



Product Definition: Set Top Boxes

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Contents

1. Set Top Box Summary Definition and Data requirements.....	2
2. Development of a common framework to categorise products based upon policies around the world.....	4
3. Product Sub-Category Rationalisation.....	5
3.1 Technology.....	7
1.1.1 Matrix Row A): Simple and/or complex set top boxes.....	7
1.1.2 Matrix Row B): Type of power supply.....	8
3.2 Features and functionality.....	8
1.1.3 Matrix Row C) Mode of signal input for digital TV signals that the STB is capable of handling.....	8
1.1.4 Matrix Row D): Auto power down.....	9
1.1.5 Matrix Row E): Additional tuners.....	9
1.1.6 Matrix Row F): Video Capabilities.....	10
1.1.7 Matrix Row G): Multi-Room (also called multi decode and display).....	11
1.1.8 Matrix Row H): Advanced home network interface.....	12
1.1.9 Matrix Row I): Return Path Broadband Modem.....	12
1.1.10 Matrix Row J): Digital Video Recording & Playback.....	12
4. Metrics.....	15
4.1 On and Standby modes.....	15
4.2 Typical Energy Consumption (TEC).....	19
4.3 Test methodologies.....	20
5. Data requirements.....	21
Appendix 1: STB Policies used to derive the common framework for analysis.....	24

1. Set Top Box Summary Definition and Data requirements

This product definition explains the product scope, metrics and data requirements for the mapping and benchmarking of energy performance of digital television set top boxes.

Table 1: Summary Product Categorisation Matrix (for explanation see section 3 Product Sub-Category Rationalisation)

Generic definition & scope	<p>The analysis is to cover set top boxes (STB) 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.</p> <p>Both Simple STB (free access) and Complex STB (conditional access) are included. (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)).</p> <p>Note: standalone digital television adapters (digital to analogue converters)¹ are not included.</p>
Signal sources	<p>The following types of STB are included according to signal sources and applicable characteristics are to be noted for each product (more than one can apply):</p> <ul style="list-style-type: none"> • Cable STB • Satellite STB • Terrestrial STB • Cable digital transport adapter (DTA) • Internet protocol (IP) STB • Thin client / remote STB
Other characteristics to be noted	<p>Additional functionality to be noted:</p> <ul style="list-style-type: none"> • Auto power down • Additional Tuners • Digital Video Recorder • Multi-Room (used with one or more thin client / remote STBs) • Additional Tuners – OTA/IP • Wideband Tuners • Advanced Video Processing • High Definition Resolution • 3D • Removable Media Player (DVD / BRD) • Removable Media Player/Recorder • Home Network Interface (e.g. WiFi, MoCA) • Provision/type of a return path • Integrated home gateway (where the STB acts as a hub to receive signal and distribute it to any suitable device within or perhaps outside of the home) • Remote access / control (e.g. manage DVR via phone app etc.) <p>Also to be noted: Test methodology used associated with energy requirement measurements</p>

¹ Digital television adapter, otherwise known as a digital-to-analogue converter or a converter box is a television tuner that receives a digital television transmission and converts the digital signal into an analogue signal that can be received and displayed on an analogue television set.

Note that products with different primary purposes, but which have STB capability are excluded from this analysis – examples include game consoles and computers with STB functionality.

Table 2. Summary of main performance data requirements (for full details see section 5 Data requirements)

<p>Key information:</p>	<p>A. Whether STB is ‘free’ or ‘conditional’ access</p> <p>B. Signal sources (one or more of: Cable, satellite, Internet Protocol, cable DTA, terrestrial or thin-client/remote)</p> <p>C. On mode power (W)</p> <p>D. Standby/sleep power (W)</p>
<p>Other information:</p>	<p>E. Auto power down (APD) power (W) (if different to standby/sleep)</p> <p>F. (Sub-)Type of set top box</p> <p>G. Power in record mode (W, for units with this capability)</p> <p>H. Declared TEC (kWh per year), along with the methodology used to determine this</p> <p>And any other product features and functionality available.</p>

2. Development of a common framework to categorise products based upon policies around the world

Despite very similar fundamental purpose for these products (delivering AV signals to a television from any of several sources), there are six different signal sources that they may be capable of handling, plus at least fifteen additional functionalities such as recorders and additional tuners. In addition, services handled can be free or pay per channel / per view. Many countries have their own schemes or policies regarding set top boxes, some having different scope and their own ways of denoting product types, functionality and performance in any databases. It is necessary to develop a framework into which the majority of available data can be slotted, enabling fair comparison of similar products.

Once products are categorised in a fair manner, it may be possible to analyse the most common permutations of features (i.e. the main sub-groups) to benchmark performance. There are certainly too many variables to analyse and present data on all possible permutations of form and function.

Seven major policies have been identified which apply to STBs, and all make distinctions between different types of product that will almost certainly affect the availability and categorisation of product data from the affected region(s). These policies and associated test methodologies were used to develop a common definition and framework for analysis. The policies considered are:

1. Australian MEPS. *AS/NZS62087.2.1:2008 Minimum energy performance standard (MEPS) requirements for digital television set top boxes.*
2. Australian Conditional Access Set Top Box (CSTB) Code of Conduct (CoC)
3. ENERGY STAR® *Technical Specifications for Set-top Boxes Version 3.0.* Published 21 January 2011 and came into effect on 1 September 2011.
4. EU Regulation (EC) No 107/2009, Ecodesign requirements for simple set-top boxes: *Commission Regulation (EC) no 107/2009 of 4 February 2009*
5. EU Code of Conduct. *Code of Conduct on Energy Efficiency of Digital TV Service Systems Version 8, European Commission Joint Research Centre, Ispra, 15 July 2009.*
6. EU Ecodesign Voluntary Agreement. *Voluntary Industry Agreement to improve the energy consumption of Complex Set Top Boxes within the EU, Proposal from the industry group, Version 3.0, 2 September 2011.*
7. US DOE Federal rule in development with a Notice of Proposed Rulemaking published in 2012².
8. 15 US based video programming distributors and set-top box manufacturers signed up to a 5-year industry voluntary agreement³ in December 2012 to reduce the energy consumption of set-top boxes. The agreement went into effect in January 2013 and will make its first published report in January 2014.

Overall, the Australian MEPS definition is the most narrow as it excludes products with digital recorders of any kind, but it does cover terrestrial digital television adaptors (non-conditional access) that the others exclude. Each of the policies includes much different functionality,

² US Department of Energy, 10 CFR Parts 429 and 430, Docket no. EERE-2012-BT-TP-0046, RIN: 1904-AC52, Energy conservation programme: Test Procedure for set top boxes.

³ See [http://www.ce.org/CorporateSite/media/ce_news/FINAL-PUBLIC-VOLUNTARY-AGREEMENT-\(12-6-2012\).pdf](http://www.ce.org/CorporateSite/media/ce_news/FINAL-PUBLIC-VOLUNTARY-AGREEMENT-(12-6-2012).pdf).

with associated energy allowances. A key product differentiator common to all is whether or not conditional access is included.

Further details of each of these policies are given in Appendix 1.

3. Product Sub-Category Rationalisation

This section explains the rationale behind the summary definition presented in section 1, and how this was developed. Table 3 shows the first proposed way to break down the product category, and each aspect is discussed in the following sections.

