Before the
CALIFORNIA ENERGY COMMISSION
Sacramento, CA

In the Matter of	)	
	)	
2013 Appliance Efficiency Pre-Rulemaking	)	
	)	Docket # 12-AAER-2A
California Energy Commission	)	
Appliances & Process Energy Office	)	(Game Consoles)
Efficiency & Renewable Energy Division	)	

COMMENTS OF THE ENTERTAINMENT SOFTWARE ASSOCIATION

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I. Introduction

The Entertainment Software Association ("ESA") thanks the Commission for this opportunity to provide further information about the video game industry's products and the strong progress that our industry has made on energy efficiency.[1] In the commentary below, we address the specific questions posed by the Commission in the recent webinar. Before turning to those questions, however, we first provide the Commission some context about the game industry's strong track record on energy efficiency that informs our responses.

Game consoles are constantly evolving. Unlike many other consumer electronics, which have a fairly stable feature set or well-understood range of functions, game consoles continue to add new features, functions, and enhanced entertainment experiences. Even its core function, game play, is always evolving in areas such as graphics, network capabilities, multi-player game play, and user interfaces. Some of these new features are included at the launch of a new generation, others are added years later. To accommodate this anticipated future innovation, it is critical that consoles have sufficient extra margin of computing capability when they launch.

Consoles' locked platform spurs improved energy efficiency. Console makers release new generations of game consoles much less frequently than makers of other consumer electronic devices. Historically, new consoles have come out roughly every five to seven years. Several factors account for this duration, including: the substantial time involved in developing and commercializing state-of-

[1] The ESA is the U.S. association exclusively dedicated to serving the business and public affairs needs of companies that publish computer and video games for video game consoles, handheld devices, personal computers, and the Internet. Our membership includes, among others, Microsoft, Sony Computer Entertainment America, and Nintendo of America, makers of the three major console platforms.

the-art technologies to take game play to new heights, the need to provide a stable platform for future software development, and the desire to maximize the return on investment from substantial R&D costs. Because the computing platform remains "locked" during this period, console makers have a powerful financial incentive to maintain computing capability while driving down production costs. This desire works hand in hand with improved energy efficiency; as chip sizes shrink, they use less energy. Console makers are able to swap in smaller, more energy efficient chips, sometimes doing so multiple times over the model's lifespan in the marketplace. The use of more energy efficient chips diminishes the need for other components designed to address heat remediation, such as fans, radiating fins, and insulation. This reduces the overall cost to build the device while also leading to dramatic improvements in energy efficiency.

The energy savings to date are both measurable and substantial. All three console systems share this trait: when it comes to energy consumption over a particular model's lifespan, the graphs all slope downward. Today's Xbox 360 uses less than half the energy for game play and navigation mode than the 2005 launch model. Today's PlayStation 3 uses just 35 percent as much power for game play mode and 34 percent in navigation mode as the 2006 launch model. And the Nintendo Wii, which has the lowest energy usage of the three systems, uses 22 percent less power in active gaming and 43 less power in standby mode than the 2006 launch model.

II. Responses to Questions

A. Basic Information

1. *Product Definition & Scope*

We support defining "Game Console" in a manner consistent with the EPA Recognition Program for Game Consoles – Performance Requirements Ver. 1.0 ("EPA Game Console Program").

The term "Game Console" means a standalone computer-like device whose primary use is to play video games. Game Consoles use a hardware architecture based in part on typical computer components (e.g., processors, system memory, video architecture, optical and/or hard drives, etc.). The primary input for game consoles are special handheld controllers rather than the mouse and keyboard used by more conventional computer types. Game Consoles are also equipped with audio visual outputs for use with televisions as the primary display, rather than (or in addition to) an external or integrated display. These devices do not typically use a conventional personal computer (PC) operating system, but often perform a variety of multimedia functions such as: DVD/ Compact Disc (CD) playback, digital picture viewing, and digital music playback.

The definition excludes two types of devices: (i) handheld gaming devices, typically battery powered and intended for use with an integral display as the primary display; and (ii) game consoles incapable of rendering HD video output (video output with a display resolution of 720 lines or greater) via HDMI.

2. *Existing Test Procedures*

The industry has developed a tentative draft outline voluntary test procedure for all modes of console operation, including: active gaming, navigation, media playback, network standby, and standby. These procedures are detailed in **Appendix #1**.

In addition, the EPA has developed a test method as part of the EPA Game Console Program.

3. *Existing Standards and Standards Under Development*

Console makers currently comply with the following energy efficiency-related regulations and laws:

- California Code of Regulations, Title 20: Div. 2, Ch. 4, ARTICLE 4, Sections 1601-1608: APPLIANCE EFFICIENCY REGULATIONS
  - (u) Power supplies, which are single voltage external AC to DC and AC to AC power supplies included with other retail products
  - (w) Battery charger systems
- United States Department of Energy, Energy Independence and Security Act of 2007, Sec. 301. External power supply efficiency standards
- European Commission (EC) Regulation No 278/2009 of the European Parliament and of the Council with regard to ecodesign requirements for no-load condition electric power consumption and average active efficiency of external power supplies
- European Commission (EC) Regulation No 1275/2008 of the European Parliament and of the Council with regard to ecodesign requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment.[2]

4. *Product Development Trends*

Historically, console makers have released new systems about every 5 years. However, with the current generation of consoles, that timeline has extended beyond five years. Nintendo released its latest generation console, the Wii U, six years after launching the Wii. Sony has announced that the PlayStation 4 will be out during the holiday 2013 season, which would put it at seven years after launch of the PlayStation 3. Microsoft has not announced a successor to the Xbox 360, which Microsoft launched nearly eight years ago.

[2] Except with respect to application of Tier 2 to the Nintendo Wii, which is no longer imported into Europe.

This duration between product releases is one of the key features that distinguishes consoles from many other major consumer electronics, such as PCs, TVs, smart phones, and tablets, of which new generations are released far more frequently. The extended lifecycle for consoles also reflects the complexity of the game software published for the platform. Games that fully exploit the potential of the console are every bit as complicated to produce as a major motion picture. They involve the contributions of hundreds of programmers, artists, software engineers, game designers, quality assurance testers, and customer support personnel, among others. Major titles can take two years or more to produce and cost tens of millions of dollars.[3]

Given these realities, game developers and publishers need a stable, persistent platform for which to develop their games. Because consoles often employ new technologies, it can take several years or more before game publishers learn to fully exploit the potential of the new console's capabilities. Further, the considerable development expense that console makers invest in bringing each console generation to market can take years to recoup.

B. Operations, Functions & Modes

1. *What are the operating modes of game consoles?*

The modes are: Active Gaming, Media Playback, Navigation, Networked Standby, and Standby.

2. *How much power is used in each mode?*

The three active modes (active gaming, navigation, and media playback) require comparable levels of power owing to the highly interactive and dynamic nature of console menu systems and the limitations of power scaling with current generation systems.

3. *How much time is spent in each mode?*

Time-in-mode is a useful metric for appliances with known, static usage profiles and where the work to be done is well-defined (e.g., clothes dryers, dishwashers, and refrigerators). In such cases, efficiency efforts can focus on reducing the power required to do the work multiplied by a time constant. By contrast, with game consoles, neither the work to be done nor the time spent doing it is static or easily defined. A game session can last anywhere from a few minutes to several hours.

[3] Much of that activity occurs within the State of California, which is a major hub for video game development. Game developers and publishers employ thousands of people in the State.

