The electricity consumption and energy savings potential of video game consoles in the United States

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Background

Over 100 million current-generation video game consoles have been sold in the US. In addition to increased sales, game consoles are consuming more energy as they become more powerful computing machines. For example, the launch models of the Microsoft Xbox 360 and Sony PlayStation 3 both consume over 175 W when in active use, while the previous models of these consoles consumed less than 100 W at launch. In addition to playing video games (historically their only function), consoles can play physical media, stream digital media from local or Internet sources, and provide access to a host of media and online services, causing the usage of game consoles to increase. The power consumption of video game consoles is increasing, the quantity of game consoles in US homes is increasing, and it is likely that the amount of time they are being used is increasing, resulting in a rapid increase in overall electricity consumption.

Figure 1: *Active power consumption of the three PlayStation console generations over time. The color of the circle corresponds to the console generation that model falls under, and area of the circle represents worldwide sales of the model (from redesign date forward). The figure shows both the trend of increasing power consumption between models, due to increased computational capabilities, and decreasing power consumption within a model, due to improved design under fixed performance.*

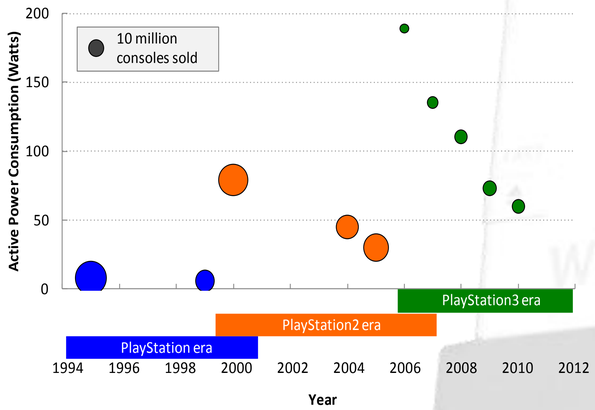
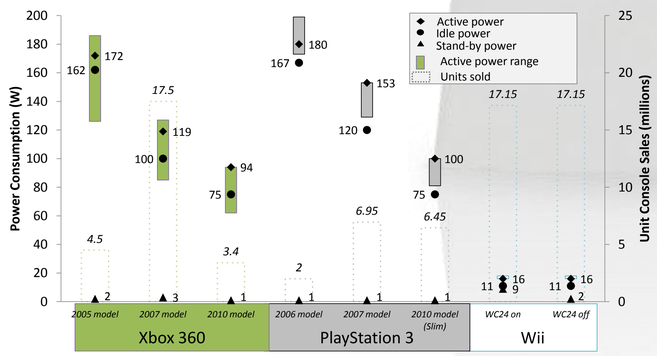


Figure 2*: Power consumption and sales figures of current-generation video game consoles. Ranges are provided for the active power.*



Estimated Console Electricity Consumption

Using the data for power consumption, number of consoles in American homes, and time the consoles are operational in each of the three modes (active, idle, and stand-by), we estimate that total console electricity consumption in the US was 16 TWh in 2010. This is roughly 1% of annual US residential electricity consumption and is double the annual electricity consumption of the state of Rhode Island. 16 TWh is approximately 330 kWh per game console per year, though actual consumption depends strongly on which console is being discussed and how it is used.

Table 1*: Base case total US console electricity use by operational mode and by console type. Energy units are GWh in 2010.*

(GWh in 2010)	Xbox 360	PS3	Wii	All
Stand-by	370	90	1,100	1,600
Active	1,600	890	80	2,600
Idle	6,800	4,100	1,000	11,800
Total	8,700	5,100	2,200	**16,000**

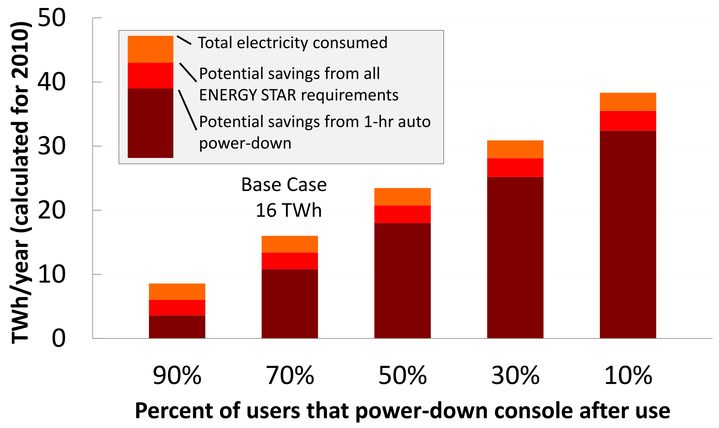
Value of Energy-saving Improvements

There are several technical options for reducing overall electricity consumption of video game consoles. Overall consumption can be decreased by reducing the power consumption in any or all of the modes of operation (stand-by, idle, or active use), or by increasing hardware flexibility so that less computationally-intensive tasks can be performed with some of the processing resources disabled. Proposed ENERGY STAR requirements target energy use in two distinct ways. The first specifies limits on how much power the console can use while operating in each state. The second specifies how long the console can be left in various states, increasing the likelihood that the console will be in its lowest power state. We find that the auto-power down requirement would save more energy that all other ENERGY STAR requirements combined, as long as more than 7% of users leave their consoles idle when not in use (Figure 3).

Table 2*. ENERGY STAR Game Console Requirement (version 5.1) summary.*

	Phase One	*Phase Two*	*Phase Three*
Operational Mode Power Requirements			
Sleep	2 W	1 W	1 W
System idle	--	45 W	25 W
Media playback	--	--	35 W
Power Management Requirements			
Sleep mode engaged after 1 hour inactivity	✓	✓	✓
Console must power down immediately after auto-wake event		✓	✓
Power management settings enabled by default	✓	✓	✓

Figure 3*: Total electricity consumed by video game consoles and potential savings of auto power-down and all ENERGY STAR Tier 3 requirements, as a function of the percent of users that manually power-down the console after use.*



Conclusions

We estimate that the total electricity consumption of video game consoles in the US was around 11 TWh in 2007 and 16 TWh in 2010, an increase of almost 50% in three years. Assuming that 30% of consoles are left idle, the savings from a 1-hour auto power-down, which could be enabled on most of the 75 million existing current-generation consoles by a firmware update, could have reduced residential energy consumption by about 1% in 2010. While the energy savings from a 1-hour auto power-down amounts to 1% of residential electricity, it is perhaps more important to note that it could be achieved with almost no upfront cost, no change in the quality and level of service provided to consumers, would have no adoption/implementation delay, and does not rely on any action or decision on the part of consumers.

Acknowledgements

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