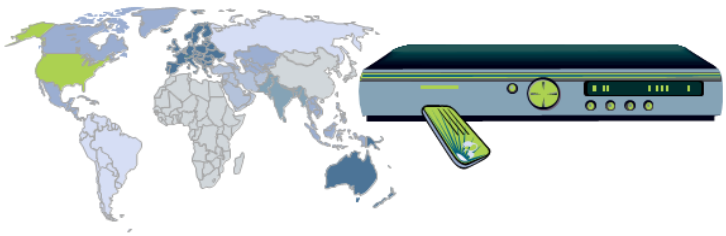


Country: USA

Technology: Set Top Boxes

Sub Category: Simple and Complex

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.

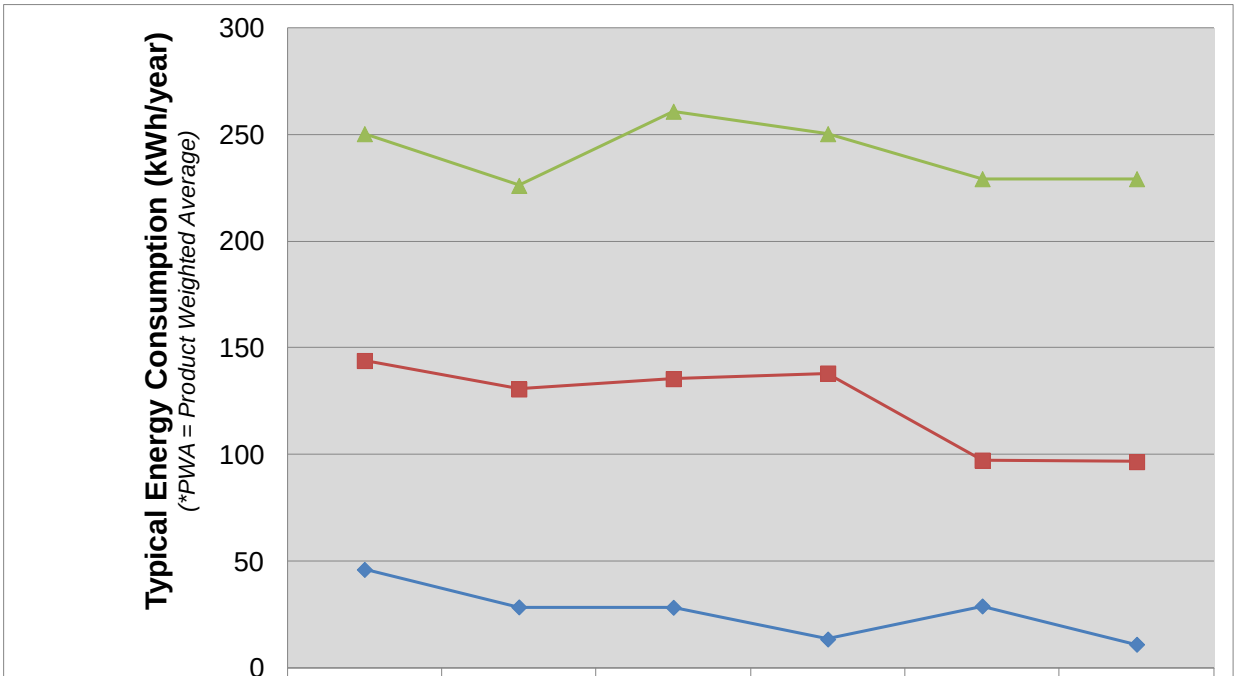
The summary definition for this product is:

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 USA

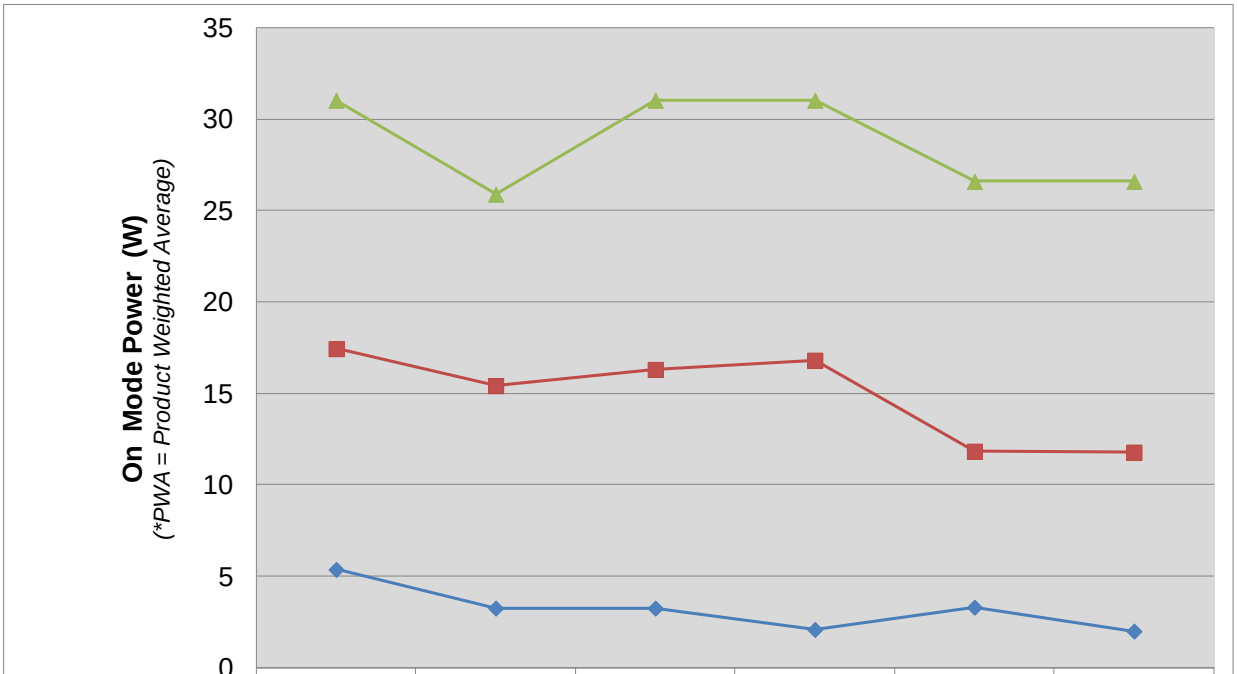


	2008	2009	2010	2011	2012	2013
Best TEC (kWh/yr)	46.1	28.5	28.3	13.4	28.9	11.0
PWA* TEC (kWh/yr)	144.0	130.7	135.5	138.1	97.3	96.6
Worst TEC (kWh/yr)	250.4	226.2	260.9	250.4	229.3	229.3

Key notes on Graph (see notes section 1)

- USA data for the majority of the 2010 set and for all of the data for 2011 to 2013 is from the ENERGY STAR programme. At the launch of each set of criteria this includes only the better performing products on the market, although market share rises over time. EPA advise that the 2013 data may be considered representative of the market as a whole. Data for 2008, 2009 and part of 2010 is from a government data set prepared to gather evidence for the ENERGY STAR criteria.
- Typical Energy Consumption, in kWh per year, is calculated according to the ENERGY STAR Version 3 method, using only the power in *on* and *sleep* modes: 14 hours in on mode and 10 hours in sleep mode per day.
- The count of products in the datasets for each year for which TEC could be calculated varied from 14 in 2008 growing to a highest count of 79 in 2013.
- ENERGY STAR Version 2 criteria took effect in 2009 and Version 3 in September 2011. V3 corresponds with the step change in product-weighted average TEC in the ENERGY STAR data set (product sales in the whole market may of course change more slowly).
- Products in the data sets for 2010 to 2012 were 100% complex (conditional access) type, and 95% complex for 2013. (Data sets for 2007 to 2009 had less than 20 products and so are considered non-representative of the simple/complex split in the market).

