



Proposal Information Template – Set-Top Boxes

2011 Appliance Efficiency Standards



Prepared by: Noah Horowitz
September 30, 2011

DOCKET

11-AAER-1

DATE SEP 30 2011

RECD. SEP 30 2011

CONTENTS

| | |
|--|----------|
| Purpose..... | 1 |
| Background | 2 |
| Overview | 3 |
| Methodology and Modeling used in the Development of the proposal..... | 4 |
| Data, Analysis and Results | 4 |
| Duty Cycle | 6 |
| Power Use per Mode..... | 6 |
| Proposed Standards and Recommendations..... | 7 |
| Bibliography and References..... | 8 |

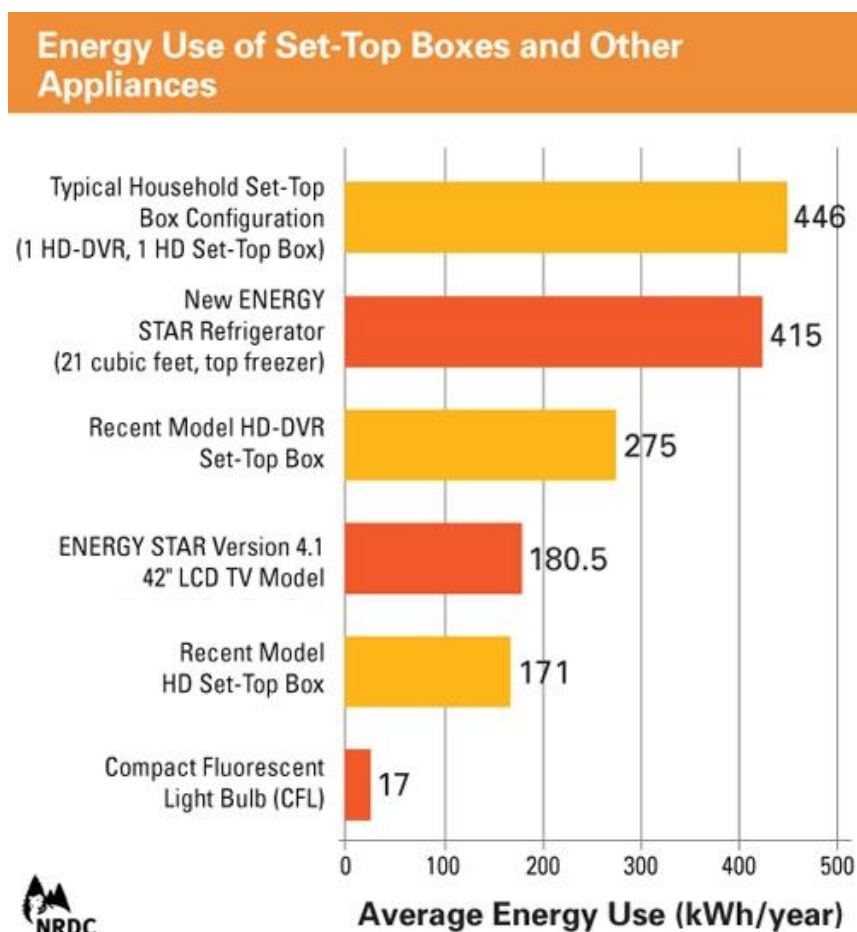
Purpose

This document is a report template to be used by researchers who are evaluating proposed changes to the California Energy Commission's (Commission) appliance efficiency regulations (Title 20, Cal. Code Regulations,, §§ 1601 – 1608) This report specifically covers TV set top boxes.

Background

More than 80% of homes in the US subscribe to some form of pay TV that they receive from their cable, satellite or phone company, also referred to as the service provider. In almost all cases, the customer receives a “set top box” (STB) that is connected to their TV which allows them to access video content – TV shows, movies, etc. Some customers not only have a STB on their main TV, but also on their 2nd and 3rd TV in the home.

NRDC and its consultant Ecos performed an extensive field [study](#) of the energy use of STBs deployed in the field in 2010 and found that with few exceptions, there was very little difference in the power consumed by STBs when they were in use (watching, recording, or playing back a show) and after the consumer turned their STB off. As a result, we found that the increasingly common type of STB, called a digital video recorder (DVR), consumed 30 to 35W even when turned off. Due to this excessively high level of standby power, each STB DVR can consume between 250 and 300 plus kWh/yr, which is typically greater than the energy consumed by the new 42 inch TV it is connected to. For homes with a DVR STB on their main TV and a basic STB on their second TV, the annual energy consumption by these two devices may be greater than the annual energy consumed by a new mid-sized refrigerator. For a graphical comparison of the energy use of STBs and other appliances, we provide the graph below:



Massive energy and economic savings could be achieved in California by requiring all new STBs deployed in the state to be more energy efficient. The biggest opportunity is to reduce the power these devices consume when the user is NOT in use.