Table 3: Initial matrix definition of possible STB sub-categorisation. (Note: Due to its later publication, the US DOE NOPR has not been reviewed for inclusion in this table)

		Aspect	Possible Permutations	Accounted for in which policy
A	Technology	Whether STB enables access to chargeable and/or free access signals	Free or conditional access, i.e. simple or complex STB	Austrl-MEPS, Austrl-CSTB CoC, VA, CoC, ES
B	Technology	Type of power supply	Built in or external	
C	Functionality	Mode of signal delivery that the STB is capable of handling.	Cable, satellite, Internet Protocol, terrestrial, Cable digital transport adapter (DTA) or thin-client/remote	Austrl-MEPS, Austrl-CSTB CoC, EC, ES, VA, CoC
D	Functionality	Auto power down	Present or not	Austrl-MEPS, Austrl-CSTB CoC, EC, VA, CoC, ES
E	Functionality	Additional Tuners,	Present or not	Austrl-MEPS, Austrl-CSTB, EC, CoC, VA, CoC, ES
F	Functionality	Video Processing: <ul style="list-style-type: none"> Advanced Video Processing High efficiency AVP Resolution Enhancement: <ul style="list-style-type: none"> High Definition Resolution Full HD Resolution Ultra-High Definition Resolution 3D Imaging: <ul style="list-style-type: none"> 3D TV processing 	Present or not Present or not Present or not Present or not Present or not Present or not	AUSTRAL-CSTB, VA, CoC, ES VA (tier 2 only) Austrl-MEPS, Austrl-CSTB CoC, VA, CoC, ES VA (tier 2 only) VA (tier 2 only) VA (tier 2 only)
G	Functionality	Multi-Room (multi decode and display)	Present or not	VA, CoC, ES
H	Functionality	Advanced home network interface	Present or not	VA, CoC, ES
I	Functionality	Return Path Broadband or DOCSIS Modem	Present or not	VA, CoC, ES

		Aspect	Possible Permutations	Accounted for in which policy
J	Functionality	Digital Video Recording & Playback <ul style="list-style-type: none"> • Digital Video Recorder • Removable media player (DVD, BluRay etc) • Removable media player /recorder (DVD, BluRay etc) 	Present or not Present or not Present or not	Austrl-CSTB, VA, EC, CoC, ES ES ES

3.1 Technology

1.1.1 Matrix Row A): Simple and/or complex set top boxes

The original intention under this annex was to address 'complex set top boxes' under this definition, and simple set top boxes at a later stage if/as required. Due to the inclusion of both types in the Australian policy, the existence of EU regulations on simple set top boxes, and potential lack of data for simple set top boxes from other countries, it would seem appropriate to include what data is available for simple set top boxes in this analysis, as it probably carries a negligible additional data collation and analysis overhead; the implications for reporting can be kept under review. These two types will, however, need to be in separate sub-categories for analysis due to significantly different functionality. Based on the policies described above, the following definitions are proposed:

- A. A **simple set top box** is a stand-alone device, using an integral or dedicated external power supply, for the reception of standard definition or high definition digital broadcasting services via IP, cable, satellite and/or terrestrial transmission and their conversion to analogue and/or line signals and/or with a digital output signal. Simple set-top boxes may include internal hard drive or solid-state memory for recording and other functionalities but not conditional access. Any such functionality will have to be noted in product performance data for sub-categorisation.
- B. A **complex set top box** performs the same basic function as a simple set top box but includes conditional access, i.e. the channels/media delivered by the set-top box are controlled according to which (chargeable) subscription package or Pay-Tv the customer subscribes to.

In principle there are three main modes for STBs: on (including play, record, and multifunction), network standby (in which the product can be assessed from outside, e.g. by the service provider), and off/standby passive (in which the product can not be assessed from outside). Conditional access products are under more direct control of the service provider and will probably spend more time in active standby awaiting remote activation signals than a typical simple set top box⁴. They may therefore have a higher consumption in standby mode, and spend longer in an active standby mode, compared to a (lower power) passive standby mode.

One means of achieving conditional access is using a card inserted in the STB to access premium services (via decryption and other network control functions). One such method is known in North America by the proprietary name of CableCARD™ (CableCARD™ is a registered trademark of CableLabs®). STBs noted with CableCARD™ functionality are assumed to be 'complex'.

Free to air STBs and terrestrial STBs are assumed to be simple type. It is not possible to generalise about whether satellite or cable STBs are simple or complex.

Note: Version 9 of the EU CoC will also distinguish between Headed (can be operated by the end-user) and Headless (not to be operated by the user) CSTBs.

- *Proposal: To invite data on both simple and complex set top boxes, but to ensure that the two types are clearly differentiated.*

⁴ Some simple STBs may also spend time in active standby for downloading electronic programme guides and checking for firmware upgrades.

1.1.2 Matrix Row B): Type of power supply.

Power supplies can be internal or using a dedicated external power supply (EPS). This will not make a difference to declared power demand as long (as the product is supplied with a dedicated EPS), since products are tested to include any power supply losses.

- *Proposal: To ignore power supply type.*

3.2 Features and functionality

In order to provide some indication of the relative prevalence of the features mentioned, the proportion of products registered on the publicly available list of ENERGY STAR qualified products as at October 2012 that have each feature is quoted for each feature (see Table 4 and Table 5).

1.1.3 Matrix Row C) Mode of signal input for digital TV signals that the STB is capable of handling

Three of the four policies identified differentiate between products capable of handling the following signal sources (see Table 4 for relative proportions):

- **Cable STB:** A STB with the principal function to receive television signals from a broadband, hybrid fibre/coaxial, community cable distribution system and deliver them to a consumer display and/or recording device.
- **Internet Protocol (IP) STB:** A STB with the principal function to receive television/video signals encapsulated in IP packets and delivers them to a consumer display and/or recording device.
- **Satellite STB:** A STB with the principal function to receive television signals from satellites and deliver them to a consumer display and/or recording device.
- **Terrestrial STB** is a STB which is capable of receiving digital television signals over the air (OTA) or free to air (FTA) and deliver them to a consumer display and/or external recording device. All of these are assumed to be of the 'simple' type.
- **Thin-Client/Remote STB:** A STB that is designed to interface between a multi-room STB and a TV (or other output device) and that has no ability to interface with the Service Provider directly. Thin client / remote STBs must rely solely on a separate STB for accessing content.
- **Cable Digital Transport Adapter (DTA, from ENERGY STAR Version 3):** A minimally-configured STB whose primary function is to receive television signals from a broadband, hybrid fibre/coaxial, or community cable distribution system and deliver them to a consumer display and/or recording device.

In principle the different sources (Cable, Satellite, Terrestrial, and IP) do not mean a different functionality. From a technical point of view, these different sources have different signal handling requirements, and therefore vary in their power needs. In addition, there are also hybrid STBs, for example: set-top boxes that support digital video broadcasting (DVB) and IP-based video. Such devices combine functionalities and can affect STBs' overall power requirements. ENERGY STAR and all known policies handle this issue by requiring each STB to have a defined *primary* signal source (even when a set-top box may handle several signal sources); ENERGY STAR also defines an STB's base functionality which is specified as the primary functionality that defines the ENERGY STAR criteria applicable to a particular STB, and can be one of the following: Cable, Satellite, IP, DTA, Terrestrial or Thin-Client/Remote. For perspective on relative popularity of these source types see Table 4.

Table 4. Count of products by signal source type in the USA ENERGY STAR product list.

