ENERGY STAR. The simple choice for energy efficiency.

ENERGY STAR®
Set-top Boxes
Draft 1 Specification Webinar

December 9, 2015

ENERGY STAR Products Labeling Program

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Webinar Details

- Webinar slides and related materials will be available on the STB Product Development Web page:
  - *https://www.energystar.gov/products/spec/set_top_box_specification_version_5_0_pd*
  - *Or follow the link under Set-top Boxes and Cable Boxes at www.energystar.gov/RevisedSpecs*
- Audio provided via teleconference:

  Call in: +1 (877) 423-6338 (U.S.)
  +1 (571) 281-2578 (International)
  Code: **198-920 #**

  - Phone lines will remain open during discussion
  - Please mute line unless speaking
  - Press *6 to mute and *6 to un-mute your line

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Introductions

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Webinar Agenda

- Introductions and kickoff of the ENERGY STAR specification revision process.
- Current Stakeholder Feedback
- Discussion of the Draft 1 specification
  - Adder Allowances
  - Base Allowances
  - Low Power Sleep for Thin Clients
  - Standard DC
  - Testing

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12:00–12:15	**Introductions and Specification Revision Kickoff**
12:15–1:00	Adder and Base Allowances
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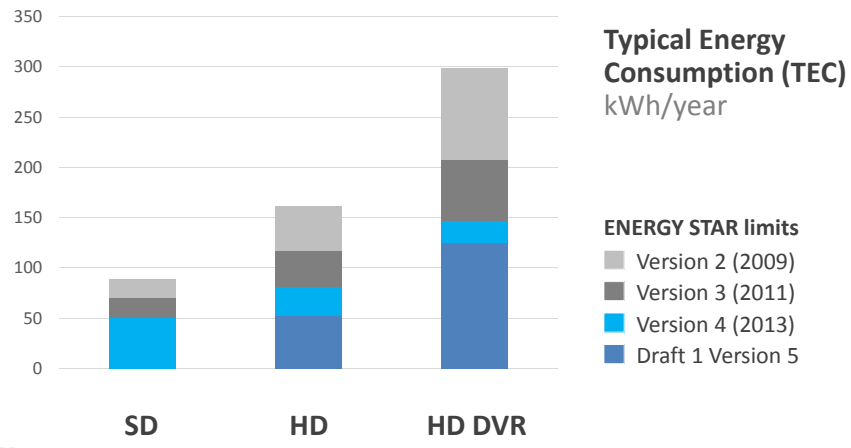
Lower Energy Consumption/More Features and Processing Power



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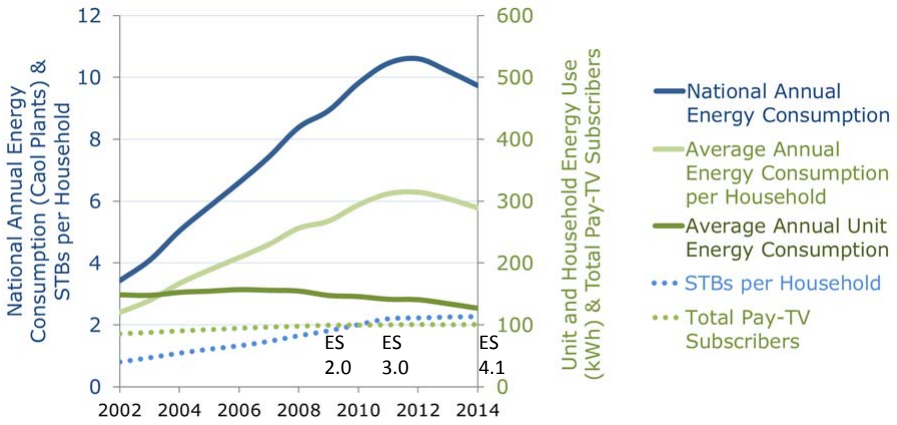
History of Efficiency Gains

- Industry reduced average unit energy consumption while moving from SD channel viewing in 2002 to HD multi-room viewing in 2014 with time and place shifting