On mode power of Set Top Boxes in the USA

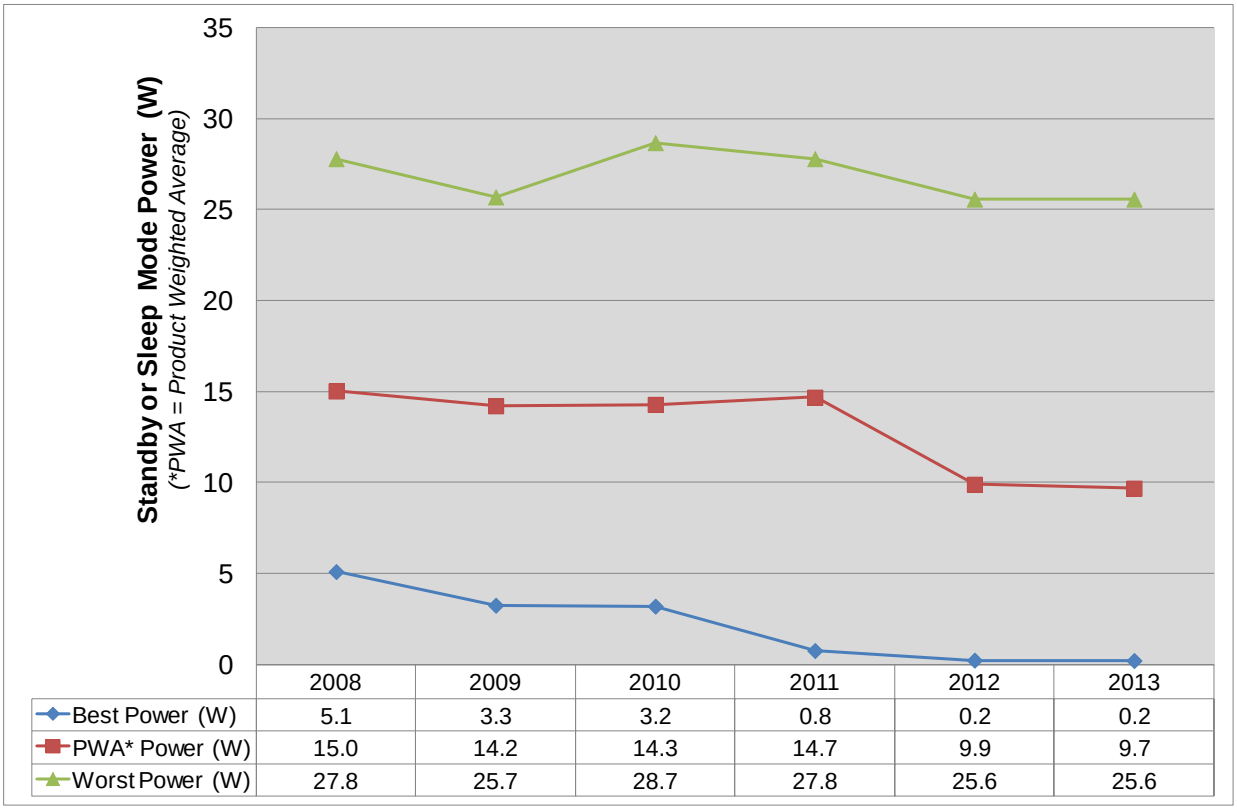


	2008	2009	2010	2011	2012	2013
Best Power (W)	5.4	3.3	3.3	2.1	3.3	2.0
PWA* Power (W)	17.4	15.4	16.3	16.8	11.8	11.8
Worst Power (W)	31.0	25.9	31.0	31.0	26.6	26.6

Key notes on Graph (see notes section 1)

- The graph shows the manufacturer's declared on mode power.
- USA data for the majority of the 2010 set and for all of the data for 2011 to 2013 is from the ENERGY STAR programme. At the launch of each set of criteria this includes only the better performing products on the market, although market share rises over time. EPA advise that the 2013 data may be considered representative of the market as a whole. Data for 2008, 2009 and part of 2010 is from a government data set prepared to gather evidence for the ENERGY STAR criteria.
- The data sets for 2007 to 2009 for the USA had less than 20 products. Products included for 2010 to 2012 were 100% complex (conditional access) type, and 95% complex for 2013.