Additionally, game consoles do much more than play games. They also provide media playback in a variety of continually evolving formats.

Usage patterns also vary widely, both among competing console systems and as the functionality of a console evolves through software updates. For example, media streaming of video programming is a feature that console makers added post-launch to the capabilities of the systems released in 2005/2006. As consoles continue to evolve, new innovations may bring further changes to usage patterns. Consumer usage patterns are therefore variable.

Any attempt to accurately define console energy use or to forecast improvement based on reduction of modal time requires a level of accuracy and scientific rigor that is not achievable. That is why console makers have, instead, focused energy improvement metrics on power in mode.

4. *How has usage changed from the past to present and how is it anticipated to change in the future?*

Historically, game consoles served a single purpose: to play video games. Game play continues to be the primary purpose for which console makers design their systems; however, over time, consoles have evolved to offer additional entertainment options including, most notably, media playback of discs and/or streamed content.

Although we cannot predict how usage patterns will change in the future, we anticipate that game play primarily, followed by media playback secondarily, will continue to be the drivers for consumer demand of future console systems. Nintendo's recently launched Wii U incorporates an innovative tablet interface for enhanced game play options. That console also includes additional media-related features, such as the ability to easily search for programs across multiple video programming providers.[4] Sony has revealed some information regarding its forthcoming PlayStation 4, which reflects a design optimized for game play features. For example, in describing the forthcoming system, Sony emphasized the enhanced game play options enabled by the redesigned controller, the new social gaming features of the operating system, and the capabilities of the new chipset to push the boundaries of game graphics.[5] Sony also has announced that the PS4 will have the capability to download movies in 4K HD, a new, ultra high resolution format. Many of the technical details have not been released as the console is still in development. Microsoft has not announced a successor to its current Xbox 360 console.

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[4] *See* **Nintendo.com,** *available at* http://www.nintendo.com/wiiu (describing the features of Nintendo's Wii U).

[5] *See* **Playstation.com,** *available at* https://us.playstation.com/ps4/ (describing the features of Sony's PlayStation 4).

5. *What are the factory default display and console power management settings?*

Today, the Xbox 360, the Wii U, and the PlayStation 3 have an auto-power down ("APD') feature enabled by default that powers down the console after 60 minutes of user inactivity for game play. The media playback time-out limits are longer, allowing for completion of media content lasting longer than an hour.

6. *What are the other power management settings?*

The user can adjust the APD settings for all three console systems.

7. *What storage is required to hold operations in a sleep state?*

There is no sleep state for game consoles. Although ACPI S3 or S4 sleep may be useful in a computer environment, it is not applicable to a game console. However, consoles do auto-power down to a low power state.

8. *How much does it cost to implement an automatic sleep function on a per-unit basis? Are these costs associated with hardware or software?*

As discussed above, consoles do not have a sleep function. Unlike a computer, a sleep mode does not make sense for game consoles in light of the standby modes. Current generation systems would not be able to implement such a feature.

9. *Are all game console models currently in the market shipped with auto-power down enabled by default in all modes?*

As of this year, the current generation Xbox 360, the PlayStation 3, and the Wii U include APD enabled by default for all modes.[6]

10. *Which setting do consumers typically choose when overriding the factory default auto-power down setting?*

We have no information on this question.

11. *Is the option to disable APD available in the out-of-the-box initial set up menu?*

[6] There is a limited case, however, where APD will not work on the Nintendo Wii U. Where the Wii U is emulating the original Wii for purposes of enabling playback of a legacy game designed for the earlier Wii system, it is not possible for the Wii U to APD.

Today game consoles with forced menu on initial activation of the game console provide APD as the default choice on initial activation of the console. If the user selects a mode other than APD on initial activation of the console, a second selection process will be prompted to confirm this choice.

Importantly, even those current generation consoles that do not have a forced menu on initial activation have APD enabled by default. Additionally, it is not a feature that is given prominence in the menu systems; nor are users encouraged to consider changing the default.

12. *To what extent do game consoles save games prior to APD?*

Whether a game saves immediately prior to APD is a determination made on a game-by-game basis by each third party developer, who is in the best position to determine the appropriate save mechanic for that particular title. Typically, games auto-save on a frequent basis throughout the game play session, minimizing the risk of inadvertent loss of progress. This automatic saving reduces the likelihood that APD will result in much, if any, lost progress even absent a mandatory save on APD requirement. See **Appendix #2** (showing that auto-save functionality is a common feature in today's games).

The console makers support working cooperatively with game developers on a game-by-game basis in assuring positive user experiences in all functions, including APD. We support providing notification of an imminent APD event through an application programmable interface (API) or other means to the game. With that API, depending on the context of the game, the developer has many options to optimize the user experience.

13. *How does media playback energy use compare with that of a standalone media player (e.g., DVD players, Blu-ray players, etc.)?*

Game consoles and media players are optimized for different functions, and their energy usage characteristics reflect that reality. Consoles typically consume more energy for media playback than dedicated DVD/Blu-ray and media streaming players because their chipsets are optimized for game play, a far more demanding function. It is not possible to significantly vary power consumption based upon function with the current generation systems.

14. *What energy saving technologies or features are currently included in game consoles and how much energy do they save?*

There are three key ways console makers reduce the power consumption of their game consoles: (i) through constant, incremental reduction of silicon die size; (ii) through APD; and (iii) through improved component efficiency, which reduces standby power.

Consumers expect a "wow" factor when buying a new generation game console. Small changes from the prior generation are not enough, particularly given the plethora of new platforms that have emerged since the current generation launched in 2005/2006. Consumers are looking for features that deliver an experience they cannot get from the current generation of console systems or from other game platforms that justify an expenditure of several hundred dollars and that will allow them to play the latest games for years to come.

Console makers design their systems to surpass these high expectations. Each new generation of game console ushers in new features and improved performance, such as higher resolution graphics and innovative control systems. These new features typically require more computing power than the prior generation and thus more energy. The overall electrical power needed to play a "next generation" game may approach the power required when the previous generation was new.

Earlier, we noted that consoles have a "locked" platform. One consequence of the "locked platform" approach is that console makers build in sufficient computing performance to accommodate new features and improvements for several years into the future. In the case of the current generation of consoles, such post-launch features included media streaming and new peripherals for gesture-based control of game play. It is important that consoles launch with sufficient computing potential to handle future innovations and functionality added years later. This aspect of consoles differentiates it from a host of other consumer electronics and appliances, which have a more static or well-defined range of functions.

The industry's approach to designing consoles has a compelling, built-in financial incentive for console makers to improve energy efficiency. The shrinking of transistors in integrated circuit chips leads to both reductions in energy usage and cost. To reliably increase the density of transistors, the power used per transistor must also be reduced to avoid excessive heat. Microprocessors that use less energy also produce less heat. With less heat generated, the heat releasing elements, such as fans and radiating fins, can be simplified to achieve cost reduction. Smaller transistors have lower "turn on" voltages that allow the use of a smaller power supply, thereby achieving further cost reduction. Smaller transistors scale more easily to higher frequencies (increased switching speeds) thereby allowing for higher performance. Also, reduced energy consumption means lower internal temperature, which can help reduce risk of component failure.

For example, in 2006, the then-new console systems took advantage of innovation in high-definition television to render games with HD graphics. In order to do so, new CPUs and GPUs employing state-of-the-art technology were developed. Although the new processors initially required more electrical power than those of the previous "generation," the resulting difference in gaming was significant and launched the current generation of game consoles.