Count of products in ENERGY STAR data set at:	Total	IP	Cable	Satellite	Cable DTA	Thin client / remote	Terrestrial
April 2012	57	22	20	12	2	1	0
October 2012	73	28	24	16	3	2	0
October 2012 as percentage	100%	38%	33%	22%	4%	3%	0%

The Australian MEPS regulation covers only ‘simple’ STBs under its terrestrial category, but also complex STBs under its Satellite and Cable categories. The other five policies include different power use allowances for all of these categories. These represent significantly different functionalities, and it is likely that power characteristics will vary accordingly; fair comparison may therefore require separation into sub-types.

- *Proposal: To request data on which of the above six modes of signal delivery the product is capable of handling, to enable possible separation by sub-type and hybrid combinations.*

1.1.4 Matrix Row D): Auto power down

Auto power down is a function to reduce energy consumption by which the unit automatically reverts from on mode to a low power state without user intervention (subject to certain conditions, such as no user input for a period of 4 hours). Some regulations require this function to be present and enabled at point of sale, others take this into account into calculating the Total Energy Consumption (see section 3 for more information). This makes a significant difference to the typical annual energy consumption of a product and is therefore of policy interest. Availability of this piece of information will probably vary and it will be assumed that if it is not mentioned, then it is not present. For context: 70% of the October 2012 ENERGY STAR qualified products had this feature.

- *Proposal: To request information as to whether products have the auto power down function, in order to monitor growth of this energy saving feature. Where the function is not mentioned, it will be assumed that it is not present.*

1.1.5 Matrix Row E): Additional tuners

Additional tuners built into the electronics unit will add a few watts per tuner to energy use. All regulations identified so far which include digital video recorders make allowance for this. For some regulations (e.g. draft EU Ecodesign Voluntary Agreement, Australian MEPS and CSTB CoC) the allowance increases with the number of tuners; for ENERGY STAR there is a flat allowance for more than one tuner, which does not increase if further tuners are added. “Wideband” tuners, which replace multiple bonded cable tuners, have different energy requirements than “normal” tuners. For context: no data on this in the October 2012 ENERGY STAR data set.

- *Proposal: To request information as to how many tuners are included, and whether or not they are “normal” or “wideband.”*

1.1.6 Matrix Row F): Video Capabilities

1.1.6.1 Video processing:

Advanced Video Coding:

Advanced video processing are methods for video encoding, transcoding or decoding, giving compression efficiency significantly beyond MPEG-2. Examples include, but are not limited to, H.264/AVC and SMPTE 421M. The regulations identified to date that cover on-mode power have an allowance for this functionality. It is likely that the presence of this will be noted, so it is proposed that this is recorded. For context: 84% of the October 2012 ENERGY STAR qualified products had this feature. If a STB is only capable of MPEG2 image processing, then it can be assumed it does not have AVP.

- *Proposal: To request information as to whether products have advanced video processing.*

High Efficiency Video Coding (HEVC)

This is defined as high efficiency methods for video encoding, transcoding or decoding, giving compression efficiency significantly beyond H.264/AVC. This includes, but is not limited to, the example of HEVC. This was only identified as a function for Tier 2 of the draft EU Ecodesign Voluntary Agreement that is not scheduled to take effect until 1 January 2014 and therefore does not apply to products already supplied. It is unlikely that it will be noted whether the AVP is high efficiency for existing products or not. However, to facilitate easier future repeat analysis that may require this (at near-zero current cost) it is proposed that this information is requested and built into the analysis process. For context: no data on this in the October 2012 ENERGY STAR data set.

- *Proposal: To request information as to whether products have high efficiency advanced video processing.*

1.1.6.2 Resolution Enhancement:

High Definition Resolution

Products that provide high definition (HD) outputs (defined as Video output with resolutions greater or equal to 720p (1280 pixels x 720 lines at 50 frames/s progressive) or 1080i (1920 pixels x 1080 lines at 25 frames/s interlaced)) require additional power. All regulations identified to date allow additional power for this functionality and it is likely that the presence of this will be noted so it is proposed that this is recorded. For context: 93% of the October 2012 ENERGY STAR qualified products had this feature.

- *Proposal: To request information as to whether products have high definition (720p or 1080i) resolution*

Full High Definition Resolution

Products which provide full high definition outputs (defined as with resolutions greater or equal to 1080p (1920 pixels x 1080 lines at 50 frames/s progressive)) require greater power than HD. However this was only identified as a function for Tier 2 of the draft EU Ecodesign Voluntary Agreement that is not scheduled to take effect until 1 January 2014 and therefore does not apply to products already supplied. It is unlikely that it will be noted whether the full HD is available on existing products. However, to facilitate easier future repeat analysis that may require this (at near-zero current cost)

it is proposed that this information is requested and built into the analysis process. For context: no data on this in the October 2012 ENERGY STAR data set.

- *Proposal: To request information as to whether products have full high definition (1080p) resolution.*

Ultra High Definition Resolution (4K)

Products that provide ultra high definition outputs (defined as Video output with resolutions greater or equal to 4Kx2K (3840 pixels x 2160 lines at 50 frames/s progressive)) require greater power than HD. No such STB products are on the market at June 2013. However this is identified as a function for Tier 2 of the draft EU Ecodesign Voluntary Agreement that is not scheduled to take effect until 1 January 2014 and therefore does not apply to products already supplied. It is unlikely that it will be noted in current data sets whether the ultra high HD is available on existing products or not. However, to facilitate easier future repeat analysis that will require this (at near-zero current cost) it is proposed that this information is requested and built into the analysis process. For context: no data on this in the October 2012 ENERGY STAR data set.

- *Proposal: To request information as to whether products have ultra high definition (4K or 2160p) resolution.*

1.1.6.3 3D TV processing

Products that provide a 3D output require greater power than a standard 2D output. However this was only identified as a function for Tier 2 of the draft EU Ecodesign Voluntary Agreement that is not scheduled to take effect until 1 January 2014 and therefore does not apply to products already supplied. 3D functionality beginning to appear as a mainstream product in late 2010 and 2011 and so is unlikely to appear in the data sets available for 2010 and previous. In addition, there is a distinction between “frame compatible” and “non frame compatible” 3D systems, and the energy requirements are likely to be different. To facilitate easier future repeat analysis that will require this (at near-zero current cost) it is proposed that this information is requested and built into the analysis process. For context: no data on this in the October 2012 ENERGY STAR data set.

- *Proposal: To request information as to whether products have 3D capability, and whether information on “frame compatible” and “non-frame compatible” is available.*

1.1.7 Matrix Row G): Multi-Room (also called multi decode and display)

Products that can provide independent output to multiple TVs in a single-family dwelling require greater power for additional simultaneous stream decode. The regulations identified to date that cover on-power modes allow additional power for this functionality and it is likely that the presence of this will be noted so it is proposed that this is recorded. In particular, the ENERGY STAR specification has a focus on this during its review process for Version 4. An issue that could usefully be examined is whether the STB units capable of supplying signal to multiple devices scale down their power consumption when few (or only one) are/is connected. For context: 25% of the October 2012 ENERGY STAR qualified products had this feature.