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

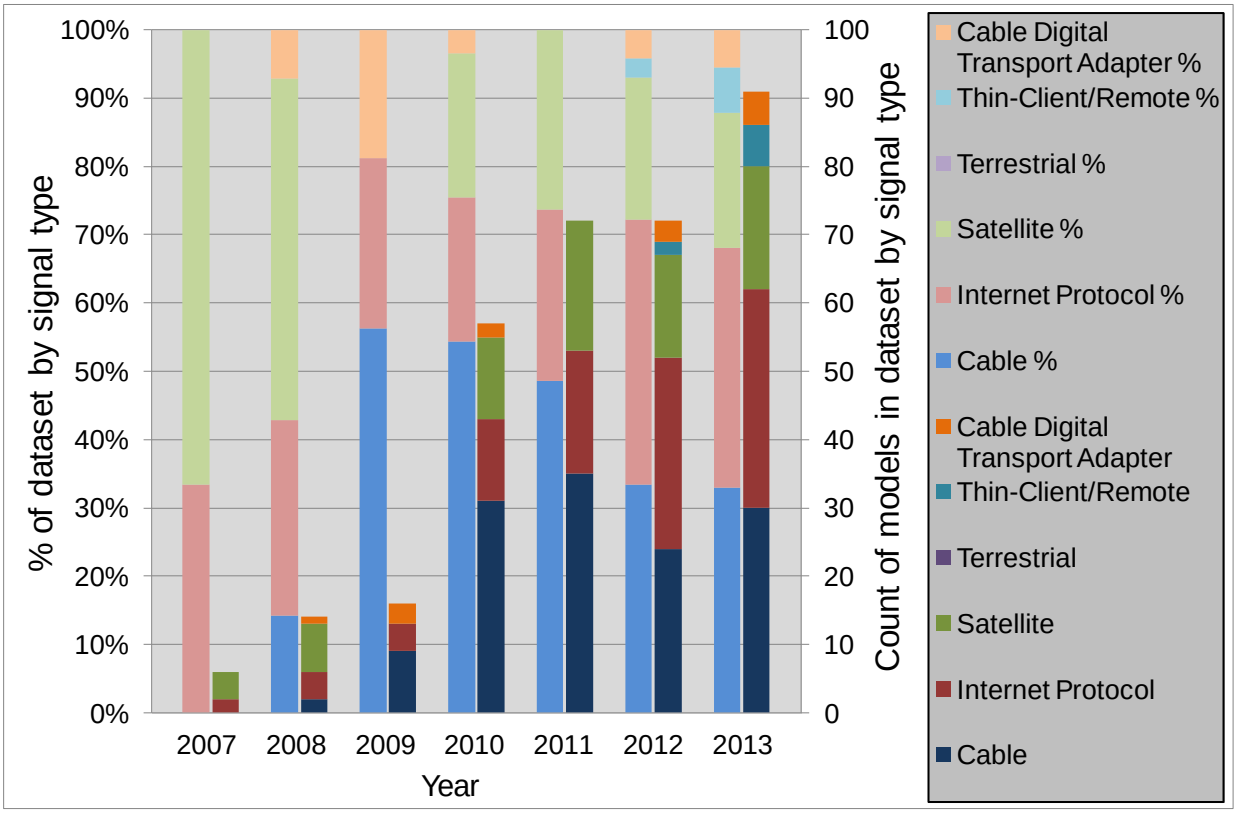


	2008	2009	2010	2011	2012	2013
Best Power (W)	5.1	3.3	3.2	0.8	0.2	0.2
PWA* Power (W)	15.0	14.2	14.3	14.7	9.9	9.7
Worst Power (W)	27.8	25.7	28.7	27.8	25.6	25.6

Key notes on Graph (see notes section 1)

- The graph shows the manufacturer's declared sleep mode power. *Sleep mode* is also referred to as *standby mode*, or as *standby active mode* in some countries. These three were assumed equivalent for this analysis.
- USA data for the majority of the 2010 set and for all of the data for 2011 to 2013 is from the ENERGY STAR programme. At the launch of each set of criteria this includes only the better performing products on the market, although market share rises over time. EPA advise that the 2013 data may be considered representative of the market as a whole. Data for 2008, 2009 and part of 2010 is from a government data set prepared to gather evidence for the ENERGY STAR criteria.
- The data sets for 2007 to 2009 for the USA had less than 20 products. Products included for 2010 to 2012 were 100% complex (conditional access) type, and 95% complex for 2013.

Share of set top box dataset by signal type in the USA



Key notes on Graph (see notes section 2)

- The graph shows the breakdown of the USA set top box dataset by input signal type.
- 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 and Internet Protocol types together account for around or over 70% of ENERGY STAR registered set top boxes since 2009.
- The data sets for 2007 to 2009 for the USA had less than 20 products. Products included for 2010 to 2012 were 100% complex (conditional access) type, and 95% complex for 2013.