Overview

| | |
|-------------------------------------|--|
| Description of Standards Proposal | We recommend that California adopt minimum efficiency standards for STBs. At a minimum, a standard would a) prevent any STB deployed in California from being capable of consuming more than 5W when turned off/in sleep mode, and b) require that STBs be deployed with an auto power down feature enabled such that a device that is left on will automatically power down to the low power sleep mode after x hours of user inactivity. (Note that devices would be allowed to wake from sleep to perform periodic updates, download a movie, tape a show, and then promptly return to low power sleep mode automatically.) |
| California Stock and Sales | There are approximately 17 million set top boxes installed in California homes (Assume 11 million homes that subscribe to pay TV and 1.6 STBs per subscriber). If the average life of a STB is five years, annual sales in California would be around 3.5 million. |
| Energy Savings and Demand Reduction | By using the NRDC 2010 field measurements as a base case the following savings would be achieved once the entire stock of STBs statewide consumed 5W or less in standby. 1750 GWh/yr, and 300 MW demand savings Additional savings could be achieved by also establishing On/Active mode power limits. These estimates do not incorporate potential market adoption of efficiency measures without a standard. It is unclear at this time what level of adoption the new ENERGY STAR specifications for STBs will achieve. |
| Economic Analysis | The full life-cycle costs and cost-benefit ratio for the standard are still to be determined and further research is required to estimate them. However the fact that the technology required for power scaling and power management is widely available and deployed today in smart phones, tablets and laptop computers suggests that the cost impacts should be modest. Upon full stock turn over, this standard will reduce Californians' electric bills by more than \$200 million/yr |

| | |
|--|---|
| Non-Energy Benefits | We are not aware of any non-energy benefits created by the proposed standard. |
| Environmental Impacts | We are not aware of any adverse environmental impacts that will be created by the proposed standard. |
| Acceptance Issues | Service providers and set top box makers will need to work together to ensure that their new STBs continue to provide consumers with a satisfactory user experience. Today's boxes do not have a true deep sleep/low power state and the only way to dramatically reduce existing STB energy use is by unplugging it. This is not an acceptable scenario for most consumers as they will experience some delay once the box is turned back on to receive the program update or view the current program guide information. In some but not all cases, the customer is able to change channels within a few seconds of replugging the device in. |
| Federal Preemption or other Regulatory or Legislative Considerations | <p>STBs are currently not a covered product by the DOE. DOE has an open docket (see June 15, 2011 Federal Register) for STBs and they are considering development of a national test method and efficiency standards for STBs as well as networking equipment. Even if DOE were to move forward, a national standard would likely not go into effect for at least five years.</p> <p>EPA has published a two-tiered specification for STBs. Version 3 just went into effect on September, 2011 and Version 4 goes into effect in July 2013. ENERGY STAR is a voluntary program and the rate of uptake of their STB specifications is unknown. Note, Version 3 is a relatively modest specification as STBs with high standby/sleep power are still able to qualify for the ENERGY STAR label. Version 4 provides significantly greater savings and few if any of the boxes on the market today are able to meet it.</p> |

Methodology and Modeling used in the Development of the proposal

NRDC relied on the data collected from the measurements it collected in 2010 and published in 2011. The modeling we conducted for this proposal was very basic and simply calculated the annual per box savings that would be achieved if all new boxes used < 5 W when in standby/sleep mode and that boxes would be on for 7 hours and in standby/sleep for 17 hours/day.

Data, Analysis and Results

We extrapolated national set top box installation rates and assumed there are 17 million installed boxes in California. We assumed there were 6.8 million cable subscribers, 3.8 million satellite subscribers and 0.5 million telephone company subscribers.

The table below provides the raw data that was collected for the STBs that were measured during our study. For each STB we show the power consumed in both on and standby (when turned "off") modes.