- *Proposal: To request information as to whether products have multi-room functionality, and aim to determine how these were tested.*

1.1.8 Matrix Row H): Advanced home network interface

This is a capability to receive and stream content into a home computer network, also known as 'Return path functionality' (send and receive). This can be achieved via Ethernet, modem or Wi-Fi and requires additional power to achieve. The regulations identified to date that cover on-power modes allow additional power for this functionality and it is likely that the presence of this will be noted so it is proposed that this is recorded. For context: 60% of the October 2012 ENERGY STAR qualified products had a 'home network interface' feature. Note that the power requirements of an Ethernet interface are negligible compared to other interfaces: ENERGY STAR does not consider wired Ethernet to be Advanced Home Networking because of the inherent low power consumption compared to other solutions; in the EU CoC there is no allowance for an Ethernet interface.

- *Proposal: To request information as to whether products have advanced home network interface functionality and connectivity protocol (e.g. Ethernet, Wi-Fi or MoCA).*

1.1.9 Matrix Row I): Return Path Broadband Modem

In addition to a return path functionality, some cable products include a broadband cable modem e.g. (DOCSIS/Euro DOCSIS⁵) or broadband telecommunications modem (e.g. ADSL), facilitating stand-alone access to the Internet. This requires additional power and the regulations identified to date that cover on-power modes allow additional power for this functionality. It is likely that the presence of this will be noted so it is proposed that this is recorded and further separate the data to distinguish between ADSL and DOCSIS return path, as DOCSIS currently provides no low power state capability. For the purposes of this analysis, the Euro DOCSIS 3,0 (or VDSL) as quoted in the European Voluntary Agreement is assumed equivalent in energy terms to the DOCSIS specified in USA ENERGY STAR⁶. For context: 23% of the October 2012 ENERGY STAR qualified products noted DOCSIS functionality.

- *Proposal: To request information as to whether cable products include a return path broadband modem, and to further distinguish between ADSL and DOCSIS modems.*

1.1.10 Matrix Row J): Digital Video Recording & Playback

Digital Video Recorder

Some products have integrated hard disks or solid-state storage devices for digital video recording capabilities, which require additional power. ENERGY STAR and EC 107/2009 explicitly allow additional power for this functionality. Where it is allowed this functionality is likely to be recorded and recording it will allow its presence to be normalised for so it is proposed that this information is requested. For context: 26% of the October 2012 ENERGY STAR qualified products noted DVR functionality.

- *Proposal: To request information as to whether products have digital video recording capabilities where this is not explicitly excluded from the product definition.*

⁵ European Data Over Cable Service Interface Specification (EuroDOCSIS): An international suite of standards that define interface requirements for cable modems involved in high-speed data and video/audio content distribution over cable television systems.

⁶ The difference in bandwidth between the European DOCSIS specification (8 MHz) and the US DOCSIS (6 MHz) is ignored for this analysis.

Removable media player

Some products have media players such as DVD, BluRay etc. which require additional power. Several of the regulations identified so far exclude this type of product from their definition of complex STBs. Only ENERGY STAR to date explicitly allows additional power for this functionality. Where it is allowed this functionality is likely to be recorded and recording it will allow its presence to be normalised for so it is proposed that this information is requested. For context: 1% of the October 2012 ENERGY STAR qualified products noted a removable media player.

- *Proposal: To request information as to whether cable products have a removable media player where this is not explicitly excluded from the product definition.*

Removable media player/recorder

Some products have media recorders such as DVD and Blu-ray that require additional power. Several of the regulations identified so far exclude this type of product from their definition of complex STBs. Only Energy Star to date explicitly allows additional power for this functionality. Where it is allowed this functionality is likely to be recorded and recording it will allow its presence to be normalised for so it is proposed that this information is requested. For context: no data on this in the October 2012 ENERGY STAR data set.

- *Proposal: To request information as to whether products have a removable media player/recorder.*

Table 5. Count of features / functionality in the October 2012 USA ENERGY STAR qualified products list.

Product feature / functionality	Count in data set	Percentage of data set products with feature / functionality
High Definition (HD) Resolution	68	93%
Advanced Video Processing	61	84%
Home Network Interface	44	60%
Digital Video Recorder (DVR)	19	26%
Multi-Room	18	25%
DOCSIS (Return path broadband model)	17	23%
CableCARD	16	22%
Multi-Stream - Terrestrial/IP	15	21%
Multi-Stream - Cable/Satellite	14	19%
N/A	4	5%
Removable Media Player	1	1%
Additional tuners	No data	No data
High efficiency advanced video processing	No data	No data
Full high definition	No data	No data
Ultra high definition	No data	No data
3D TV processing	No data	No data
Removable Media Player / recorder	No data	No data
Total number of products	73	100%

4. Metrics

The principal metrics for STB energy performance are:

- a) Power for 'on' or 'active' mode, also called TV mode (W), which may have variants depending upon the additional functionalities available
- b) Power for various types of 'standby' mode
- c) Power for deep sleep state (W), but only since 2011
- d) Typical energy consumption (TEC) per year (kWh/year) based on consistent assumptions of hours per year in each mode multiplied by the relevant power levels.

No efficiency metric (i.e. kWh/[secondary metric]) is generally in use.

4.1 On and Standby modes

The exact definitions of the on and standby modes differ between schemes, and so this must be understood to ensure fair comparison. The operational modes as defined in the relevant policies and standards are summarised in Table 6 (on and active modes) and Table 7 (standby and sleep modes). Edition 3 of IEC 62087 was published in April 2011 and provides a comprehensive set of definitions for global use which are suitable for this project. From the definitions quoted in Table 3a and Table 3b below plus pragmatic reason, **it is proposed to assume for this analysis that:**

- i. **On mode, on/active mode** and On (Average) mode (IEC 62087 Ed3:2011) are equivalent across the board (subject to defining which additional functionalities are included and operational during the test).
- ii. **On (Play) mode** (IEC 62087 Ed3:2011) is when a STB with recording capability is playing a previously recorded program.
- iii. **On (Record)** (IEC 62087 Ed3:2011) is when a STB with recording capability is recording a program.
- iv. **On (multifunction)** (IEC 62087 Ed3:2011) is when a STB with recording capability is recording one or more programs while outputting another to a display device either from a pre-recorded source or another service.
- v. **Sleep mode** (US ENERGY STAR) is equivalent to **standby mode** (EU VA) and equivalent to **standby active**.
- vi. **Standby passive** is assumed the same as **deep sleep** and is the main alternative to on mode for simple STBs. Deep sleep state is primarily a US term and is defined under ENERGY STAR Version 3 as *a power state within Sleep Mode characterized by reduced power consumption and increased time required to return to full On Mode functionality*. Due to the absence of data on this state prior to 2011 (when it was first defined), it will not feature all of the analysis. Data on this mode will not be used in the calculation of TEC for benchmarking purposes but can be set into context with prior levels.
- vii. **Network standby** (EU CoC) does not yet have an agreed international definition, but is broadly equivalent to **standby active, low** (IEC 62087).
- viii. The Australian data set uses the term 'HDMI standby' but this has no direct equivalent in other systems. HDMI standby is when the STB turns to standby via a command from the HDMI CEC when the main viewing device is turned off or into standby.
- ix. **Standby active, high** (IEC62087) is a relatively transient state for most products/services and unlikely to be widely used or reported. This cannot be compared to other standby states.

Table 6. Definitions in various standards / regulations for on and active operational modes.IEC 62087 Edition 3 was published in April 2011. The additional modes covered in Ed 3 are indicated in *italics*.