Major Policy Interventions (*see notes section 3)*

Mandatory performance requirements

In December 2013 DOE announced that there will be a voluntary agreement to improve the energy efficiency of all pay-TV set top boxes in the USA and that the process to develop mandatory standards has been halted.

Previously, US DOE had published a notice of a proposed rulemaking for a test procedure for set-top boxes (78 FR 5075 on January 23, 2013) and a public meeting followed in February 2013 with a request for information. A DOE bulletin of December 2013 announced the withdrawal of the *notice of proposed rulemaking* for a test procedure for set-top boxes and the proposed *coverage determination* for set-top boxes and network equipment.

Voluntary endorsement label: ENERGY STAR

US EPA launched its ENERGY STAR specification for set-top box hardware in 2001. This specification was withdrawn in February 2005 when EPA judged that savings could not be ensured without a relationship with Pay TV providers. EPA restarted the program in 2008 with a unique partnership with both hardware makers and Pay TV providers. Version 2 of the criteria took effect in January 2009 and Version 3 in September 2011.

A Version 4 criteria set was published along with Version 3 in 2011 but this was withdrawn before it took effect as the market had evolved in ways that had not been anticipated Development of Version 4.1 continues at October 2013, following a public webinar in September 2013 to discuss proposed requirements.

Voluntary agreement

DOE, the Natural Resources Defense Council (NRDC), the American Council for an Energy-Efficient Economy (ACEEE), the Appliance Standards Awareness Project (ASAP), the Consumer Electronics Association (CEA) and the National Cable & Telecommunications Association (NCTA) announced non-regulatory energy efficiency standards for pay-TV set-top boxes[2] in December 2013.

The agreement, which runs to 2017, covers all types of set-top boxes from pay-TV providers, including cable, satellite and telephone companies. The agreement also requires the pay-TV industry to publicly report model-specific set-top box energy use and requires an annual audit of service providers by an independent auditor to ensure boxes are performing at the efficiency levels specified in the agreement. The agreement aims to improve set-top box efficiency by 10 to 45 percent (depending on box type) by 2017.

[2] See https://www.ncta.com/sites/prod/files/VOLUNTARY-AGREEMENT-ENERGY-EFFICIENCY-OF-SET-TOP-BOXES.pdf

Cultural Issues (*see notes section 4)*

The following observations on the US market have influenced the type of set top box made available to US consumers, and their efficiency:

1) The Federal Communications Commission (FCC) rule mandating the use of CableCard in all devices[3] (the 'integration ban rule'). This has resulted in increased power in On and Sleep modes for Cable STBs. There has been an ongoing effort by industry to reverse this mandate.

2) Large cable companies are composed of various acquisitions of smaller cable operators, which has made upgrading the network difficult. This has limited the ability to lower Sleep mode power.

3) Most cable franchises have only a single cable operator. Thus, cable companies have little competition between each other, which has limited STB choices for consumers. Satellite and Telco competition has mitigated this somewhat.

[3] This regulation originally stems from the Telecommunications Act of 1996 and sought to stimulate a competitive market in set-top boxes by separating the security (service access) functions specific to the individual provider from the other functions of the set-top box. This was implemented through FCC rule found in Part 76, Subpart P of the CFR. 47CFR76.1204(a)(1). The requirement eventually came into force in 2007 and forced set top boxes to have a cable service access device installed that read a 'CableCard' supplied by the service provider.

Notes Section 1. Typical Energy Consumption and Power Graphics

1.1 Test methodologies, Performance Standards and Labelling Requirements

1.1.1 Test Methodology

The only test methodology for set-top boxes relevant to the USA market at October 2013 is the *ENERGY STAR® Program Requirements Product Specification for Set-top Boxes, Test Method Rev. Jan-2011*. This test methodology took effect with ENERGY STAR specification for set top boxes Version 3.0, and uses the test set up and instrumentation requirements of CSA C380-08 *Test procedure for the measurement of energy consumption of set top boxes*.

Note: The Voluntary Agreement announced in December 2013 uses for its Tier 1 requirements (January 2014) the ENERGY STAR Version 3 STB Testing Programme. For its Tier 2 (January 2017), it uses the *CEA-2043: Set-top Box (STB) Power Measurement* standard developed under the auspices of the Consumer Electronics Association (CEA) R4 Video Systems Committee, ANSI 2043-2013.

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 study, the approach described under ENERGY STAR Version 3 was adopted wherever the available data makes that calculation possible.

