, averaged according to sales

Selection of CSTBs	manufacturers kWh/yr (% of allowance)	service providers, kWh/yr (% of allowance)
all boxes	70 (46%)	117 (67%)
boxes with same specifications (allowance 180 – 185 kWh/yr)	85 (46%)	126 (68%)
same specs and standby > 1 W	127	133
same specs, standby > 1 W and no APD	129	136

In this table, the energy consumption per box per year averaged over all boxes sold is given. In the first row the consumption averaged over sales of all boxes is given. In the second row the consumption averaged over sales of a group of boxes with the same specification and with a significant market share is given. This group of boxes has an allowance of 180 – 185 kWh/yr, depending on whether it was a terrestrial / IP box or satellite/ cable box. In the first and second row the percentage of the allowance is also given, in brackets.
In the 3rd and 4th row the average energy consumption is given for the same groups of boxes, but filtered for standby power > 1 W and standby power > 1 W + presence of APD (Auto Power Down), respectively. It shows that a large part of the difference in average energy consumption between manufacturers and service providers can be explained by the increased presence of a low standby power in the boxes put out and measured by manufacturers.
The rationale for showing the difference between average consumption levels found with manufacturers and with service providers is that the boxes put out by service providers contain the software that is used by customers whereas for manufacturers that is not necessarily the case. Software is an important factor determining the energy consumption of a given model of CSTB. Inclusion of software brand, type and version into the reporting template, at least for service providers, should be considered in the future.

To adjust for the benchmarking:

Average according to EU methodology is 78 kWh per year, but for benchmarking comparisons TEC must be calculated according to the ENERGY STAR formula.

$$78 = 0.365 \times ((9 \times P_{on}) + (15 \times P_{standby}))$$

We have no data on what P_{on} and $P_{standby}$ are for this data set, but we could make an assumption that the ratio between them will be the same in 2010/2011 as it was in

2011/2012: that would allow us to solve for $P_{standby}$ and so estimate TEC for 2010/2011 according to the ENERGY STAR formula.

Table A1 shows figures derived using the 2011/2012 data set (which was provided as complete product performance data, just without model names or brands).

Table A1. Derivation of the ratio between P_{on} and $P_{standby}$ from the 2011 EU data set.

Type of STB	Average ratio of P_{on} to $P_{standby}$	Percentage of data set represented by that type
All	**8.20**	**100%**
Cable	7.71	29%
IP	1.67	30%
satellite	13.13	34%
terrestrial	14.94	6%

The ratio clearly varies significantly according to which type of signal input it has and so the average would be wrong if the proportions by signal varied much between 2010/2011 and 2011/2012. This is an additional source of uncertainty; the resultant figure will be at best 'illustrative'. A ratio of 8.2 can be applied:

$$78 = 0.365 \times ((9 \times P_{on}) + (15 \times P_{on}/8.2))$$

Therefore:

$$P_{on} = 19.7W \text{ and so } P_{standby} = 2.4W$$

Inserting these back into the ENERGY STAR equation gives:

$$TEC_{ENERGY\ STAR} = 0.365 \times ((14 \times P_{on}) + (10 \times P_{standby}))$$

$$TEC_{ENERGY\ STAR} = 0.365 \times ((14 \times 19.7) + (10 \times 2.4))$$

$TEC_{ENERGY\ STAR}$ = 109.4 kWh per year, an indicative figure for TEC in benchmarking for the EU voluntary agreement data set in 2010.

Data for 2006

Source document: Summary of the 2006 annual report for Code of Conduct on Energy Efficiency of Digital TV Service Systems, Presentation slides from 28th of March 2006 entitled *Code of conduct on digital TV service systems, Results 2006, Hans-Paul Siderius*. Available from http://iet.jrc.ec.europa.eu/energyefficiency/ict-codes-conduct/code-conduct-digital-tv-services, accessed 25 October 2013. Extract slides are shown in Figure A2, with data summarised in Table A2.

Table A2. 2006 averages for EU voluntary agreement data set.