Mode as stated in standard / regulation	EU Ecodesign voluntary agreement	EU Code of Conduct-Test Specification Jan 2011 Revision.	EU Commission Regulation (EC no 107/2009)	Australian MEPS Regulation**	Australian CSTB CoC	ENERGY STAR Version 3.0***	IEC 62087 Ed 2:2008 and Ed 3:2011
On mode (on/active) On (Play)	Operational mode in which the CSTB is at least actively performing its base functionality. *	Operational state in which the STB is at least actively delivering the Base Functionality.	A condition in which the equipment is connected to the mains power source and at least one of the main function(s) providing the intended service of the equipment has been activated.	Used, and defined in AS/NZS 62087.2.1 Clause 1.5.10	N/A	An operational state in which the STB is actively delivering one or more of its principal functions and some or all of its applicable secondary functions.	Ed 2 The appliance is connected to a power supply and fulfils its main function. <i>Ed 3. The appliance is playing back a pre-recorded program.</i>
<i>On (Average)</i>	(This happens to be measured, as part of the test method but is not defined in this standard).	N/A	N/A	N/A	(This happens to be measured, as part of the test method but is not defined in this standard).	(This happens to be measured, as part of the test method but is not defined in this standard).	<i>Ed 3. The appliance is performing the function of providing a viewer with video and audio from a broadcast.</i>
<i>On (Record)</i>	(This happens to be measured, as part of the test method but is not defined in this standard).	N/A	N/A	N/A	(This happens to be measured, as part of the test method but is not defined in this standard).	(This happens to be measured, as part of the test method but is not defined in this standard).	<i>Ed 3. The appliance is connected to a power source and records a signal from an external or internal source</i>
<i>On (Multifunction)</i>	(This happens to be measured, as part of the test method but is not defined in this standard).	N/A	N/A	N/A	(This happens to be measured, as part of the test method but is not defined in this standard).	N/A	<i>Ed 3. The appliance is performing multiple functions simultaneously</i>

* The energy consumption targets related to “on” and “Standby” modes might be variable and dependent on the real functionality requested from the CSTB.

** Australian MEPS are based upon testing to standard AS/NZS 62087.1, which is identical to IEC 62087 Ed2:2008.

*** ENERGY STAR Version 3.0 will be superseded by Version 4.1 which is expected to take effect in 2014; definitions will remain identical but TEC requirements and functionality power allowances are more stringent.

Table 7. Definitions in various standards / regulations for standby and sleep operational modes.

IEC 62087 Edition 3 was published in April 2011. The additional modes covered in Ed 3 are indicated in *italics*.

Mode as stated in standard / regulation	EU Ecodesign voluntary agreement	EU Code of Conduct-Test Specification Jan 2011 Revision.	EU Commission Regulation (EC no 107/2009)	Australian MEPS Regulation**	Australian CSTB CoC	ENERGY STAR Version 2.0***	IEC 62087 Ed 2:2008 and Ed 3:2011
Passive standby	N/A	State in which the STB does not have the functionality of the "On" state but is only capable to switch to another state by responding to a user notification by a remote control of the unit, or an internal signal of the unit, e.g. "wake-up timer".	A condition where the equipment is connected to the mains power source and provides a reactivation function, and/or information or status display.	The appliance is connected to a power source, does not fulfil the main function but can be switched into another mode with the remote control unit or an internal sign	N/A	N/A	TEXT A: The appliance is connected to a power source, does not fulfil the main function but can be switched into another mode with the remote control unit or an internal signal
Active standby	N/A	N/A	N/A	The appliance is connected to a power source, does not fulfil the main function but can be switched into another mode with the remote control unit or an internal signal and is able to exchange / receiving data with / from an external source.	N/A	N/A	(only used as variants defined below)
Standby active, low	N/A	N/A	N/A	N/A	N/A	N/A	TEXT A plus: ... and can additionally be switched into another mode by an external signal
Standby active, high	N/A	N/A	N/A	N/A	N/A	N/A	TEXT A plus: ...and is exchanging / receiving data with / from an external source.
Standby (user initiated or auto-power down or other)	Operational mode in which the CSTB has less energy consumption, capability, and responsiveness than in the "On" mode.*	N/A	N/A	N/A	Operational mode in which the CSTB has less energy consumption, capability, and responsiveness than in the "On" mode.*	N/A	N/A

Network Standby	N/A	State in which the STB does not have the functionality of the "On" state but is at least capable to switch to another state by responding to a notification by an external signal, e.g. from the service provider.	N/A	N/A	N/A	N/A	N/A
Sleep (from auto-sleep or user initiated or other)	N/A	N/A	N/A	N/A	N/A	A state in which the STB is connected to a mains power source, is not providing a primary function, and offers one or more of these functions which may persist for an indefinite time: activation of other modes (incl. Sensor or timer); information display; sensor-based functions.	A state in which the STB has less power consumption, capability, and responsiveness than in the On/Active state.
Deep Sleep state	N/A	N/A	N/A	N/A	N/A	A power state within Sleep Mode characterized by being <15% of on mode power and increased time required to return to full On Mode functionality.	N/A

* The energy consumption targets related to "on" and "Standby" modes might be variable and dependent on the real functionality requested from the CSTB.

** Australian MEPS are based upon testing to standard AS/NZS 62087.1, which is identical to IEC 62087 Ed2:2008.

*** ENERGY STAR Version 3.0 will be superseded by Version 4.1 in July 2013; definitions will remain identical but TEC requirements and functionality power allowances are more stringent.

4.2 Typical Energy Consumption (TEC)

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). It is therefore proposed to adopt a TEC figure for use in this analysis from the performance data in each mode.

TEC is calculated assuming a certain number of hours per day in each relevant mode of operation- the daily usage profile. The daily usage profile is defined in various ways in different schemes and also according to the functionality available in the device. The schemes also aim to take into account local viewing hours: ENERGY STAR assumes 14 hours in on mode with 10 hours in sleep mode per day; the EU Voluntary Agreement and CoC assume 9 hours in on mode and 15 in sleep (both in the case of STBs without automatic power down). Each of these calculation approaches has its own way of dealing with time spent in playback and record modes, which are not directly comparable (i.e. those fitted with internal hard disk or that accept removable playback/recording media).

For the purposes of the analysis in this study it is proposed to adopt the approach described under ENERGY STAR wherever the available data makes that calculation possible. In this way, products with the same mix of functionality should be fairly compared. The ENERGY STAR approach involves higher assumed hours in on, play and record modes and so total energy consumption estimates for the year will be higher than if the duty cycles of the EU approach were used: this should be borne in mind when considering results. However, for comparative analysis the resulting consumption figures will tend to more strongly differentiate product performance levels, due to greater influence of the higher power usage modes.

The proposed calculation for total energy consumption, taken from ENERGY STAR, is:

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

Where:

- $TEC_{\text{PRIMARY}} = 0.365 \times ((T_{\text{TV}} \times P_{\text{TV}}) + (T_{\text{SLEEP}} \times P_{\text{SLEEP}}) + (T_{\text{APD}} \times P_{\text{APD}}))$
- $T_{\text{TV}}, T_{\text{SLEEP}}, T_{\text{APD}}$ as shown in Table 8.
- $TEC_{\text{PLAY/RECORD}} = 0.365 \times [(P_{\text{PLAYBACK}} - P_{\text{TV}}) \times T_{\text{PLAYBACK}} + (P_{\text{RECORD}} - P_{\text{TV}}) \times T_{\text{RECORD}}]$

$T_{\text{PLAYBACK}}, T_{\text{RECORD}}$ as shown in Table 9.