Power Measurements of Cable, Satellite and IPTV Set-Top Boxes



| Service Provider Type | Service Provider Name | Make | Model Name | Product Class | MultiRoom Capability | Additional Tuners | Active Power Use (W) | Standby Power Use (W) |
|-----------------------|-----------------------|--------------------|------------------|---------------|----------------------|-------------------|----------------------|-----------------------|
| Cable | Comcast | Motorola | DCH70 | SD | No | No | 11 | 10 |
| Cable | Comcast | Motorola | DCH70 | SD | No | No | 10 | 10 |
| Cable | Verizon FIOS | Motorola | QIP2500 | SD | No | No | 13 | 12 |
| Cable | Time Warner | Motorola | DCT2224 | SD | No | No | 14 | 14 |
| Cable | Verizon FIOS | Motorola | QIP2500 | SD | No | No | 14 | 14 |
| Cable | Verizon FIOS | Motorola | QIP2500 | SD | No | No | 14 | 14 |
| Cable | Verizon FIOS | Motorola | QIP2500 | SD | No | No | 14 | 14 |
| Cable | Verizon FIOS | Motorola | QIP2500 | SD | No | No | 14 | 14 |
| Cable | Time Warner | Scientific Atlanta | Explorer 2100 | SD | No | No | 17 | 16 |
| Cable | Comcast | Motorola | DCT2000 | SD | No | No | 17 | 16 |
| Cable | Comcast | Motorola | DCT2000 | SD | No | No | 18 | 18 |
| Cable | Comcast | Motorola | Starfone5FT2 | SD | No | No | 19 | 19 |
| Cable | Charter | Motorola | Starfone5FT2 | SD | No | No | 20 | 19 |
| Cable | Comcast | Pace | RNG110 | HD | No | No | 13 | 12 |
| Cable | Bresnan | Pace | DC700X | HD | No | Yes | 14 | 14 |
| Cable | Time Warner | Cisco | Explorer 4250HDC | HD | No | No | 19 | 18 |
| Cable | Time Warner | Cisco | Explorer 4250HDC | HD | No | No | 19 | 18 |
| Cable | Comcast | Motorola | DCX3200 | HD | No | No | 20 | 20 |
| Cable | Time Warner | Scientific Atlanta | Explorer 3250HD | HD | No | No | 20 | 19 |
| Cable | Cox | Scientific Atlanta | Explorer 3250HD | HD | No | No | 19 | 19 |
| Cable | Verizon FIOS | Motorola | QIP7100 | HD | Yes | Yes | 21 | 21 |
| Cable | Time Warner | Cisco | Explorer 8300HD | HD | No | No | 23 | 23 |
| Cable | Comcast | Motorola | DCH3200 | HD | No | No | 26 | 25 |
| Cable | Bresnan | Motorola | DCH6200 | HD | No | No | 35 | 35 |
| Cable | Comcast | Pace | TDC577X | SD/DVR | No | Yes | 26 | 24 |
| Cable | Comcast | Pace | TDC575D | SD/DVR | No | Yes | 26 | 25 |
| Cable | Time Warner | Cisco | Explorer 8300HDC | HD/DVR | No | Yes | 26 | 25 |
