Proposal Information Template – Game Consoles

2011 Appliance Efficiency Standards

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Please note: all savings estimates and information in this document are preliminary and are based on data available to the authors at the time of the report. If the CEC moves forward with this topic, we anticipate updating our estimates and recommendations based upon additional input from stakeholders.

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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 video game consoles.

Background

With over 10 million game consoles sold in California since 2005, game consoles have become a significant energy end use in California homes, and some of the installed units may consume as much as 500 kWh/year if users do not turn them off after use.

Leveraging their natural connection to TVs, game consoles are vying to become a general purpose entertainment system, providing new functions in addition to gaming, such as playing movies, browsing the internet, displaying photos, video conferencing etc. This expansion is resulting in longer On hours, and subsequently increased annual energy use. Recent announcements indicate that game consoles are also beginning to expand into the set-top box market, which could exacerbate the energy waste issue by keeping them in a quasi-permanent high-energy On mode, consuming potentially even more energy than current set-top boxes do.

While the latest console models are relatively energy efficient in active gaming mode compared to early models and to PCs of equivalent configuration, they do not significantly scale power down in modes that do not require the full capabilities of the console, such as when playing movies, in idle or pause mode, or when providing other non-gaming functions. This results in significant energy waste over the typical use of the console.

This standard proposal aims to ensure that all consoles sold in California adopt minimum energy efficiency design best practices to minimize energy waste when not fully utilizing the console capabilities. The proposed standard is structured in two tiers, in order to capture low-hanging fruit early while leaving enough time for manufacturers to implement significant design changes in a second tier:

- Tier 1, January 2014: improvements that can be achieved mostly through software changes, as well as minor hardware updates.
- Tier 2, January 2016: improvements that may require the redesign of some parts of the console, but rely on existing and mature technologies in the high tech sector such as in PCs.

Overview

Description of Standards Proposal	We recommend that California adopt a two-tier standard (2014 and 2016) for video game consoles, including auto-power down requirements and power limits in significant modes other than active game play mode.
California Stock and Sales	Based on VGChartz data, we estimate a stock of approximately 10 million units and annual sales of approximately 2 million units in 2010, trending towards 3 million by 2020.
Energy Savings and Demand Reduction	We estimate that the standard would result in the following annual energy savings by 2020 (after stock turn over): Tier 1: Annual energy savings: 340-670 GWh, most likely 500 GWh. Peak demand reduction: 50-95 MW, most likely 70 MW. Tier 2: Annual energy savings: 470-920 GWh, most likely 700 GWh. Peak demand reduction: 65-130 MW, most likely 100 MW. The low and high ends of the range correspond to differing usage pattern assumptions, particularly regarding the extent of networked standby functionality by 2020. These estimates do not incorporate potential market adoption of efficiency measures without a standard. ENERGY STAR for Game Consoles is work-in-progress, its requirements are uncertain at this time, and even when final, there is no guarantee that all manufacturers will meet ENERGY STAR. Appliance standards are the most certain way to guarantee savings beyond business-as-usual.

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 in similar products such as PCs suggests that the cost impacts should be modest. The proposed standard is expected to have a positive impact on jobs due to the following 2 factors: 1. The technologies required to scale power are in part developed in California. Requiring higher energy efficiency in effect shifts part of the console lifecycle costs from energy generation to technology design and manufacturing activities that benefit California's high tech industry. 2. Consumers will be able to reinvest the savings from avoided electricity costs into more labor-intensive economic activities, generating economic growth in California. While these employment benefits are difficult to estimate, the *Energy Efficiency, Innovation and Job Creation in California* report by UC Berkeley Economist David Roland-Holst estimates that for every one fossil fuel job made unnecessary by energy efficiency, up to 50 new jobs have been created across California's diverse economy.
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	Implementing the proposed standard requires the completion of a test procedure to verify compliance. As explained below, we expect the ENERGY STAR test procedure to be finalized by then and to be fully adequate for the purposes of this standard.
Federal Preemption or other Regulatory or Legislative Considerations	There are no known interactions with other existing laws for this standard. There is currently no federal mandatory standard, and there is significant potential for California to influence the direction of national adoption. The Department of Energy is scheduled to begin a rulemaking for '*Computers, Computer Equipment and Certain Computer Components*' which could cover game consoles. However its scope is uncertain and this rulemaking is in its very early stages with significant uncertainty in the schedule. At the very earliest, the effective date would be in 2018, when California's standard would have already reached full stock turnover. There are other legislative and voluntary initiatives under-way on game consoles: In the EU, Ecodesign Lot 3 includes Game Consoles and Lot 26 covers Networked Standby which impacts game consoles. Both these standards are under development. As their timeline, final adoption and final levels are uncertain, we recommend CEC moves forward with a California standard and monitors the EU standards. EPA is currently developing a recognition program for game consoles. As with other ENERGY STAR programs this would be voluntary, there is no guarantee that it will be adopted by all manufacturers. We recommend California moves forward with a California standard and monitors the ENERGY STAR program.