In the years following launch, manufacturers were able to reduce the electrical power required for HD gaming by over 50 percent. The power reduction was achieved in the absence of any mandatory or voluntary power cap.

Constant reductions in die size are what make these substantial savings possible. Thanks to Moore's Law, the electrical cost of computing power per watt has gone down significantly throughout and within the generations, and any increase in electrical power consumption brought on by a step increase in computing power is only temporary. This is brought about by the ability to reduce the size of the individual computing elements on a processor chip. The process is commonly referred to as "Die-Shrink," and these improvements typically pay for themselves. No additional costs are passed on to the consumer; in fact, these improvements, while costly in the short term, yield lower costs in the long term and enable all three console makers to offer better energy performance at lower price points over time.

APD is another way console makers strive to reduce energy consumption; however, it is not possible to accurately quantify the energy savings of APD. An APD event does not necessarily indicate that the consumer would have left the console on absent APD. For instance, a consumer may leave the console on because he or she knows it will go into APD and so therefore opts not to turn it off. Or, the consumer may have turned the console off immediately absent an APD feature. We know of no practical way to gather statistical information about the consumer's intent when they leave the console. Nevertheless, we agree that the potential for APD to save energy is sufficiently compelling that all three console makers' current generation models include that feature enabled by default."

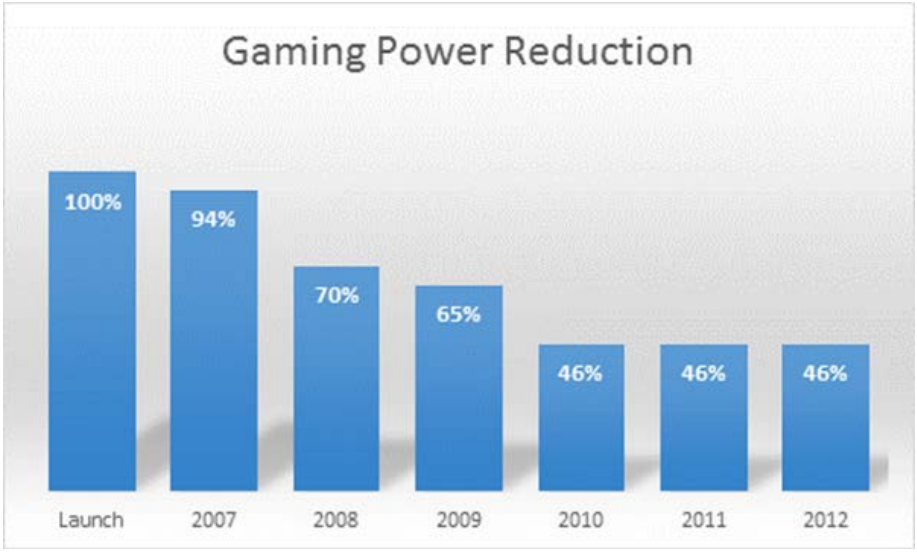
Third, and finally, improvements to the efficiency of console components have enabled console makers to significantly reduce standby power - the power consumed while the console is turned off, awaiting a signal from a remote control or game controller to wake it up. Xbox 360 consumed a little over three watts in this mode at launch in 2006. Models now on the market consume less than 0.5 watts in standby – a sixfold reduction. This power reduction is particularly significant because, we suspect, consoles are in standby mode most of the time. With the implementation of APD, more time is spent in standby, reducing energy consumption further.

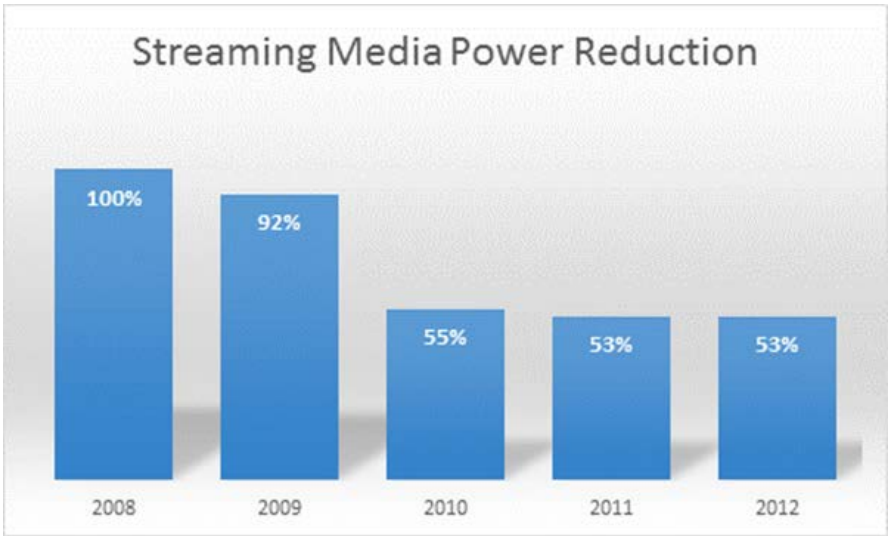
The combination of these three advances has enabled console makers to substantially reduce the energy consumption of their respective systems, as the data below illustrates:

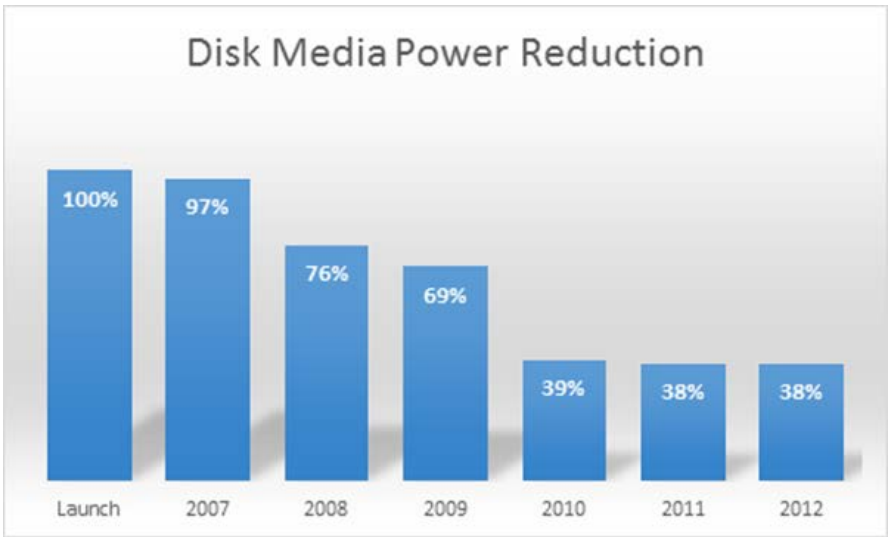
Xbox 360

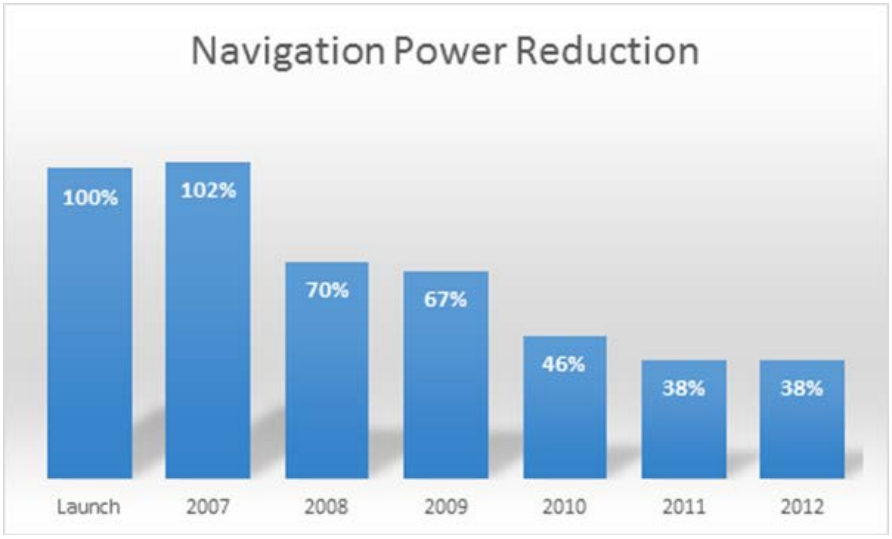
A recently produced Xbox 360 sold at retail today consumes less than 50 percent of the energy that it consumed when Microsoft launched the product in 2005. Additionally, Microsoft has reduced by sixfold the amount of energy the Xbox 360 consumes in "standby" mode.

This impressive energy savings is attributable to a variety of improvements Microsoft has made to the system, including redesigned CPUs and GPUs and the addition of digital voltage regulation, among other innovations. Since its original launch, the Xbox 360 has included a user-enabled APD, which Microsoft has continually enhanced through software updates over the product's lifecycle. Today, the APD function is enabled by default. Furthermore, Microsoft has reduced the standby time from five hours to one.






Disk Media Power Reduction
100%
97%
76%
69%
39%
38%
38%
Launch
2007
2008
2009
2010
2011
2012


Navigation Power Reduction
100%
102%
70%
67%
46%
38%
38%
Launch
2007
2008
2009
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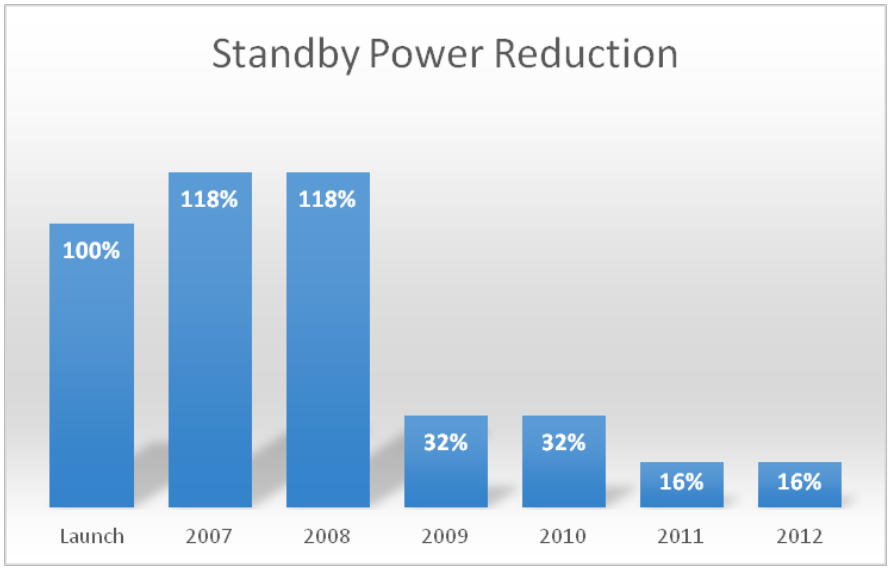
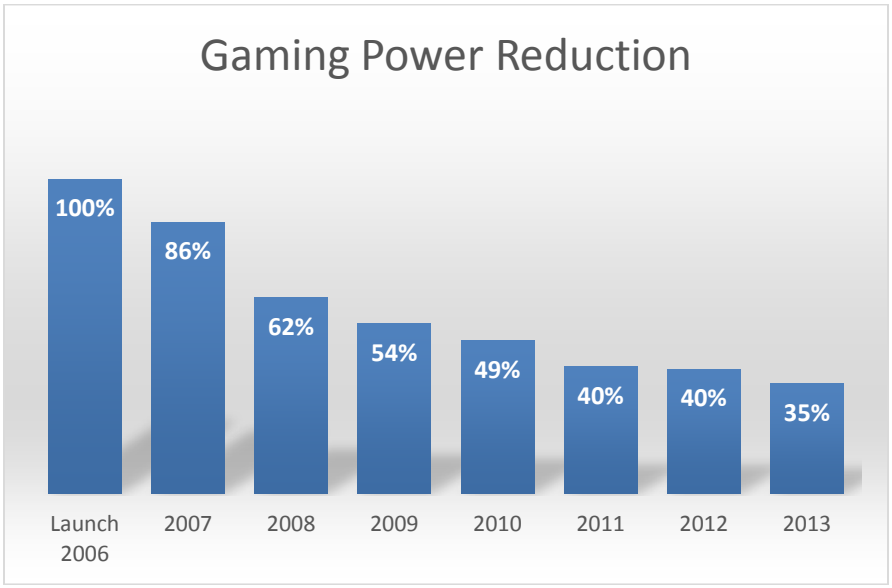
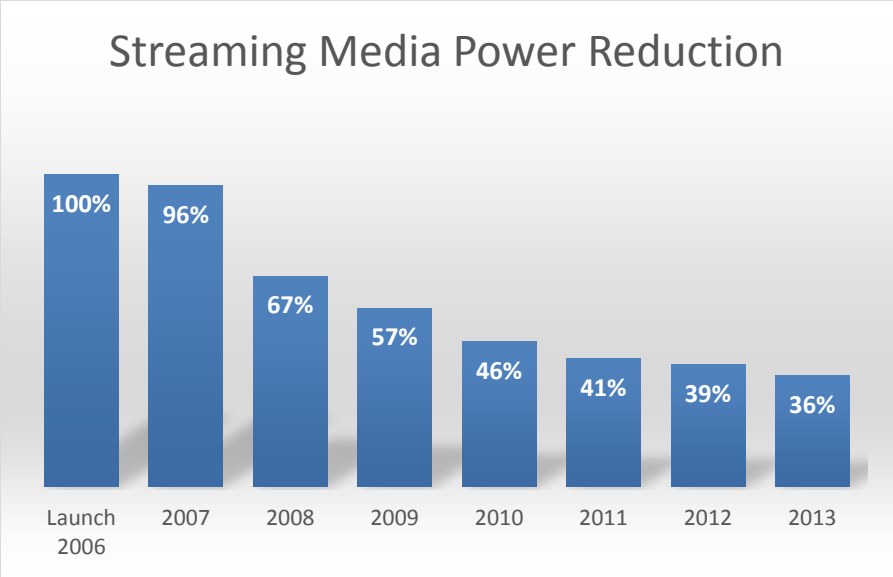
2011
2012



PlayStation 3

Sony's continued improvements to the PlayStation 3 have likewise netted substantial energy savings. The most recent model of the PlayStation 3 uses only 35 percent as much energy during game play than the model sold at launch in 2006. Also, the PlayStation 3 includes an APD feature that is enabled "on" by default. Today's PlayStation 3 weighs 48.5 percent less than the PlayStation 3 sold at launch, and the overall packaging is down 58.7 percent, which translates to lower energy costs for shipping the product.