Sources: SNL Kagan (2012), NRDC (2011), Porter, Moorefield, & May-Ostendorp (2006), Urban, Tiefenbeck, & Roth (2011), Urban & Roth (2014), USVA Report (2014, 2015)

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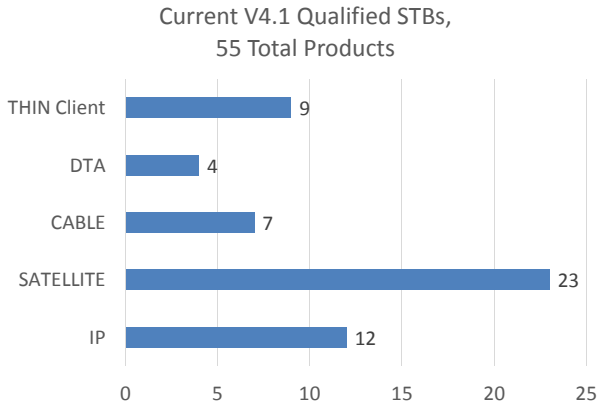
Version 4.1 Qualified Products



- 19 STBs qualified for multi-room operation
- 25 STBs with DVR
- From 9 ENERGY STAR manufacturer partners

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Current Stakeholder Feedback

- Common Base across technologies may be penalizing cable boxes that have QAM tuners.
- DOCSIS 1x1 has not achieved initially expected savings, since full-band tuners, while more efficient at high data rates, do use more power than discrete DOCSIS tuners in 1x1 mode.
- Cost challenges in Low Power Sleep for Thin Clients.
- Some stakeholders still request Multi-Stream Adder.
- Manufacturers may encounter difficulty in testing with service provider software, and can be difficult to determine worst case conditions.

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General Procedure

- Revised Adder Allowances to reflect current technology.
  - Regression Analysis on Industry Voluntary Agreement Tier 2 (VA) and ENERGY STAR data to provide insight on adder levels.
  - Harmonize VA and ENERGY STAR adders as data recommends.
- Base Allowances set to reflect top products.
  - Base Allowances intended to capture system overhead in a technology-neutral manner.
  - Thin Clients are designed to have minimal overhead so maintain a separate base allowance from MVPD Network Set-top-boxes.

Adder Regressions Performed

Base Types	Regressions
Cable	All, ENERGY STAR Only, VA Only
Satellite	All, ENERGY STAR Only, VA Only
MVPD IP	All, ENERGY STAR Only, VA Only
Non-Thin Clients (Cable, Sat, MVPD)	All

Data Analyzed:

- Industry Voluntary Agreement (VA) Tier 2 Products
- ENERGY STAR V4.1 Qualifying Products List (QPL)

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Regression Analysis

- Traditional Linear Regression fits 1 X to 1 Y variable.
- We have many adders in the same product.
- Multivariable Regression allows all adders to be analyzed at the same time. Multiple X are fitted to 1 Y variable.

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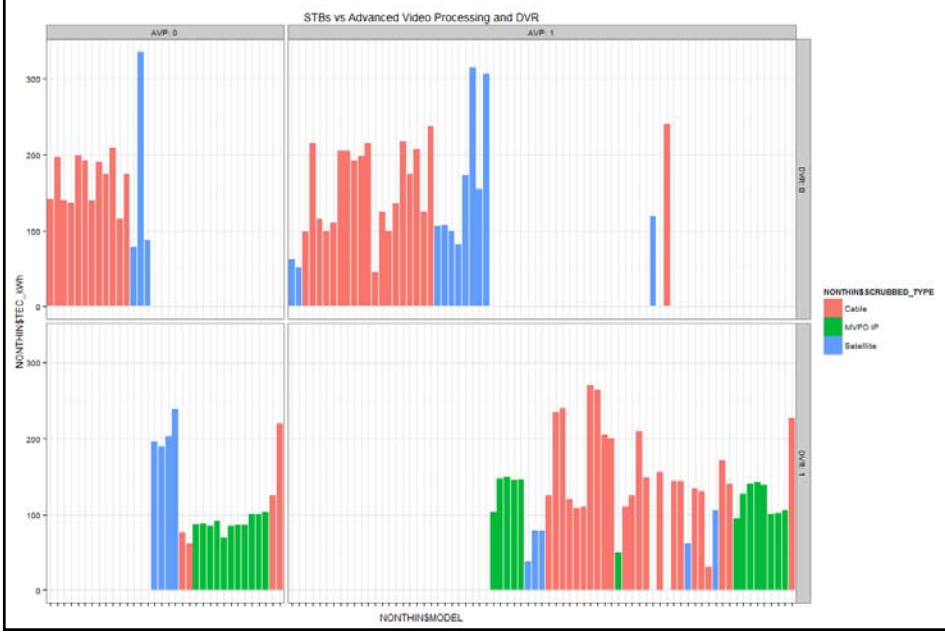