| Cable | Cox | Cisco | Explorer 8240HDC | HD/DVR | No | Yes | 25 | 25 |
| Cable | Time Warner | Cisco | Explorer 8300HDC | HD/DVR | No | Yes | 29 | 26 |
| Cable | Verizon FIOS | Motorola | QIP7216 | HD/DVR | Yes | Yes | 29 | 28 |
| Cable | Comcast | Motorola | DCX3400 | HD/DVR | No | Yes | 29 | 28 |
| Cable | Comcast | Motorola | DCT3416 | HD/DVR | No | Yes | 30 | 30 |
| Cable | Comcast | Motorola | DCT3412 | HD/DVR | No | Yes | 31 | 30 |
| Cable | Verizon FIOS | Motorola | QIP6416 | HD/DVR | No | Yes | 31 | 31 |
| Cable | Comcast | Motorola | DCH3416 | HD/DVR | No | Yes | 34 | 32 |
| Cable | Verizon FIOS | Motorola | QIP6416 | HD/DVR | No | Yes | 36 | 35 |
| Cable | Bresnan | Pace | TDC779X | HD/DVR | No | Yes | 41 | 41 |
| Cable | Bresnan | Motorola | DCH6416 | HD/DVR | No | Yes | 47 | 46 |
| Satellite | DirectTV | DirectTV | D11 | SD | No | No | 12 | 9 |
| Satellite | DirectTV | DirectTV | H24 | HD | No | No | 16 | 15 |
| Satellite | DirectTV | DirectTV | H23-600 | HD | No | No | 19 | 18 |
| Satellite | Dish Network | Dish Network | 625 | SD/DVR | Yes | Yes | 30 | 29 |
| Satellite | DirectTV | DirectTV | HR24 | HD/DVR | Yes | Yes | 31 | 31 |
| Satellite | DirectTV | DirectTV | HR22-100 | HD/DVR | Yes | Yes | 33 | 30 |
| Satellite | DirectTV | DirectTV | HR21-100 | HD/DVR | Yes | Yes | 33 | 32 |
| Satellite | DirectTV | DirectTV | HR22-100 | HD/DVR | Yes | Yes | 37 | 35 |
| Satellite | DirectTV | DirectTV | HR22-100 | HD/DVR | Yes | Yes | 37 | 36 |
| Satellite | DirectTV | DirectTV | HR20-700 | HD/DVR | Yes | Yes | 38 | 37 |
| Satellite | DirectTV | DirectTV | HR20-700 | HD/DVR | Yes | Yes | 38 | 38 |
| Satellite | Dish Network | Dish Network | ViP922 | HD/DVR | Yes | Yes | 43 | 40 |
| Satellite | Dish Network | Dish Network | ViP612 | HD/DVR | Yes | Yes | 44 | 42 |
| Satellite | Dish Network | Dish Network | ViP622 | HD/DVR | Yes | Yes | 52 | 49 |
| Satellite | Dish Network | Dish Network | ViP722 | HD/DVR | Yes | Yes | 55 | 52 |
| IPTV | AT&T U-Verse | Motorola | VIP1200 | HD | No | No | 10 | 9 |
| IPTV | AT&T U-Verse | Motorola | VIP1200 | HD | No | No | 10 | 10 |
| IPTV | AT&T U-Verse | Motorola | VIP1225 | HD/DVR | Yes | Yes | 19 | 12 |
| IPTV | AT&T U-Verse | Motorola | VIP1216 | HD/DVR | Yes | Yes | 18 | 17 |
| Streaming Device | N/A | Apple | MCS72LL/A | Internet | No | No | 3 | 0.5 |
| Streaming Device | N/A | Roku | XR-HD | Internet | No | No | 7 | 7 |