Streaming Media Power Reduction
100%
96%
67%
57%
46%
41%
39%
36%
Launch 2006
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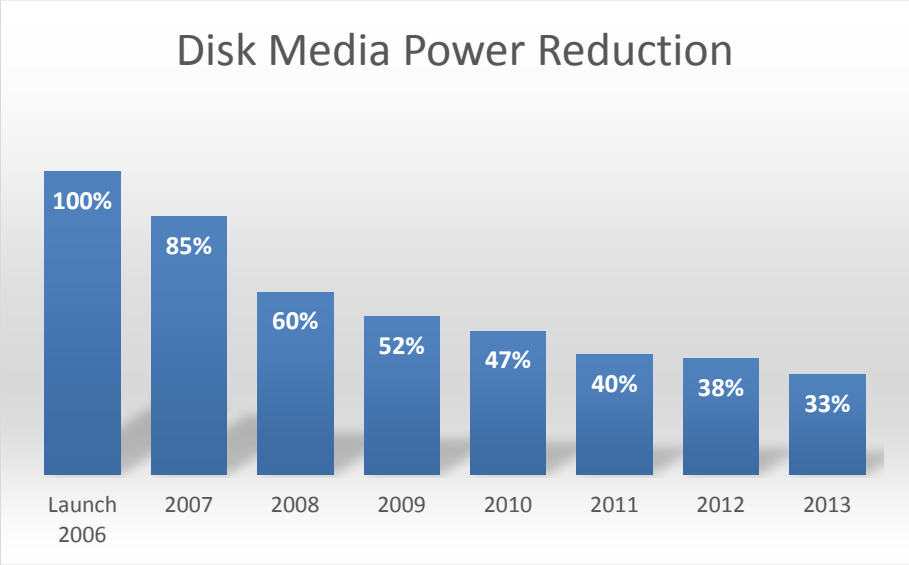
2008
2009
2010
2011
2012
2013


Disk Media Power Reduction
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60%
52%
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38%
33%
Launch 2006
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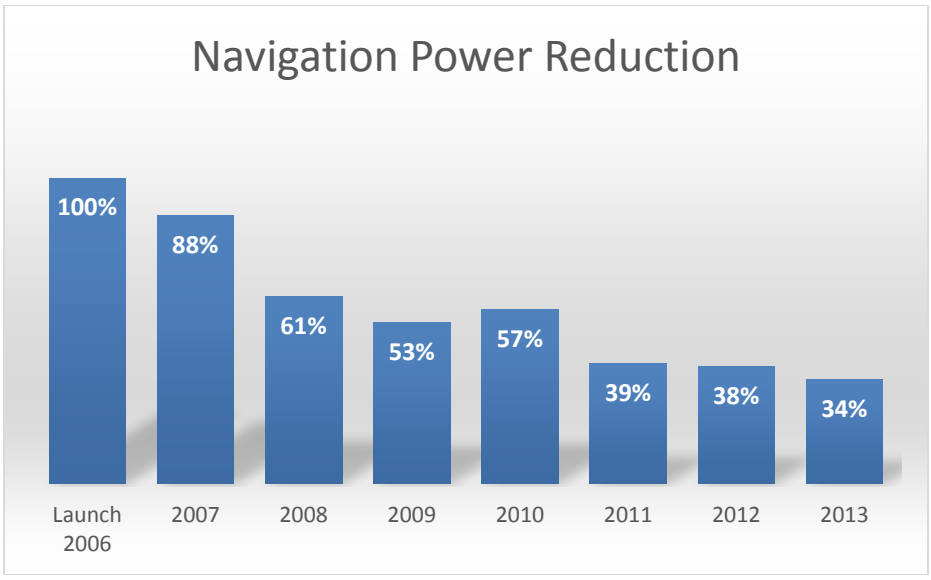
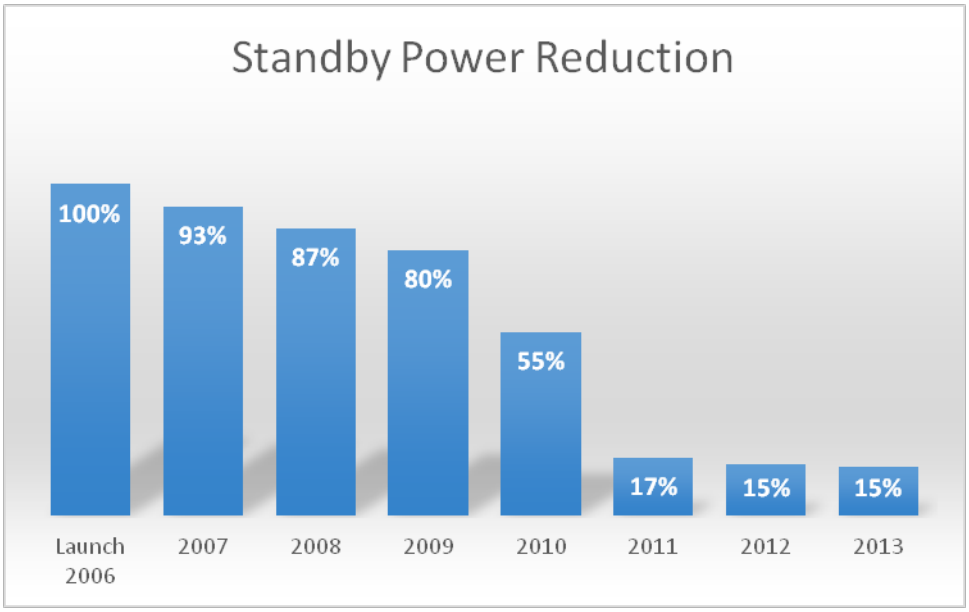
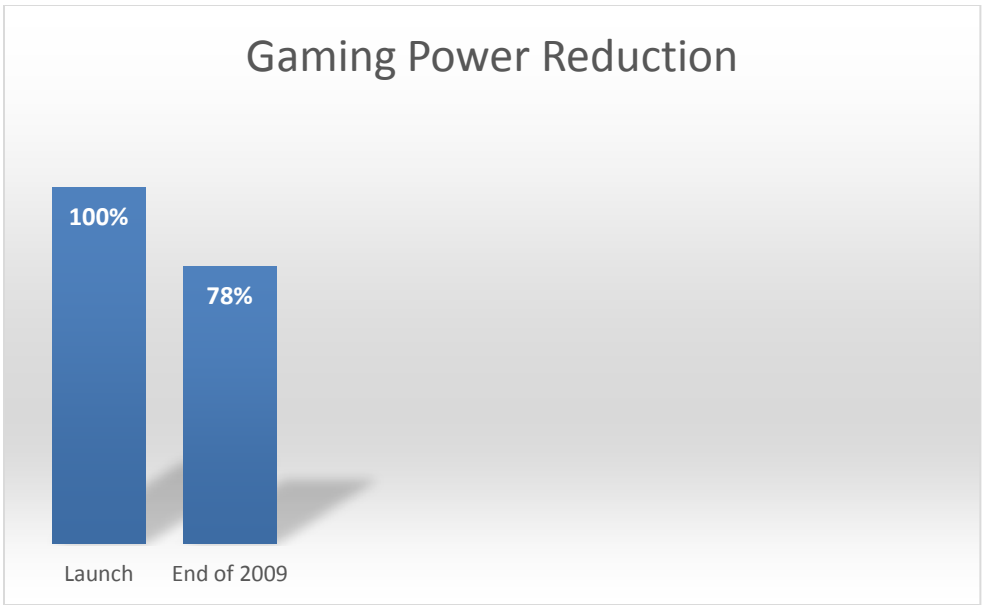
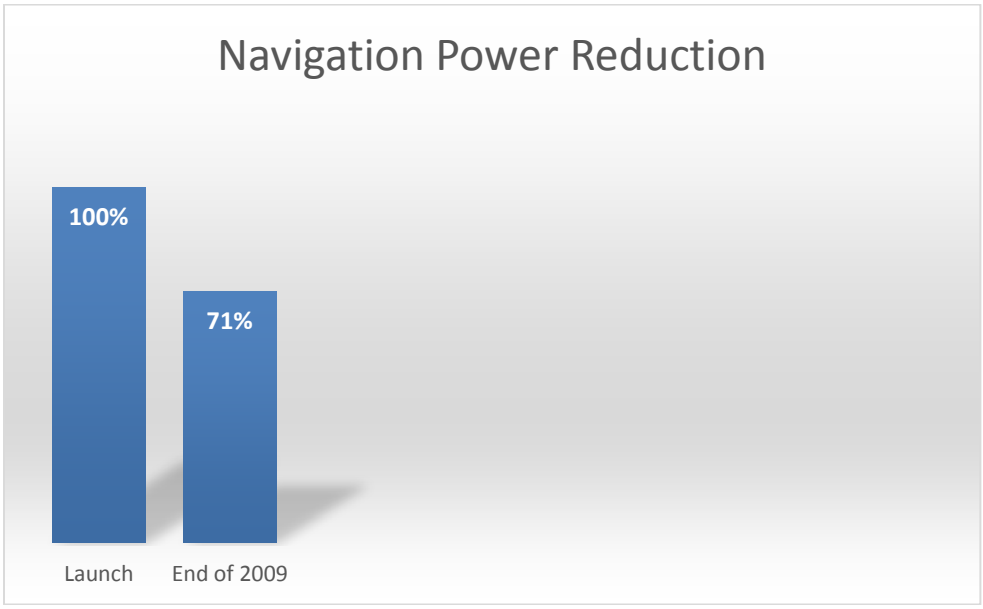