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Adder Regression Results 1

- AVP, HD
  - Included in table only for comparison with VA, but set to 0 kWh/yr
  - Standard features, accounted for by base allowance
- Cable Card
  - Regression result: 26-30 kWh/yr
  - Supports VA method of 15 kWh per card up to two cards.
- DVR
  - Average of regression results across data supports retaining current allowance of 45 kWh.
  - Aligns with VA.

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Adder Regression Results 2

- DOCSIS2
  - Set to 0 kWh/yr, to recognize leadership in transitioning to DOCSIS3
- DOCSIS3
  - Retained at V4.1 level: 11 kWh/year.
- HEVP, HEVP-TC, UHD
  - Limited market penetration, limited data for analysis.
  - Retained at V4.1 levels:
    - HEVP: 15 kWh/yr
    - HEVP-TC, UHD: 5 kWh/yr
- HNI
  - Regression results of 20–36 kWh considered significant.
  - Retained at V4.1 level: 17 kWh/yr

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Adder Regression Results 3

- MIMO HNI
  - Regression results: 27 kWh/yr for 2.4 GHz, 22 kWh/yr for 5 GHz. (Unknown # of Wi-Fi streams)
  - Small number of models with MIMO HNI.
  - Based on Results of Small Networking Equipment testing and analysis, proposing:
    - 2 kWh per 2.4 GHz Stream
    - 5 kWh per 5 GHz Stream
- Multi-room
  - Regression results of 22–56 kWh considered significant.
  - Proposing 35 kWh Allowance.
- Multi-stream
  - Consolidate allowance
  - Functionality covered by DVR, HNI, MR in most circumstances.

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Adder Regression Results 4

- Transcoding
  - Regression results of 24–30 kWh/year considered significant (unknown number of streams).
  - Proposing to harmonize with the VA's allowance of 13 kWh for the capability with 5 kWh for each additional stream.
- Access Point, Router, Telephony
  - No STBs in the dataset supported these features.
  - No change in Telephony.
  - Based on recent tests of router and access points, EPA is proposing 5 kWh/year for Access Point and 10 kWh/year for Router.

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Adder Regression Results and Proposed Allowance

Additional Functionality	DraftV5.0 Allowance (kWh/year)	
Advanced Video Processing	[new-VA Placeholder]	0
Advanced Video Processing – Additional	[new-VA Placeholder]	0
CableCARD	[no change]	15
CableCARD – Max One Additional	[new]	15
Digital Video Recorder (DVR)	[no change]	45
DOCSIS® 2	[from 20 to]	0
DOCSIS® 3	[no change]	11
HD	[new-VA Placeholder]	0
High Efficiency Video Processing (HEVP)	[no change]	15
High Efficiency Video Processing for Thin Clients (HEVP-TC)	[no change]	5

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Adder Regression Results and Proposed Allowance

Additional Functionality	DraftV5.0 Allowance (kWh/year)	
Home Network Interface (HNI)	[no change]	17
MIMO Wi-Fi HNI: for each 2.4 GHz Spatial Stream	[from 3 to]	2
MIMO Wi-Fi HNI: for each 5 GHz Spatial Stream	[from 10 to]	5
Multi-room	[from 56 to]	35
Multi-stream – Cable/Satellite	[from 16 to]	0
Multi-stream –IP	[from 6 to]	0
Multi-stream – Additional	[new]	0
Transcoding	[new-VA]	13
Transcoding – Each Additional	[new-VA]	5
UltraHD Resolution	[no change]	5