- $TEC_{\text{PLAY/RECORD}}$ is only applicable where a play/record function is available. In the absence of any power data for this, it will be disregarded.

Table 8. Base functionality hours of use proposed for use in this analysis (adopted from the ENERGY STAR criteria).

	Hours in On (TV) = T_{TV}	Hours in Sleep = T_{SLEEP}	Hours in APD = T_{APD}
Without APD	14.0	10	0.0
With APD	7	10	7

Table 9. Assumed hours spent in playback and record modes for devices proposed for use in this analysis (adopted from ENERGY STAR Version 2 and Version 3).

	PVR/DVR (hours/day)	Removable media playback	Removable media playback with record
Hours on-playback = T_{PLAYBACK}	2	2	2
Hours on-record = T_{RECORD}	3	0	1

Note on deep sleep mode: As well as time in on mode and standby, the definition in ENERGY STAR Version 3 added hours spent in deep sleep state where that is enabled by default. Since deep sleep was only defined in 2011 and will not be present in the majority of data sets, it will not be used in this analysis.

The power use of an STB can often include a hidden component related to additional features that cannot be turned on or off through user intervention (for example H264, AVC decoding and multiple tuners that are on all the time). As there is no control over this power consumption they must be considered as a part of the STBs basic power consumption. Where an STB has recording capability any extra power associated with recording and playback should be considered as per Table 9. ENERGY STAR requires these values to be recorded.

The ENERGY STAR criteria require the measurement of P_{Playback} and P_{Record} for STBs with either fixed or removable media. These measurements must also be reported for ENERGY STAR registration. These values are used as supplementary TEC parameters to determine compliance with the requirements. ENERGY STAR and other programs also require power consumption in standby modes to be reported. Other functional allowances must also be reported and are used to determine the TEC limit for a particular STB.

4.3 Test methodologies

The following test methodologies have been identified that are likely to be used by participants for data to be submitted. Note that analysis of these test methodologies has not been completed, pending input from participating countries:

1. IEC 62087 Edition 3 (2011) *Methods of measurement for the power consumption of audio, video and related equipment*. This standard covers power measurements for a wide range of products. It provides the basis of test methods for and general conditions for the EU Code of Conduct. Edition 3 contains a complete rework of STB measurement to make it consistent with EU, Australian and ENERGY STAR requirements. Edition 2 was published in 2008; Edition 3 in April 2011.
2. AS/NZS 62087.2.1:2008 *Power consumption of audio, video and related equipment, Part 2.1: Minimum energy performance standards (MEPS) requirements for digital television set-top boxes*. This standard contains the MEPS and regulatory requirements.
3. AS/NZS 62087.1:2010 *Power consumption of audio, video and related equipment, Part 1: Methods of measurement* is the Australian and NZ standard based on the 2008 IEC 62087 Ed2:2008 standard.
4. CSA C380-08 *Test Procedure for the Measurement of Energy Consumption of Set-Top Boxes (STBs)* is the Canadian standard used for both US and Canadian ENERGY STAR criteria for set top boxes Version 2.0.

5. *ENERGY STAR® Program Requirements Product Specification for Set-top Boxes, Test Method Rev. Jan-2011*. This standard takes effect with ENERGY STAR specification for set top boxes Version 3.0, but uses the test set up and instrumentation requirements of CSA C380-08.

Note: DOE is developing a test method to be finalised in spring 2013, which is expected (by EPA) to be based on existing test methods, including ENERGY STAR and no major changes to testing and qualification are anticipated⁷. This DOE standard will in due course (typically 180 days after publication of the Final Rule) be referenced by ENERGY STAR Version 4 and all other USA policies.

6. ANSI/CEA-2043 *Set-top Box (STB) Power Measurement*⁸. This standard is under development with an ANSI public review deadline at January 2013. It defines a method for measuring Set-top Box power consumption based on IEC62087 and clarifies test procedures, definitions, terms, and provides localization for North American markets. CEA-2043 supersedes CEA-2013 and CEA-2022.
7. ANSI CEA 2022:2007 *Digital STB Active power consumption measurement*. This standard establishes test methods for the measurement of STB power consumption. It is currently being revised to integrate the IEC 62087 Ed3:2011 requirements and will be superseded by CES-2043.
8. ANSI CEA 2013:2007 *Digital STB Background power consumption*. This standard defines background power consumption for STBs and provides test methods to measure these background power states. It uses the terms “sleep” and “active” extensively. It will be superseded by CES-2043
9. IEC 62301 *Household electrical appliances – Measurement of standby power, edition 2.0 (2011)*. This is used to define the general test conditions for the measurement of standby and on mode power described (in detail) in the EU Ecodesign Voluntary Agreement. (Note: IEC 62087 Ed 3 does not rely on IEC 62301 for standby measurements as it contains its own methods).
10. Relevant EU Regulation, EU Code of Conduct and EU Voluntary Agreement test methodologies.

Further test methodologies may be identified with input from participants.

Overall it is anticipated that performance results from these various standards will be closely comparable, subject to the uncertainties associated with differing definitions of operational modes given in Table 6 and Table 7. It is therefore likely that there will not be a requirement to adjust performance data in a process of normalisation, although this has to be verified through further analysis. One area yet to be fully investigated is that there might be a difference in test methodologies regarding networked standby and in particular how many network ports should be operational during testing.

5. Data requirements

While in principle there are only three main STB operating modes that determine their energy consumption, other functionality issues present a significantly segmented market by:

- Variations in handling of different signal sources (Cable, Satellite, Terrestrial, IP) and associated power needs and

⁷ Source: EPA webinar slides from 5 April 2012, see

http://energystar.gov/products/specs/system/files/STB_V4_Webinar_2012_04_05.pdf.

⁸ See http://standards.ce.org/apps/group_public/project/details.php?project_id=51.

- Built-in functionalities (Video Processing, Resolution Enhancement, 3D Imaging, Multi-Room decode and display, Advanced home network interface, Return Path Broadband, and Digital Video Recording & Playback capabilities).

In addition to the functionalities, the existence of hybrid STBs warrants thorough and detailed data collection and analysis in order to accurately present the market trends as well as cultural differences. Therefore, to enable the most effective analysis of data and comparison between countries, we would like to collect the data listed below:

Information on new products on sale

For all years available between 2000 (being the first year in which CSTBs were widely available) and 2012 and for all categories as defined in Table 6 and Table 7, ideally this will be in the form of **individual model information** including (in approximate order of priority):

Key information:

- A. Whether STB enables access to pay-per-view and/or free access signals (stated as 'free' or 'conditional' access, i.e. simple or complex STB)
- B. Mode of signal delivery that the STB is capable of handling (one or more of: Cable, satellite, Internet Protocol, cable DTA, terrestrial or thin-client/remote)
- C. On mode power, and playback power if different (W)
- D. Standby/sleep (or network standby) power (W)

Other information:

- E. (Sub-)Type of set top box (title given for category according to national schemes or standards)
- F. Auto power down (APD) power (W) (which may be the same as standby or sleep mode, but this should be verified)
- G. Power in record mode (W, for units with this capability)
- H. Declared TEC (kWh per year), along with the methodology used to determine this

Product features and functionality:

- I. Additional features incorporated in the product:
Auto power down; Additional Tuners (normal or wideband); High Definition Resolution; Multi-Room (multi decode and display); Digital Video Recorder; Removable media player (DVD, BluRay etc.); Removable media player /recorder (DVD, BluRay etc.)
- J. Other additional features incorporated in the product:
Advanced Video Processing; High efficiency AVP; Full HD resolution; Ultra high definition resolution; 3D TV processing (frame compatible or non-frame compatible); Advanced home network interface; Return Path Broadband Modem (ADSL or DOCSIS)
- K. Power in any other types of standby mode, with associated definition(s) of the mode (W)
- L. Deep sleep state power (W).