Ecos took these measurements in the field in the summer of 2010, using a Watts up? PRO ES power meter, from set-top boxes connected to service from a cable, satellite or IPTV service provider.

59 total set-top boxes measured
44 unique set-top box models

Set Top Boxes

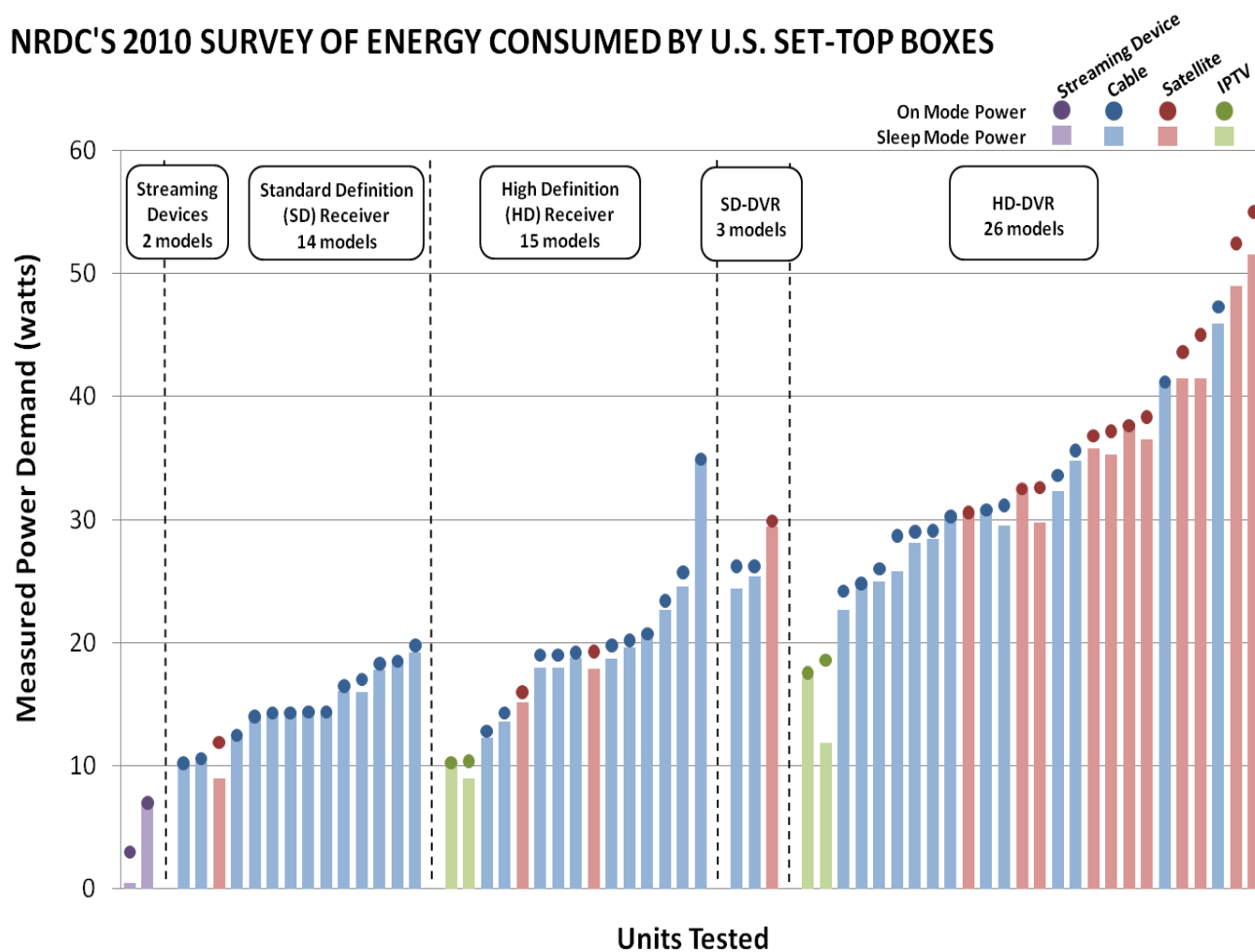
Duty Cycle

We assumed a duty cycle of 7 hours on and 17 hours standby. As there was very little difference in the power use between these modes, the duty cycle assumptions that we applied were not critical.

Power Use per Mode

The power use data in each operating mode was provided in the table above. We present the same data in graphical form below which illustrates the similarity in power use levels between Active/On and Sleep modes.

NRDC'S 2010 SURVEY OF ENERGY CONSUMED BY U.S. SET-TOP BOXES



Proposed Standards and Recommendations

We recommend CEC establish minimum efficiency requirements for new STBs deployed in California that would include the following elements:

- a) Any new STB deployed in California shall not be capable of consuming more than 5W when turned off or when in deep sleep mode,
- b) Require new STBs be deployed with an auto power down feature enabled such that a device that is left on will automatically power down to the low power deep sleep state after 4 hours of user inactivity. (The user should not have to “opt in” for this feature to work, nor should the software prompt the user to turn this feature off)

In refining this standard proposal consideration should be given to the following:

- Regulated STBs shall be allowed to wake for updates, downloads, to record shows, etc provided the box automatically promptly (within 5 minutes?) returns to deep sleep upon completion of this activity. Some language will also be needed to prevent overly frequent updates that cause the box to spend too much time in higher power consuming modes. CEC stakeholder discussions should be used to refine the specifics of this part of the proposal.
- The standard should encourage, rather than discourage deployment of whole home solutions whereby a multi room STB would be attached to the main TV and lower power STBs (these are sometimes referred to as thin client STBs and would consume much lower levels of standby power than current devices) would be connected to the other TVs in the home. When implemented properly, this will result in a decrease in overall household STB energy use even though the multi room box may consume higher levels of power than a conventional box.
- The existing test methods developed by CEA and used by ENERGY STAR may require minor modifications to ensure the methodologies are capable of properly testing/verifying the auto power down feature, the frequency of updates, and the power levels a STB consumes after an update is completed.

Bibliography and References

1. NRDC Report – “ Better Viewing, Lower Energy Bills, and Less Pollution: Improving Energy Efficiency of TV STBs”<http://www.nrdc.org/energy/files/settopboxes.pdf>
2. Energy Star STB Specifications – Links to ENERGY STAR 3 and 4 specifications:
http://www.energystar.gov/ia/partners/product_specs/program_reqs/STB_Version_3_Program_Requirements_Service_Providers.pdf and
http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/settop_boxes/ENERGY_STAR_STB_Final_Version_4_Specification.pdf
3. DOE Proposed Determination for STBs from the Federal Register:
<http://69.175.53.6/register/2011/jun/15/2011-14825.pdf>