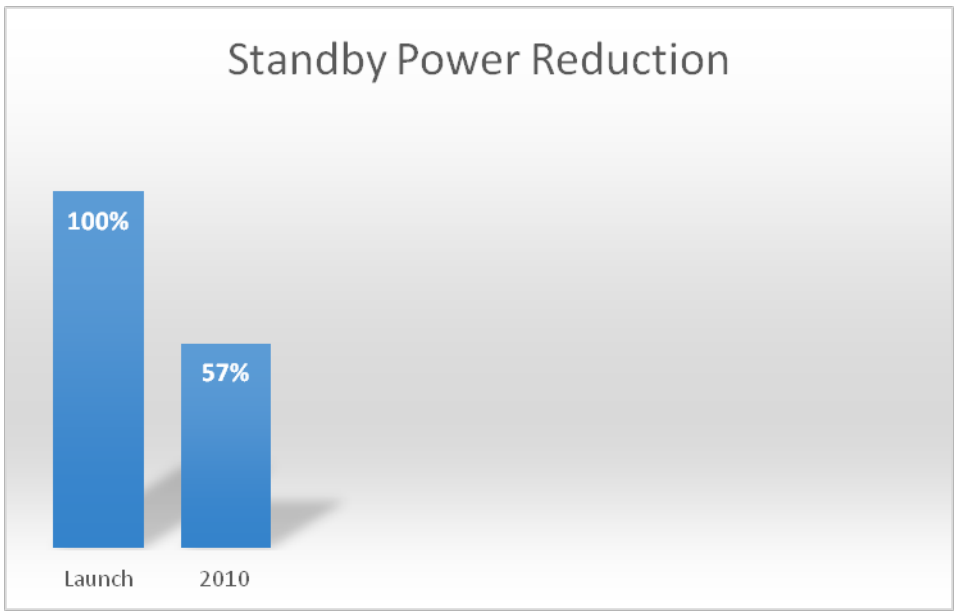


Nintendo Wii

Nintendo Wii has the lowest energy usage of the three console systems, and as a result there is limited ability to make further, substantial reductions in energy usage. Nevertheless, Nintendo also has continued to reduce the energy consumption of the Wii, and today's model uses 22 percent less power in active gaming mode and 43 percent less power in standby mode than the model launched in 2006. Because the Wii U just launched in late 2012, it is too early to provide comparative information on improved energy efficiency relative to the launch model.


Gaming Power Reduction
100%
78%
Launch
End of 2009


Navigation Power Reduction
100%
71%
Launch
End of 2009



C. Hardware Technology

1. *How efficient are the power supplies of game consoles currently in the market?*

To the extent game consoles use external power supplies, those power supplies comply with applicable CEC and DOE efficiency requirements.

2. *To what extent do manufacturers take advantage of existing performance scaling capabilities in console processors?*

Previously, processors were either "on" or "off." They used approximately the same amount of electrical power whether they were performing a complicated function or sitting and waiting for a new command. A processor with power-scaling capability uses electrical and computing power proportionate to the task at hand. Such a processor needs fewer watts for media play, for example, than for active gaming.

Console makers have committed to taking into consideration scaling down of power use in proportion to the function when new technologies and/or functionalities are introduced. However, power scaling does not have infinite elasticity. In order for the manufacturer to achieve a certain downscaled number for media streaming, the manufacturer may be forced to use a chip that has an energy ceiling below that which is optimal for other, non-scaled functions, like game play. Alternatively, a subset of chips that could handle both extremes may exist (e.g., a chip designed for high-end ultrabooks) but at an exorbitant cost relative to what is an affordable option for a device priced at several hundred dollars.

Of course, power scaling has limitations. Even though there is scalability in processor power, there are still minimal power demands even when idling. These demands are proportional to the maximum power requirements of the processor. This means that a processor that requires 100 watts for a complicated task may still require 40 watts when idling and 70 watts while performing a simpler task.

There are other limiting factors. Power scaling technology applies mostly to CPUs and GPUs. However, these components are only two of many that require significant power. Others include the hard disk drive, optical disk drive, specialized interface processors, and a fan. Memory, power conversion, and distribution components and other support circuitry all require a power overhead in order to simply respond to the first command. Therefore, while a console utilizing power-scaling silicon optimized for high-performance gaming will use considerably less electrical power while performing less complex functionality (e.g. media play), it cannot achieve the same actual power levels of stand-alone products optimized to deliver only the less complex functionality.

D. Market Characteristics

1. *How many game consoles were sold in California in 2006 and projected for 2012 through 2015 by brand and model?*

We do not have state-specific sales data.

2. *If California-specific figures are unavailable, please provide U.S. figures.*

Year	Total U.S. Home Console Sales (YTD)
2006	11,500,000
2007	17,600,000
2008	21,000,000
2009	20,500,000
2010	19,000,000
2011	17,000,000
2012	11,600,000

Source: The NPD Group/ Retail Tracking Service

E. Market Competition for Efficient Products

1. *What are the current market drivers initiating the improvement of game console energy efficiency?*

The game console business model provides a powerful financial inducement for console makers to make consoles more energy efficient over the course of a model's

lifespan in the marketplace. Please see above discussion in section (A)(14) for further details.