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Resulting Base Allowances

Base Type	V4.1 Allowance (kWh/year)	V5.0 Allowance (kWh/year)
Cable DTA	40	40
Cable	60	40
Satellite	65	40
MVPD IP (Multichannel Video Programming Distributor)	65	40
Thin-client / Remote	30	7
OTT (Over the top) IP (Internet Protocol)	10	7

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Low Power Sleep for Thin Clients

- At the end of V4.1 spec, EPA proposed adding a mandatory deep sleep requirement in a future specification revision.
- Deep sleep is currently possible on Thin Clients and Over-the-top (OTT) IP STBs.
- The TEC of Thin Clients and OTT IP STBs was adjusted to reflect what it would be with Deep Sleep enabled.
  - Assumed 0.5 W for 4 hours.

Table 1: Operational Mode Durations

APD Enabled by Default	Auto-matic Deep Sleep	T_{WATCH_TV}	T_{SLEEP}	T_{APD}	T_{DEEP_SLEEP}
NO	NO	14	10	0	0
NO	YES	14	$10 - T_{DEEP\ SLEEP}$	0	Deep Sleep as-deployed duration
YES	NO	$7 - \frac{4 - T_{APD\ ON\ to\ SLEEP}}{2}$	10	$7 + \frac{4 - T_{APD\ ON\ to\ SLEEP}}{2}$	0
YES	YES	$7 - \frac{4 - T_{APD\ ON\ to\ SLEEP}}{2}$	$10 - T_{DEEP\ SLEEP}$	$7 + \frac{4 - T_{APD\ ON\ to\ SLEEP}}{2}$	Deep Sleep as-deployed duration

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Displayless Video Gateways and STBs

- EPA is considering combining the DVG and STB definitions and replacing them with a single STB product category, for simplicity.
- EPA welcomes feedback on how to continue differentiating between gateways and products covered under the ENERGY STAR specification for Small Network Equipment.

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Clarifications

- Multi-room:
  - … capability to provide independent live audio/video content to ~~multiple devices (2 or more Clients)~~ two or more Clients …
- Multi-stream:
  - … multiple independent streams of video content for use with one or more Clients, one or more directly connected Display Devices, or a DVR, picture-in-picture, etc. …
- Telephone:
  - … ability to ~~provide analog telephone service~~ support analog telephones …
- Service Provider:
  - A business entity that provides video content, a delivery network, and associated installation or support services to subscribers with whom it has an ongoing contractual relationship. Equivalent with Multichannel Video Program Distributors (MVPDs).

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New Definitions

- Transcoding
  - Additional capability to translate, transrate (e.g., HD to Mobile bitrate), transcale (e.g., HD to Mobile resolution), transcrypt (e.g., CAS to DRM), or perform audio format conversions (e.g., AC-3 to AAC) in real-time.
  - EPA is proposing an allowance of 13 kWh per year, plus 5 kWh per additional stream, to harmonize with the VA.
- Standard dc
  - A method for transmitting dc power defined by a well-known technology standard, enabling plug-and-play interoperability.
  - Common examples are Universal Serial Bus (USB) and Mobile High-definition Link (MHL). Usually Standard dc includes both power and communications over the same cable but that is not required.

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Standard Dc

- EPA seeks to open the specification to dc-powered (e.g. USB) Thin Clients, i.e., streaming sticks.
  - Since ac-dc power conversion occurs at the TV, there is an associated power loss.
  - EPA welcomes feedback whether the proposed 85% conversion factor is representative of typical conversion losses.

Equation 1: TEC Requirement for STBs

$$\left(1 - Incentive_{CLIENT\_ONLY}\right) \times TEC \div eff_{ac-dc} \leq TEC_{MAX} = TEC_{BASE} + \sum_{1}^{n} TEC_{ADDL\_i},$$

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Other Updates

- Terrestrial base type removed due to lack of market availability.
- APD Clarification
  - APD Must be enabled by default on shipping from the manufacturer.
  - APD timing set to engage ≤ 4 hours from last user activity.
  - Emergency Alert System (EAS) can wake the box.
- External Power Supply (EPS) Requirement
  - Single- and Multiple-voltage EPSs shall meet the Level VI or higher performance requirements under the International Efficiency Marking Protocol when tested according to the Uniform Test Method for Measuring the Energy Consumption of External Power Supplies.
  - Single- and Multiple-voltage EPSs shall include the Level VI or higher marking.