The proposed calculation for total energy consumption (as in ENERGY STAR Version 3) is:

$$TEC_{COMBINED} = TEC_{PRIMARY} + TEC_{PLAY/RECORD}$$

Where:

- $TEC_{PRIMARY} = 0.365 \times ((T_{TV} \times P_{TV}) + (T_{SLEEP} \times P_{SLEEP}) + (T_{APD} \times P_{APD}))$
- T_{TV}, T_{SLEEP}, T_{APD} as shown in Table 1.
- $TEC_{PLAY/RECORD} = 0.365 \times [((P_{PLAYBACK} - P_{TV}) \times T_{PLAYBACK}) + (P_{RECORD} - P_{TV}) \times T_{RECORD})]$

$TEC_{PLAY/RECORD}$ is only applicable where a play/record function is available. In the absence of any power data for this it is disregarded – as was the case for the vast majority of products for which data was available across all participating countries, not just for the USA.

Similarly, figures for P_{APD} were available for only a very small proportion of products across the participating countries and so APD was also disregarded in the analysis.

Table 1. Base functionality hours of use proposed for use in this analysis (adopted from the ENERGY STAR Version 3 criteria, using the hours profile 'without APD').

	Hours in On (TV) = T_{TV}	Hours in Sleep = T_{SLEEP}	Hours in APD = T_{APD}
Hours in each mode (adopted from the 'Without APD' profile)	14.0	10	0.0

1.2 Product Classifications

In the USA, the only product classification achievable is to display the ENERGY STAR symbol on products that meet those criteria.

1.3 Data sources and limitations

Two sources were used for the data used in this analysis:

(1) Product performance datasets collated by US EPA during the process of developing the ENERGY STAR criteria. These datasets cover 2007 to 2010. No information is available on how representative of the full market these datasets may be, but it is assumed that they may include products across the whole performance spectrum.
(2) ENERGY STAR datasets published on the US EPA website that include only better performing products that meet the criteria. These datasets cover 2010 to 2013.

The data set analysed for 2010 is mixed and includes 11 products from the development data sets and 46 from the ENERGY STAR database.

The main limitations associated with these datasets are:

a) Trends pre-and post-2010 may not be continuous nor comparable due to differences in data sources.
b) All data post 2010 represents better performing products only and not the whole market; it is unknown how representative of the full market data before that is.
c) The ENERGY STAR criteria changed in September 2011 which led to a step change in average performance between 2011 and 2012. It is unknown the extent to which this represents a step change in total market average performance.

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.

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.

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.

Notes Section 2. Signal type graphic

2.1 Data sources and limitations

Signal type is reported as declared by the manufacturers in the ENERGY STAR and also in the development datasets, and was used as reported in this analysis.

Notes Section 3. Major Policy Interventions

The ENERGY STAR Programme

The USA ENERGY STAR programme is a joint programme of the US Environmental Protection Agency (EPA) and the US Department of Energy. The programme endorses the more energy efficient products.

The ENERGY STAR label was established to:

- Reduce greenhouse gas emissions and other pollutants caused by the inefficient use of energy; and
- Make it easy for consumers to identify and purchase energy-efficient products that offer savings on energy bills without sacrificing performance, features, and comfort.

This voluntary program was designed to create self-sustaining markets for energy-efficient products and services via a common labeling strategy and awareness campaign and through strategic market interventions designed to overcome barriers identified for designated product markets.

ENERGY STAR was launched in 1992 with a label for computers and monitors and now extends to cover most major appliances, office equipment, lighting, home electronics, new and existing homes and commercial and industrial buildings.

An important motivator for suppliers to get products registered with ENERGY STAR is that federal agencies are required to purchase only energy efficient products[4] – defined as being either ENERGY STAR qualified or designated energy efficient by the Federal Energy Management Programme (FEMP).

The USA ENERGY STAR programme switched to mandatory third party certification of all products in January 2011.

[4] The Energy Policy Act of 2005 requires federal agencies to buy either ENERGY STAR products or products designated as energy efficient by the Federal Energy Management Program (FEMP). These requirements are included in the Federal Acquisition Regulation (FAR) Subpart 23.203. See http://www.energystar.gov/index.cfm?c=fed_agencies.fed_ag_index

Notes Section 4. Cultural Issues

No additional notes.