2. *How are consumers identifying the most and least efficient products on the market?*

In our experience, consumers do not focus on energy efficiency when comparing console systems.

III. Conclusion

The unique design and lifecycle of game consoles provides a compelling financial incentive for console makers to drive down costs and energy consumption as the model matures in the marketplace. This persistent trend, coupled with console makers' other voluntary efforts to improve energy efficiency have yielded, and will continue to yield, substantial improvements. For these reasons, it is not necessary for the CEC to develop a mandatory standard for game consoles. We look forward to a further discussion of these matters at the upcoming workshop.

APPENDIX #1

Test Procedure for All Modes for Game Consoles

This is a tentative draft outline being considered in the industry and concrete requirements will be considered in the future.

5.1 Scope

The purpose of this test method is two-fold:
Measure game console energy use in the major operating modes
Verify conformity with the auto-power down standard.

This test procedure covers the game console major operating modes listed below. It is
understood that not all game consoles provide all the modes listed.

1. Active Gaming
2. Navigation
3. Media Playback
    a. DVD
    b. Blu-ray Disc
    c. Streaming HD
4. Off/Standby after Auto-Power Down
5. Off/Standby after pressing the Off button
6. Off/Standby when switched off from controller
7. Other modes for research purposes

5.2 Testing Requirements

5.2.1 Game and Media Selection

Game title: The tests shall be conducted with retail software written specifically for the
console under test, certified by the console manufacturer. Select the top 3 selling game
titles for the console under test in the previous calendar year.

5.3 Number and selection of units to be tested

The selection and number of units to be tested shall follow the requirements of the regulation or voluntary standard this test procedure is being used to verify.

5.4 Approved meters, testing accuracy and test conditions

Refer to IEC 62087 specification on “Methods of measurement for the power consumption of audio, video and related equipment”.

5.5 Equipment Unit Under Test (UUT) Preparation

1. Record the manufacturer and model name of the UUT on the test sheet.
2. Connect to display through HDMI connection if available, or AV connection if the console is not High Definition capable.

3. Power the UUT on.
4. Console to peripherals connections, such as Infra Red and Bluetooth, should be configured as shipped.
5. Network connection: For consoles with wireless capability, power to a wireless LAN
radio (e.g. IEEE 802.11) should remain on during testing and must maintain a live wireless connection to a wireless router or network access point, which supports the
highest and lowest data speeds of the client radio, for the duration of testing. For consoles without wireless capability, the Ethernet connection should be enabled.
6. Ensure DVD upscaling is set to on
7. Remove any disk (media or game) from UUT.
8. Apart from above settings, ensure that the UUT is configured as shipped including all
accessories and motion sensor bar if available connected, Wake-on-LAN (WOL) enabled,
power management and software shipped by default.
9. Power the UUT off.
10. Connect an approved meter capable of measuring true power to an ac line voltage
source set to the appropriate voltage/frequency combination for the test.
11. Plug the UUT into the measurement power outlet on the meter. No power strips or UPS units should be connected between the meter and the UUT. For a valid test to take place the meter should remain in place until power data is recorded for all modes.
12. Record the ac voltage and frequency.
13. Power the UUT on.

5.6 Energy Consumption Measurement and Auto-Power Down Verification Test Method

The following modes, if provided in the UUT, shall be tested as indicated below:

5.6.1 Navigation Mode Testing

14. Power the UUT on.
15. Wait until the operating system has fully loaded, and the Home Menu is displayed and stable.
16. Disable all power management.
17. Set the meter to begin accumulating true power values at an interval of less than or
equal to 1 reading per second. Accumulate power values for a minimum of 5 minutes
and record the average (arithmetic mean) value observed during that period.

5.6.2 Media Playback DVD

18. Insert the test DVD movie.
19. Navigate through DVD menu and play the video for 15 minutes.

20. Set the meter to begin accumulating true power values at an interval of less than or
equal to 1 reading per second. Accumulate power values for the first 5 minutes of the
video and record the average (arithmetic mean) value observed during that 5 minute
period.
21. Eject the DVD.

5.6.3 Media Playback Blu-ray Disc

22. Insert the test Blu-ray Disc (BD) movie.
23. Navigate through BD menu and play the video for 15 minutes.
24. Set the meter to begin accumulating true power values at an interval of less than or
equal to 1 reading per second. Accumulate power values for the first 5 minutes of the
video and record the average (arithmetic mean) value observed during that 5 minute
period.
25. Eject the BD.

5.6.4 Streaming HD

26. Enter the console's online movie service, and access the test movie (same title as for the DVD and Blu-ray test).
27. Play the movie for 15 minutes.
28. Set the meter to begin accumulating true power values at an interval of less than or
equal to 1 reading per second. Accumulate power values for the first 5 minutes of the
video and record the average (arithmetic mean) value observed during that 5 minute
period.
29. Exit video streaming mode, go back to Home Menu.

5.6.5 Off/Standby after pressing the Off button

30. Press Off button
31. Wait for 5 minutes for the Off/Standby mode power to stabilize
32. Set the meter to begin accumulating true power values at an interval of less than or
equal to 1 reading per second. Accumulate power values for at least 5 minutes and record the average (arithmetic mean) value observed during the measurement period.
33. Power the UUT back on.

5.6.6 Off/Standby when switched Off from controller

34. Power UUT Off using controller. If the controller offers several ways to power the
console Off, use the most commonly used/most intuitive way, and record your choice
35. Wait for at least 5 minutes for the Off/Standby mode power to stabilize
36. Set the meter to begin accumulating true power values at an interval of less than or
equal to 1 reading per second. Accumulate power values for at least 5 minutes and record the average (arithmetic mean) value observed during that 5 minute period.
37. Power the UUT back on.

5.6.7 Navigation Mode APD

38. Wait until the operating system has fully loaded, and the Home Menu is displayed and stable.
39. Wait for 65 minutes and do not perform any interaction with the console or controller
so as not to delay APD.
40. Set the meter to begin accumulating true power values at an interval of less than or
equal to 1 reading per second. Accumulate power values for at least 5 minutes and record the average (arithmetic mean) value observed during the measurement period.
41. Power the UUT back on.

5.6.8 Active Gaming APD

42. Wait until the operating system has fully loaded, and the Home Menu is displayed and stable.
43. Insert disk into console
44. Start game, move beyond any introduction section, play game regularly for at least 5
minutes
45. Wait for 65 minutes and do not perform any interaction with the console or controller so as not to delay APD.
46. Note the time when the console auto-powers down.
47. Set the meter to begin accumulating true power values at an interval of less than or
equal to 1 reading per second. Accumulate power values for at least 5 minutes and record the average (arithmetic mean) value observed during the measurement period.
48. Start the timer
49. Power console back on by pushing a button/key on the controller or console

5.6.9 Disk-Based Media Playback APD

50. Power the UUT back on.
51. Wait until the operating system has fully loaded, and the Home Menu is displayed and stable.