Information on stock and sales

For all years available between 2000 and 2012:

- M. Total national stock of products in service (in thousands of products)
- N. Total national annual sales (in thousands of products)
- O. Average on mode and standby mode power consumption (W) of the stock.

Additional Information Required for Data Processing

- P. Test methodology(ies) used to derive the data, and any relationship to known international standards (e.g. clone of test method IEC 62087 Edition 3 [with these amendments: A, B and C], etc.). In particular it is essential to understand how test methodology deals with the additional features present in the product, i.e. which of these were activated and for what proportion of the test period in the reported power data
- Q. Dates at which any changes to test methods occurred during period of reported data
- R. List of local regulations that define and affect product efficiency.

Additional Information Required for Other Planned Analysis

- S. Summary of all major policy actions affecting complex set top boxes over the period data is available including whether voluntary or mandatory, the year when policy was first considered, the year of formal announcement of the policy plans, and the year when the policy came into force
- T. Summary of any cultural or other issues that are thought to affect this product at the local level.

Appendix 1: STB Policies used to derive the common framework for analysis

1. Australian MEPS

MEPS are defined in AS/NZS62087.2.1:2008 *Minimum energy performance standard (MEPS) requirements for digital television set top boxes*. This definition distinguishes between Free to Air (FTA) and Subscription TV (STV) with different requirements for each.

- FTA products “receive and decode FTA **terrestrial** digital television broadcast signals, for use by a video display device or a recording device”.
- STV products “receive, decode and descramble digital television broadcast signals from a **cable or satellite** source, for use by a video display device or a recording device”. This includes products to decode FTA signals transmitted via cable or satellite and includes conditional access products.

2. Australian Conditional Access Set Top Box (CSTB) Code of Conduct (CoC).

This code covers satellite STBs including those with recording technologies. The performance limits and TEC parameters are closely based the EU Ecodesign Voluntary Agreement, including its additional allowances.

3. ENERGY STAR

The specification at September 2012 is ENERGY STAR Technical Specification for Set-top Boxes Version 3.0, which came into effect September 1 2011⁹. Version 3.0 covers a very wide range of product types and functionalities and defines five basic STB types (Cable, Satellite, Cable Digital Transport Adapter (DTA), Internet Protocol, Terrestrial, Thin Client/Remote). The specification also defines ten additional functionalities with associated consumption allowances that can be added in a modular fashion which include: conditional access, HD, multi-room and multi-stream, recording and removable media playback. Version 3 covers three operational modes: on mode; sleep mode and deep sleep state. The development of versions is summarised here:

- i. Version 4.0 was published alongside Version 3 in January 2011 and is due to come into effect on 1 July 2013. Similar to Version 3.0, with more stringent Typical Energy Consumption (TEC) Allowances: 32% Average Decrease in Base Allowances (50% Decrease for IP Boxes); 21% Average Decrease in Adder Allowances¹⁰. After publication of Version 4, EPA kept the specification under review to track market changes with consultations during spring and summer 2012. An update called Version 4.1 was current at September 2012¹¹ and a final update is anticipated during 2012.
- ii. Version 3 of the specification was published on 21 January 2011 and come into effect on 1 September 2011.
- iii. Version 2: Tier 1 entered into force in January 2009 and Tier 2 in January 2011. Tier 1 excluded Digital Television Adapter (DTA) for terrestrial digital broadcast; Game Consoles; IP STBs sold or provided outside of a dedicated service or service contract and products that meet the definitions in the ENERGY STAR® Technical Specifications for Consumer Audio and DVD Products.

⁹ Available at http://www.energystar.gov/index.cfm?fuseaction=products_for_partners.showSetTopBoxes, under the 'Current' tab, accessed 27 September 2012.

¹⁰ Source: EPA webinar slides from 5 April 2012, see http://energystar.gov/products/specs/system/files/STB_V4_Webinar_2012_04_05.pdf.

¹¹ Available at http://www.energystar.gov/index.cfm?fuseaction=products_for_partners.showSetTopBoxes, under the 'In development' tab, accessed 27 September 2012.

- iv. Version 1 took effect in 2001 and was suspended in 2005.

4. EU Regulation (EC) No 107/2009

The EU regulation specific to simple STBs is the *Commission Regulation (EC) no 107/2009 of 4 February 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for simple set-top boxes*. This regulation governs simple set top boxes, which are defined as having no conditional access (CA) functions and no recording functions based on removable media in a standard library format, but can have additional functions such as time-shifting/recording functions using an integrated hard disk and a second tuner.

5. EU Code of Conduct¹²

This voluntary Code of Conduct sets an aspirational energy efficiency performance target to be achieved by the best CSTBs in class. The document defining this is the *Code of Conduct on Energy Efficiency of Digital TV Service Systems Version 8*, European Commission Joint Research Centre, Ispra, 15 July 2009¹³. This code only covers 'complex set top boxes' which are distinguished from simple STBs on the basis of having 'conditional access' – i.e. are products with systems to prevent unauthorised viewing of content. This Code closely aligns with the ENERGY STAR specification on base functions, and on additional functionalities, and includes the same 5 types of system as listed above. The Code EXCLUDES personal computers and game consoles fitted with integrated digital TV tuners.

6. EU Ecodesign Voluntary Agreement

The EU industry is negotiating for a voluntary agreement to agree a minimum energy efficiency specification with the European Commission instead of a mandatory regulation. The draft document current at September 2012 was entitled *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*¹⁴. The structure and approach is very similar to the EU code of conduct, but with less stringent requirements. This proposal covers the complex set top box, which is defined as "a standalone device equipped to allow *conditional access* that is capable of receiving, decoding and processing data from digital broadcasting streams and related services, and providing output audio and video signals", and where "*conditional access*" means the encryption, decryption, and authorization techniques employed to make access to content conditional upon prior authorisation". The proposal covers many variations of functionality, similar to the ENERGY STAR list and adopts the same basic five types of STB as per US ENERGY STAR and EU Code of Conduct. The Voluntary Agreement EXCLUDES products without conditional access, and devices whose primary function is something other than the reception of television signals.

7. US DOE published a Notice of Proposed Rule Making for set top boxes¹⁵ in late 2012 and a public meeting on 27 February 2013 will discuss proposals. DOE had earlier suspended its process during 2012 in order "to allow industry representatives and energy efficiency advocates time to negotiate a non-regulatory agreement to improve the energy efficiency of set-top boxes"¹⁶ – and a voluntary agreement was signed in December 2012.

¹² See http://re.jrc.ec.europa.eu/energyefficiency/html/standby_initiative.htm

¹³ PDF available from http://re.jrc.ec.europa.eu/energyefficiency/pdf/CoC_Digital_TV-version%208_2009.pdf

¹⁴ Available from http://www.eceee.org/Eco_design/products/complex_set_top_boxes.