Power mode	Average all types	Terrestrial	Cable	Satellite
Number of products included in average	21	3	5	**13**
Percentage of data set by type	100%	14%	24%	**62%**
Active standby	10.8	7.1	9.6	**12.5**
On mode	15.0	14.8	10.6	**15.0**

Hence we should discard the cable and terrestrial averages as they are from 7 or less products. ***Only use the satellite average.***

From this we can calculate satellite type TEC for mapping and for benchmarking:

Mapping EU average in 2006 for satellite signal type only:

TEC_{EU} = 0.365 x ((9 x P_{on}) + (15 x $P_{standby}$))
= 117.7 kWh per year

Benchmarking EU average in 2006 for satellite signal type only:

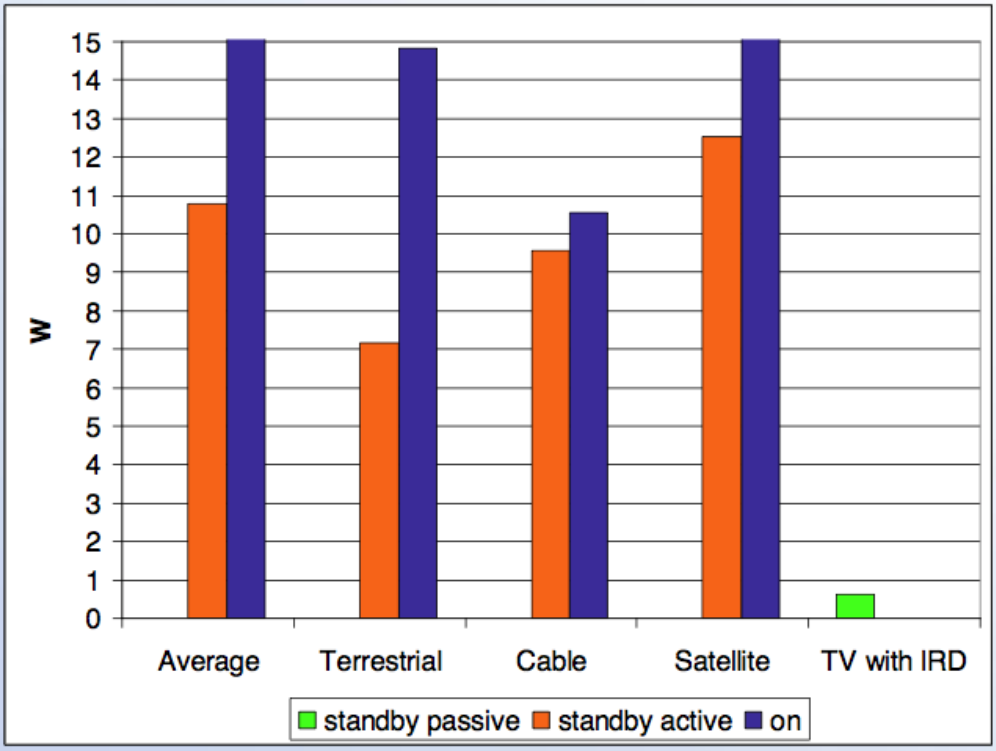
$TEC_{ENERGY\ STAR}$ = 0.365 x ((14 x P_{on}) + (10 x $P_{standby}$))
= 122.3 kWh per year

Figure A2. Slides regarding data for 2006 extracted from *Code of conduct on digital TV service systems, Results 2006.*

Overview of results 2006

- Reports by: BSkyB, Pace, Panasonic, Philips, Pioneer, Sony
- Number of models reported: 101
- Models complying: 88 %
- Type of boxes (% complying):
  - simple converter boxes: 3 (2 complying)
  - digital TVs with IRD: 68 (100 %)
  - stand alone STB: 21 (57 %)
    - cable: 5 (2 complying)
    - sattelite: 13 (8 complying)
    - terrestrial: 3 (2 complying)
  - PVR: 9 (8 complying)

Results 2006



Data prior to 2006

This was drawn from graphs included in the same 2006 report as Figure A3. However, for 2006 only satellite had sufficient products to make an adequately robust average (7 or more products): it is unlikely that prior years had better data, and so it is prudent to only use the satellite data for prior years too.

Table A3. Satellite type STB averages for EU, estimated from Figure A3.

	2002	2003	2004	2005
Active standby, W	18	11	9	13
On mode, W	21	17	13	17
TEC_{EU} (mapping)	167.5	116.1	92.0	127.0
$TEC_{ENERGY\ STAR}$ (benchmarking)	173.0	127.0	99.3	134.3

Figure A3. Slide regarding data prior to 2006, extracted from *Code of conduct on digital TV service systems, Results 2006.*