Methodology and Modeling used in the Development of the proposal

Savings estimates were developed using the best available data from a number of sources as well as our own assumptions as detailed below.

A test method to measure power in each mode and verify non-power requirements such as auto-power down is being developed as part of the ENERGY STAR program, on the basis of a straw-man test method developed by NRDC in collaboration with the game console industry. The first draft of the ENERGY STAR test method is available on the ENERGY STAR web site at http://www.energystar.gov/index.cfm?c=revisions.game_console_spec. ENERGY STAR expects the 2nd draft of its game console performance requirements and test method to be available by end October 2011. We can reasonably expect the final version to be adopted by end of 2011 or very early 2012, in time to be leveraged for California Appliance Standards.

Data, Analysis and Results

Sales

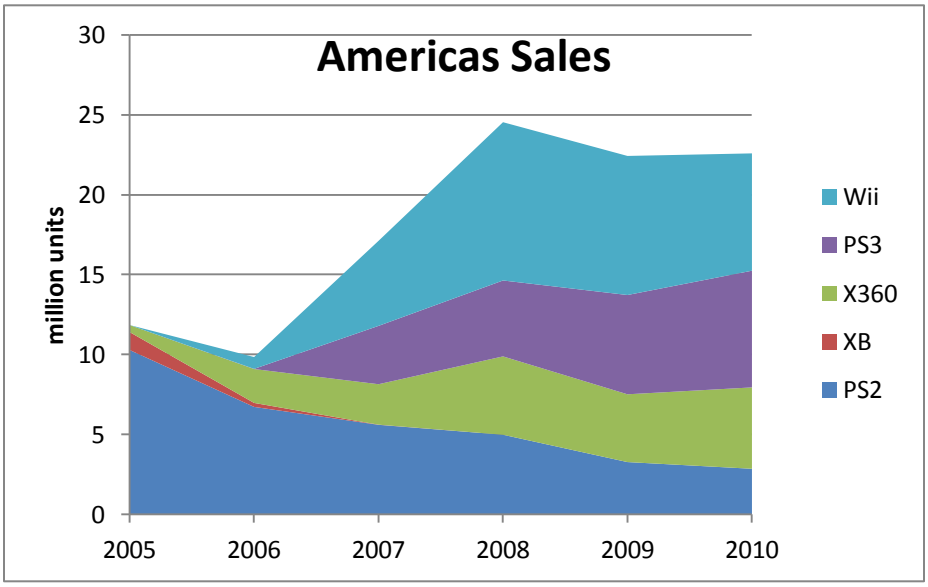
California sales were extrapolated from the Americas region sales as provided by VGChartz: http://www.vgchartz.com/hw_annual_summary.php.

The extrapolation factors used were the following:

Table 1: California Sales Extrapolation factors

Americas to US	73%	Ratio of US to Americas GDPs (Americas including North, Central and South America)
US to California	12%	Population ratio

Figure 1: Historical sales



We extrapolated 2005-2010 sales using a logarithmic trend line, assuming continued market growth following economic recovery and continued California population growth, however we factored in slowing growth due to increasing saturation of game consoles in California homes.