52. Insert movie test title into console
53. Start the movie, move beyond movie menu
54. Once movie is playing, start timer
55. Wait for 245 minutes and do not perform any interaction with the console or controller so as not to delay APD.
56. Note the time when the console auto-powers down.
57. Set the meter to begin accumulating true power values at an interval of less than or
equal to 1 reading per second. Accumulate power values for at least 5 minutes and record the average (arithmetic mean) value observed during the measurement period.
58. Power the UUT back on

5.6.10 Media Streaming Playback APD

59. Wait until the operating system has fully loaded, and the Home Menu is displayed and stable.
60. Locate test movie title on Netflix or the equivalent
61. Start the movie, move beyond movie menu
62. Once movie is playing, start timer
63. Wait for 245 minutes and do not perform any interaction with the console or controller so as not to delay APD.
64. Note the time when the console auto-powers down.
65. Set the meter to begin accumulating true power values at an interval of less than or
equal to 1 reading per second. Accumulate power values for at least 5 minutes and record the average (arithmetic mean) value observed during the measurement period.
66. Power the UUT back on

End of test procedure.

Appendix 2

IN-GAME SAVE MECHANICS		
Game Title	**Publisher**	**Save Procedure**
XBox 360		
Ace Combat 6: Fire of Liberation (*2007*)	Namco Bandai Games	• Auto-save (option to turn-off) between missions • Also manual save option • Each mission takes roughly 10-20 minutes to complete
Alan Wake (*2010*)	Microsoft Game Studios	• Auto-save at checkpoints, roughly every 3-4 minutes of game play • Option to resume to last checkpoint
Batman: Arkham Asylum (*2009*)	Eidos Interactive, Warner Brothers	• Auto-save, roughly every 3-5 minutes of game play
Crysis 3 (*2013*)	Electronic Arts	• Auto-save at checkpoints every 3-5 minutes of game play
De Blob 2 (*2011*)	THQ, SyFy Kids	• Auto-save, roughly every 3-5 minutes of game play
Fifa 13 (*2012*)	Electronic Arts	• Can manually save or auto save after every match on Career Mode • Match time may range depending on the user's choice from roughly 10 minutes to an hour
Forza Horizon (*2012*)	Microsoft Game Studios	• Auto-save between races and free roaming mode • Generally, races last between 3 and 10 minutes
Gears of War 2 (*2008*)	Microsoft Game Studios	• Auto-save at checkpoints every 3-5 minutes of game play
Halo 4 (*2012*)	Microsoft Game Studios	• Auto-Save, roughly every 5-7 minutes of game play • Option to resume to last checkpoint
Lego Lord of the Rings (*2012*)	Warner Brothers	• Auto-save, roughly every 3-5 minutes of game play
Madden 13 (*2012*)	Electronic Arts	• Auto-save for online career mode between games • No auto-save for offline career mode, option to manual save • Game time may range depending on the user's choice from roughly 20 minutes to an hour
Mass Effect 3 (*2012*)	Electronic Arts	• Infrequent auto-save at level progression; option to manual save during game play when the game permits (usually during non-

IN-GAME SAVE MECHANICS		
Game Title	**Publisher**	**Save Procedure**
		combat sequences)
NBA 2K13 (2012)	2K Sports	• Auto-save or manual save option after every game or settings change • Game time may range depending on the user's choice from roughly 20 minutes to an hour
NHL 13 (2012)	Electronic Arts	• Auto-save or manual save option after every game or settings change • Game time may range depending on the user's choice from roughly 15 minutes to an hour
SSX (*2000*)	Electronic Arts	• Auto-saves in between snowboarding "runs" – which last several minutes • Achievements earned over course of "career" carry through to new game sessions
Tiger Woods PGA Tour 14 (*2013*)	Electronic Arts	• Auto-save between rounds • Option to manually save between holes (mid-round) • Each round may take 20 – 40 minutes to complete

IN-GAME SAVE MECHANICS		
Game Title	**Publisher**	**Save Procedure**
PlayStation 3		
Assassin's Creed III (*2012*)	Ubisoft	• Auto-save, roughly every 3-5 minutes of game play
Batman: Arkham City (*2011*)	Warner Brothers	• Auto-save after achievements, roughly every 5 minutes of game play
Battlefield 3 (*2011*)	Electronic Arts	• Auto-save at checkpoints every 3-5 minutes
Borderlands 2 (*2012*)	2K Games	• Auto-save and manual save option after completion of each level • Level completion takes roughly 5 to 10 minutes
Epic Mickey 2: The Power of Two (*2012*)	Disney Interactive Studios, Sony Computer Entertainment	• Auto-save at checkpoints every 3-5 minutes
Final Fantasy XIII-2 (*2012*)	Square Enix	• Infrequent auto-save at level progression; option to manual save during game play when the game permits (usually during non-combat sequences)
God of War: Ascension (*2013*)	Sony Computer Entertainment	• Auto-save at checkpoints every 3-5 minutes • Option to resume to last checkpoint
Gran Turismo 5 (*2010*)	Sony Computer Entertainment	• Auto-save between changes made or between races • Generally, races last between 4 and 15 minutes
Little Big Planet 2 (*2011*)	Sony Computer Entertainment	• Auto-save after completing each level • Level completion takes roughly 5 to 10 minutes
MLB: The Show 13 (*2013*)	Sony Computer Entertainment	• Manual and auto-save available after each game (in "Season" and "Franchise" modes) • Auto-saves when settings change (does not use traditional checkpoints) • Resumes with saved progress
Pirates of the Caribbean: At World's End (*2007*)	Disney Interactive Studios	• Auto-save, roughly every 3-5 minutes of game play • Option to resume to last checkpoint

IN-GAME SAVE MECHANICS		
Game Title	**Publisher**	**Save Procedure**
Resistance 3 (*2011*)	Sony Computer Entertainment	• Auto-save, roughly every 5-10 minutes of game play
Tom Clancy's Ghost Recon: Future Soldier (*2012*)	Ubisoft	• Auto-save, roughly every 3-5 minutes of game play • Option to resume to last checkpoint
Uncharted 3: Drake's Reception (*2011*)	Sony Computer Entertainment	• Auto-save, roughly every 5-10 minutes of game play • Option to resume to last checkpoint

IN-GAME SAVE MECHANICS		
Game Title	**Publisher**	**Save Procedure**
Nintendo Wii U		
Batman: Arkham City Armored Edition (*2012*)	Warner Brothers	• Auto-save after achievements, roughly every 5 minutes of game play
Monster Hunter Ultimate 3 (*2013*)	Capcom	• Manual Save at specific save locations and between quests • A quest can take 5-20 minutes to complete
Need for Speed: Most Wanted U (*2013*)	Electronic Arts	• Auto-save, roughly every 3-5 minutes of game play
New Super Mario Brothers U (*2012*)	Nintendo	• Option to manually save after each level • Each level takes roughly 3-5 minutes to complete
Ninja Gaiden 3: Razor's Edge (*2012*)	Nintendo, Koei Tecmo	• Auto-save at checkpoints, roughly 3-5 minutes of game play
Nintendo Wii		
Scribblenauts Unlimited (*2012*)	Warner Brothers, Nintendo	• Auto-save by traveling between rooms • Option to manual save in-game
Madden NFl '12 (*2011*)	Electronic Arts	• Can save mid-game manually, or auto-save after game • Resumes with saved progress
Mario Kart Wii (*2008*)	Nintendo	• Auto-saves as tracks are unlocked following races, which last roughly 5 minutes • Previously unlocked tracks available upon resume
New Super Mario Bros (*2009*)	Nintendo	• Auto-saves at checkpoints, roughly every 2-3 minutes • Resumes with saved progress
Sonic and the Black Knight (*2009*)	Sega	• Auto-saves at checkpoints, roughly every 2-4 minutes • Option to resume to last checkpoint