¹⁵ US Department of Energy, 10 CFR Parts 429 and 430, Docket no. EERE-2012-BT-TP-0046, RIN: 1904-AC52, Energy conservation programme: Test Procedure for set top boxes. Available from http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx/ruleid/33.

¹⁶ See http://www1.eere.energy.gov/buildings/appliance_standards/residential/set_top_boxes.html, accessed 27 September 2012.

A report titled 'Rulemaking Overview and Preliminary Market and Technology Assessment: Set-top Boxes and Network Equipment' was published by DOE in January 2012.

8. **US voluntary agreement for energy efficiency of set top boxes.** Signed in December 2012 and coming into effect January 2013, the agreement covers 15 video programming companies and STB manufacturers.
9. **Switzerland has regulated the set top boxes according the EU Code of Conduct, Version 8.**
10. **Republic of Korea has a standby regulation in place regarding set top boxes.**

No information currently available on regulation in Japan.

Table 10. Summary of the main policies in effect regarding set top boxes

Policy	Summary Description	Notes & Exclusion
<p>1. Australian MEPS. <i>AS/NZS62087.2.1:2008 Minimum energy performance standard (MEPS) requirements for digital television set top boxes.</i></p>	<p>This regulation sets maximum power limits for passive standby, active standby and on mode power for FTA products, and for active standby only for STV products. Higher allowances are made for high definition products compared to standard definition. On mode MEPS for FTA products are 15W for standard definition and 22W high definition. Active standby MEPS for STV products is identical to that allowed for standard definition FTA products (15W).</p>	<p>Note 1: This regulation excludes digital receivers that are integrated with other equipment such as television receivers, digital recorders and DVD players. This regulation also excludes MPEG 4 encoded signals and is limited to MPEG 2.</p> <p>Note 2: Australian data is unlikely to be available for STBs with PVR.</p>
<p>2. Australian Conditional Access Set Top Box (CSTB) Code of Conduct (CoC)</p>	<p>The code covers satellite STBs including those with recording technologies and is voluntary, but signatories must meet the specified performance. The Government monitors the scheme and provides an annual report of its progress. Targets are set jointly by the participating members and Government.</p>	<p>Note 1: This CoC was created as a joint effort between the Government and the subscription TV industry in December 2009.</p> <p>Note 2: The performance limits and TEC parameters are closely based the EU Ecodesign Voluntary Agreement Including its additional allowances.</p>

Policy	Summary Description	Notes & Exclusion
<p>3. ENERGY STAR</p> <p><i>ENERGY STAR® Technical Specifications for Set-top Boxes Version 3.0.</i></p> <p>Published 21 January 2011 and came into effect on 1 September 2011.</p>	<p>Version 3.0 specification covers a very wide range of product types and functionalities, including recording and removable media playback and conditional access.</p> <p>The specification defines six basic STB types, most of which have different energy allowances, implying expectations that energy consumption will not be comparable between these. Listed in order of decreasing 'annual energy allowance':</p> <ul style="list-style-type: none"> - Satellite: 70 kWh/year - Cable: 60 kWh/year - Internet Protocol (IP): 50 kWh/year - Cable DTA: 35 kWh/year - Terrestrial: 22 kWh/year - Thin Client/Remote: 27 kwh/year <p>An annual energy consumption is defined assuming a basic 14 hours on (or 7 on and 7 in APD if applicable), and 10 hours in sleep mode or deep sleep state, with several timing variations for different functionalities.</p>	<p>Note 1: Version 4 of the specification was also published on 21 January 2011, updated to Version 4.1 in August 2012 and comes into effect on 1 July 2013.</p> <p>Note 2: The ENERGY STAR database makes available on mode power, sleep mode power, off mode power and annual typical energy consumption (TEC) for each product in Watts.</p>
<p>4. EU Regulation (EC) No 107/2009, Ecodesign requirements for simple set-top boxes</p> <p><i>Commission Regulation (EC) no 107/2009 of 4 February 2009</i></p>	<p>This EU regulation is specific to simple STBs which have no conditional access (CA) functions and no recording functions based on removable media in a standard library format.</p>	<p>Note 1: Simple STBs can have additional functions such as time-shifting/recording functions using an integrated hard disk and a second tuner.</p>
<p>5. EU Code of Conduct.</p> <p><i>Code of Conduct on Energy Efficiency of Digital TV Service Systems Version 8, European Commission Joint Research Centre, Ispra, 15 July 2009.</i></p>	<p>This code only covers 'complex set top boxes' which are distinguished from simple STBs on the basis of having 'conditional access' – i.e. are products with systems to prevent unauthorised viewing of content.</p> <p>It assumes 4.5 hours per day on, 4.5 hours in sleep from Auto-power down, and 15 hours in sleep mode.</p>	<p>Note 1: This Code closely aligns with the ENERGY STAR specification on base functions, and on additional functionalities, and includes the same 5 types of systems.</p> <p>Note 2: It differs in its definition of on and sleep modes, and for calculation of annual consumption.</p>

Policy	Summary Description	Notes & Exclusion
<p>6. EU Ecodesign Voluntary Agreement.</p> <p><i>(Voluntary Industry Agreement to improve the energy consumption of Complex Set Top Boxes within the EU, Proposal from the industry group, Version 3.0, 2 September 2011)</i></p>	<p>This proposal covers the complex set top box and adopts the same basic five types of STB as per the ENERGY STAR and Code of Conduct. It defines STBs as “a standalone device equipped to allow conditional access that is capable of receiving, decoding and processing data from digital broadcasting streams and related services, and providing output audio and video signals”, and where “conditional access” means the encryption, decryption, and authorization techniques employed to make access to content conditional upon prior authorisation”. The proposal covers many variations of functionality, similar to the ENERGY STAR list.</p> <p>It adopts the same basic five types of STB as per the ENERGY STAR and Code of Conduct. For annual consumption, it assumes 15 hours in standby and 9 hours in on mode; or if auto-power down (APD) is included, 4.5 hours on and 4.5 hours in APD standby.</p>	<p>Note 1: The Voluntary Agreement excludes products without conditional access, and devices whose primary function is something other than the reception of television signals, such as computers fitted with digital TV tuners, games consoles with digital TV tuners, digital receivers with recording function based on removable media in a standard library format (VHS tape, DVD, Blu-ray disk and similar), digital TVs with integrated receiver decoder</p>
<p>7. US industry voluntary agreement</p>	<p>In the U.S., industry representatives from 15 video programming distributors and set-top box manufacturers have recently announced an industry voluntary agreement to reduce the energy consumption of set-top boxes. Full text of the 5-year agreement, signed on Dec. 6 2012, can be found here: http://www.ce.org/CorporateSite/media/ce_news/FINAL-PUBLIC-VOLUNTARY-AGREEMENT-(12-6-2012).pdf. The agreement went into effect on Jan. 1 2013.</p>	<p>The agreement also includes a reporting requirement, which may be useful to the 4E mapping and benchmarking study. However, the first annual report will only be released in April 2014.</p>
<p>8. Swiss regulation</p>	<p>Regulation is in place in Switzerland aligned with the EU Code of Conduct version 8.</p>	<p><i>[further investigation to be carried out on this].</i></p>
<p>9. Republic of Korea standby regulation</p>	<p>Regulation is in place.</p>	<p><i>[further investigation to be carried out on this].</i></p>
<p>10. Japan</p>	<p>[no information yet available]</p>	<p><i>[further investigation to be carried out on this].</i></p>