Figure 2: Sales Projections

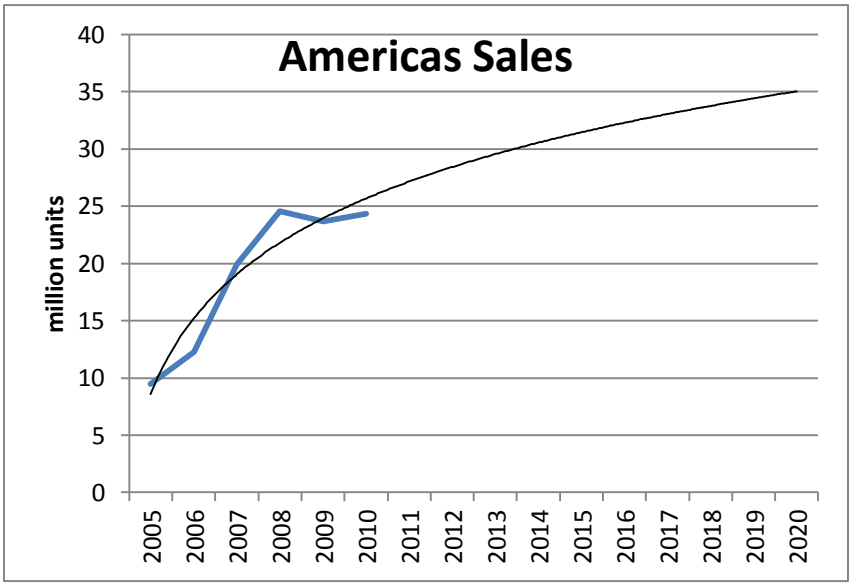


Table 2: California Sales Assumptions

Year	Americas	US (M)	CA (M)
	(million units)	**73%**	**12%**
2005	9.45	6.90	0.83
2006	12.26	8.95	1.07
2007	19.95	14.56	1.75
2008	24.56	17.93	2.15
2009	23.69	17.29	2.08
2010	24.36	17.78	2.13
2011	27.14	19.82	**2.38**
2012	28.42	20.74	**2.49**
2013	29.54	21.56	**2.59**
2014	30.55	22.30	**2.68**
2015	31.45	22.96	**2.76**
2016	32.28	23.57	**2.83**
2017	33.05	24.12	**2.89**
2018	33.75	24.64	**2.96**
2019	34.41	25.12	**3.01**
2020	35.03	25.57	**3.07**

Duty Cycle

Average time spent in each mode was derived from the following sources:

- CEA Gaming and Energy Study, September 2010
- Measured usage data from one console manufacturer.

As the modes measured by each data source are defined slightly differently, we reconciled and combined the data as presented below:

Table 3: Console Duty Cycle

Duty cycle summary	CEA Study	Manufacturer	Combined
Active game play	6.9%	7.5%	**6.9%**
Pause/Idle	4.6%		**4.6%**
Navigation		1.4%	**1.4%**
Media	4.6%	0.6%	**4.6%**
Off/Standby	83.9%	90.4%	**82.5%**

Preference was given to the CEA study over manufacturer data when overlapping, as CEA study covers all 3 consoles while manufacturer data is for one console model only.

Note that there is significant uncertainty around game console usage: the CEA study is based on phone interviews of adults (not including minors which are a significant if not the primary user population of consoles), and manufacturer data is for one console model only. Anecdotal evidence suggests higher time spent in Pause/Idle mode than reported in the above data sources, at least for some console models which provide few visible and auditory signs of being on when the TV is switched off or displaying content from other sources. This can easily lead users to forget to turn consoles off for long periods of time. We believe that these duty cycle estimates are conservative but have used them for lack of more comprehensive and accurate data.

Power Use per Mode

Power use in each mode comes from a combination of manufacturer data as well as direct measurements by NRDC. Measurements were taken on 2010 console models.

Table 4: Power per Mode

Function	PS3 Slim 2010 (W)	Xbox 360S 2010 (W)	Wii 2010 (W)	Average[1] High Def (W)
Active game play	93.0	82.0	14.0	**87.5**
Pause/Idle (Game, Media, Nav.)	84.0	73.5	14.0	**78.8**
Navigation	79.0	70.0	12.0	**74.5**
Media (movies, music, internet)	75.0	65.0	14.0	**70.0**
Networked standby	11.0	N/A	10.0	**11.0**
Off/Standby	0.7	0.3	1.3	**0.5**

[1] The average is for PS3 and Xbox 360 only, per explanation above.

The average power use was based on high definition (HD) consoles only (PS3 and Xbox360), not including Wii (which is Standard Definition), because Wii's successor announced for 2012, the Wii U, will also be HD, and we assume that by the time the standard goes into effect most of the market will have shifted to HD. We assume that Wii U will use an amount of power comparable with other HD consoles. We will review these assumptions as soon as more information is available on Wii U and other consoles latest models.

Savings Estimates

Table 5: Tier 1 Savings

Scenario	Annual Energy Savings[2] (GWh)	Peak Demand Reduction (MW)	Annual Savings by 2020 ($M)	Lifetime Unit Savings ($)	
				Low	High
Low - 10% of consoles use networked standby	343	48	$48	$16	$136
Medium - 50% of consoles use networked standby	506	71	$71	$24	$131
High - 90% of consoles use networked standby	669	94	$94	$31	$126

Table 6: Tier 2 Savings

Scenario	Annual Energy Savings[3] (GWh)	Peak Demand Reduction (MW)	Annual Savings by 2020 ($M)	Lifetime Unit Savings ($)	
				Low	High
Low - 10% of consoles use networked standby	471	66	$66	$22	$142
Medium - 50% of consoles use networked standby	697	98	$98	$32	$140
High - 90% of consoles use networked standby	924	129	$129	$43	$138

Notes:

1. Assumes a 3-yr life-cycle: savings from more efficient models are captured for 3 years
2. Savings estimates are conservative as they do not take into account the reduction in Active Game Play energy use which will likely result from increased efficiency in other modes.
3. High lifetime unit savings correspond to a scenario where use leaves console on (Pause or Idle) 50% of time (not necessarily a typical situation). It is intended to reflect savings potential for people who do leave their consoles on a significant portion of the time. The Low estimates represent the average savings across the stock using the CEA study average duty cycle.