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Test Method Discussions

1. DC Powered STB Test Requirements
2. Testing with Multiple Streams over HNI
3. UltraHD Test Stream
4. Multi-room STB Test Requirements
5. Test Conduct for DVGs

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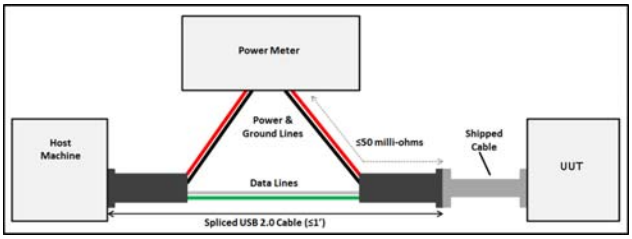
Dc Powered Set-top Boxes

- DOE has included instructions for testing dc powered STBs similar to the requirements in ENERGY STAR Displays.
- Example of a spliced cable setup is as follows:



Testing with Multiple Streams

- The VA specifies that if STBs offer concurrent operation of integrated HNIs they must be tested with the HNIs providing video content.
  - DOE interprets this as different HNI connections must be used to stream to the two (or more) connected Clients.
- DOE proposes to include this requirement but requests comment as follows:
  - Is this setup commonly used in the field?
  - Are Clients connected over different HNI connections, if available?

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UltraHD Test Stream

- It is optional to test UltraHD capable STBs with an UltraHD test stream for the ENERGY STAR V. 4.1 specification.
- For ENERGY STAR V. 5.0, DOE requests feedback on the following topics:
  - Do current STBs upscale HD content for UltraHD capable/4k TVs?
  - What test method changes are necessary if UltraHD STBs need to be tested with an UltraHD test stream?

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Multi-Room STB Test Setup

- DOE proposes to update the Multi-room test setup requirement as follows:

ENERGY STAR V. 4.1	ENERGY STAR V. 5.0
STBs claiming the Multi-room allowance must be tested with 3 live video streams with **at least one Client**…	STBs claiming the Multi-room allowance must be tested with 3 live video streams with **two Clients**…

- The updated requirement aligns with the Multi-Room definition and the Figure that shows the setup for the test.

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Multi-Room STB Test Conduct

- DOE has included tables to describe the setup and test conduct for Multi-Room STBs in on and sleep modes.
- Test requirements are same as before; the tables provide a visual aid, which makes it easier to follow the test.

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Multi-Room STB Client-Only Incentive

- To receive the client-only incentive, Multi-room STBs are tested as follows:

Device in Figure 2	CEA-2043 Test	Result	Notes
STB 1 (UUT)	8.3 SLEEP*	P_{CLIENT_ONLY}	Multi-room STB not being used locally for viewing or recording
STB 2	8.2.2.2: ON (Play)	Not Measured	Thin Client in On Mode over a home network
STB 3	8.2.2.2: ON (Play)	Not Measured	Thin Client in On Mode over a home network

- DOE requests comment as follows:
  - Is the ON (Play) test appropriate or should ON (Watch TV) be used instead?
  - Are there any STBs that only share DVR content and cannot share live streaming with Clients?

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Test Conduct for DVGs

- DVGs could be tested differently under the VA compared to ENERGY STAR.
  - VA does not require all DVGs to be connected to three Clients; only those that claim the MR allowance require three Client connections.
  - DOE assumes all DVGs likely support three Client connections and may be tested as such under both programs.

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Welcome to All Partners and New Stakeholders

Event	Date
Version 4.1 specification effective	*September 2013*
Draft 1 Version 5.0 specification released	*November 16, 2015*
Draft 1 Webinar	*December 9, 2015*
Draft 1 Comments Due	December 18, 2015
Draft 2 Released	January 2016
Version 5.0 specification finalized	Spring 2016
Version 5.0 specification effective	Early 2017

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Thank you!

Once again, please email comments by December 18 to:
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Thank you for participating!

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