[2] After stock turnover

[3] After stock turnover

Proposed Standards and Recommendations

Table 7: Proposed Tier 1 and Tier 2 Measures

Function	Tier 1 – Jan 2014	Tier 2 – Jan 2016	Rationale
Auto Power Down (APD)	Enabled by default	Enabled by default	See detailed APD proposal in Appendix A Savings estimate: 50% reduction in idle time.
Active Game Play	N/A	N/A	No limit on active gaming for fairness with gaming PCs and in order not to impact performance.
Inactive - Gaming (Pause)	70 W	60 W	Console needs to scale power down when not fully utilizing the capabilities of the device.
Navigation	70 W	60 W	Modest reductions from current levels, recognizing that this is a transitory mode with a limited impact on annual energy use.
Media (movies, music, internet)	50 W	25 W	Benchmarks: - Most efficient standalone Blu-Ray player: 9.9W - Wii movie streaming: 14 W
Other modes (internet browsing, photos, music, set-top…)	70 W	60 W	Same as Navigation. If any of the other mode emerges as one of the primary uses of consoles, specific limits would need to be set.
Standby/Off	0.5 W	0.5 W	Same as EU Ecodesign 1275/2008
Networked Standby	4.0 W	2.0 W	Same as proposed EU Ecodesign Lot 26

These levels are preliminary and need to be discussed with stakeholders for technical feasibility and cost-effectiveness.

Please note that our proposal does NOT include a modal limit for Active Game Play. As such the proposal would not limit gaming performance. The proposal is focused on reduce power use in functions which do not require the full capabilities of the consoles.

Bibliography and Other Research

As indicated within the document.

References and Appendices

Appendix A: Auto-Power Down Function

The following requirements form the basis of the auto-power down (APD) agreement for games consoles developed by NRDC, Sony, Microsoft and Nintendo:

- Consoles will be shipped with auto power-down enabled such that the user does not have to opt-in to activate the APD function in accordance with ErP regulatory requirements.
- The user shall not be automatically prompted to permanently disable the auto-power down at any point.
- The user shall have the option to disable APD for all modes and for Active Game mode only. Consoles shall present the option of disabling APD for Active Game mode only first so as to encourage users to leave APD enabled for other modes.
- The user shall have the option to change the time settings for the auto-power down function from within the equivalent system settings menu options e.g. for retail display purposes or for heavy game users.
- After activation of auto power-down, consoles will switch-off to Standby and/or allowable Sleep modes as defined in this proposal.
- The trigger used to activate auto-power down is user inactivity, and this will function across all operational modes (with the exception of the specifically defined exemptions explained below). The period of inactivity required to trigger auto-power down will differ depending on the specific use of the consoles as defined further below.
- By default, auto power-down must be set at 1 hour or less from the time of the last user input.
- Consoles shall not auto-power down during the first 4 hours while audio-visual Media Playback remains active (including video files, streaming audio-visual content, IPTV or Digital TV).
- When in gaming mode consoles shall auto-power down (following the requirements of this procedure) only for games placed on the market from January 2014 onward.
- In limited circumstances users may be prompted to cancel the APD timer temporarily to allow certain types of games or media content to run without user input e.g. simulation games which run without user input for periods longer than 1 hour:[4]
    - Upon starting such games or media content the user will be prompted to temporarily suspend auto-power down if required.
    - Auto-power down will be re-enabled when the console is next powered on.
- After an automatic wake event, consoles shall power down within 5 minutes after performing required system maintenance and downloads, or other functions that may require an automatic wake-up.
- Accessories bundled with the console and using the console as a direct power source shall also power down and will be included in auto-power down power measurements.
- Console operating systems must support *auto-save and resume* where this is also supported by and appropriate for game software by providing means:
    - For notification between the console and software in advance of impending auto-power down
    - To enable game software to save information as appropriate to avoid loss of user data or game position
    - To ensure users can be automatically returned to their saved game after an auto-save event.

[4] This will reduce the likelihood of users trying to permanently disable auto-power down in such circumstances.