

# The Latest-Generation Video Game Consoles: How Much Energy Do They Waste When You're Not Playing?




The latest-generation game consoles are on track to gulp a massive amount of electricity—enough to power all the homes in Houston, the nation’s fourth-largest city, for a year—and cost consumers more than \$1 billion annually. Astoundingly, \$400 million of that will be spent when the consoles are in “standby” (a.k.a. sleep) mode and no one is using them. NRDC’s latest testing and analysis shows the recently introduced Microsoft Xbox One is the biggest energy user, followed by the Sony PlayStation 4; their consumption is two to three times higher than their predecessors.<sup>1</sup> In comparison, the Nintendo Wii U is an energy sipper.

NRDC’s analysis shows that collectively these new consoles will use roughly 10 billion kilowatt-hours of electricity annually in the United States alone, enough electricity for all of Houston’s homes, once all previous-generation consoles in use have been replaced by these newer ones.<sup>2</sup> Although the


new consoles have incorporated some energy-saving design features, including better power scaling (drawing less power when doing less work) and transitioning automatically to a lower-power state after an extended period of user inactivity, more improvements remain achievable and necessary.

## PROJECTED VIDEO GAME CONSOLE U.S. ENERGY CONSUMPTION

**ANNUAL ELECTRICITY CONSUMPTION**  
**10-11** BILLION KILOWATT HOURS PER YEAR



EQUIVALENT TO THE OUTPUT OF **4** LARGE POWER PLANTS\*  
\*500 MEGAWATTS EACH



**\$1** ANNUAL ELECTRICITY BILLS **BILLION**



AS MUCH ELECTRICITY AS ALL THE HOUSEHOLDS IN THE CITY OF **HOUSTON**  
4TH-LARGEST CITY IN THE U.S.



## PLAYING MORE THAN GAMES

With an estimated 110 million units sold in the United States since 2005—enough to have one in almost every home in America—game consoles use several power plants' worth of electricity annually. Over the past five years, they have expanded to new functions such as playing Blu-ray movies and streaming online video and music, resulting in longer periods of use. The latest-generation consoles also draw more power to play games, due to their significantly higher processing and graphics capabilities. Some offer voice and motion recognition, which can significantly increase energy consumption if not implemented in the most efficient manner.

As a follow-up to NRDC's groundbreaking 2008 report on the energy use of video game consoles,<sup>3</sup> we performed extensive laboratory tests on the latest generation of the most popular consoles—the Nintendo Wii U, Sony PlayStation 4, and Microsoft Xbox One.<sup>4</sup> We measured their power draw in key operating modes and compared them with their predecessors (Wii, PS3, and Xbox 360), as shown in Figures 1 and 3.

The manufacturers have incorporated many energy efficiency features into their designs. However, the overall electricity consumption of the new consoles still increased two- to threefold for the Xbox One and PS4, compared with their predecessors. Our analysis shows most of the increase in annual energy consumption is due to excessive power draw in standby mode, as seen in Figure 2, and, for the Xbox One, more time switched on due to its TV viewing feature (represented as Media in Figure 2). Other contributing factors, although to a lesser extent, are the higher “on mode” power consumption for game play and video streaming with the Xbox One and PS4. Meanwhile, the Wii U consumes slightly less energy than its predecessor the Wii, despite providing higher-definition graphics and faster processing capabilities, in large part thanks to its very low power draw in connected standby mode.

### A Quick Look at the Most Popular Consoles

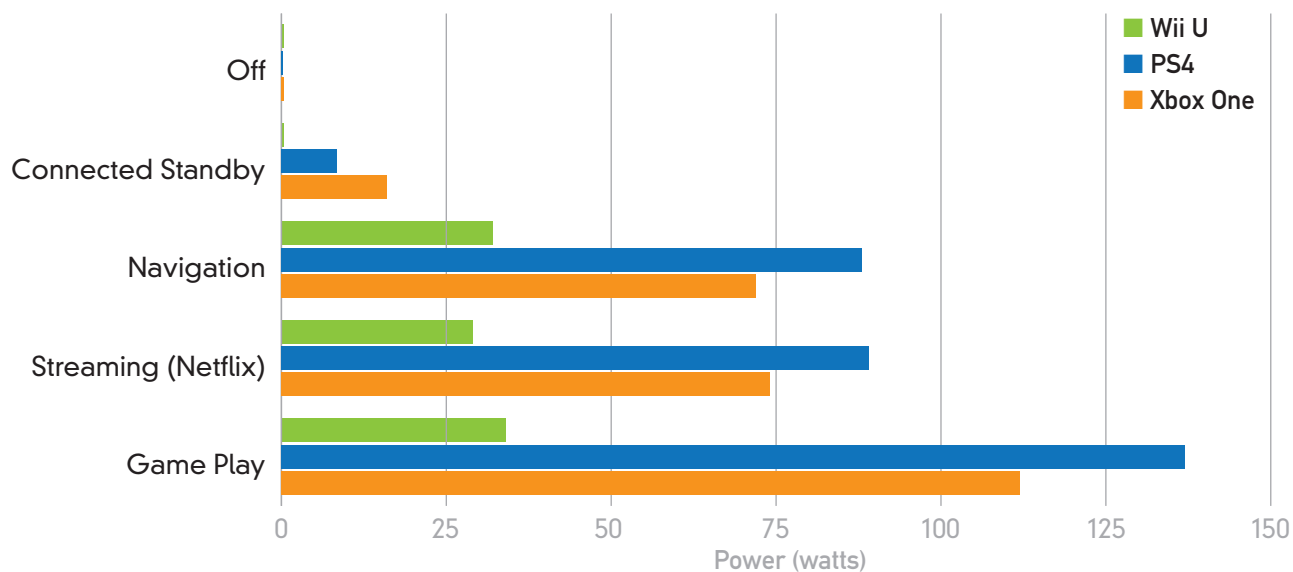
**Nintendo Wii U:** Consuming on average just 37 kilowatt-hours (kWh) annually, the Wii U is the energy saver of the group. Attracting buyers with interactive, community-oriented game play rather than high-end graphics, the Wii U takes far less energy to operate than its competitors. In particular, it consumes very little energy when switched off, even though it remains connected to the Internet and checks for updates.

**Sony PlayStation 4 (PS4):** Targeted at enthusiastic gamers, the PS4 draws the most power to play games and watch videos. However, it manages to hold its overall annual energy consumption to 181 kWh by limiting power when in standby but connected to the Internet. It could still reduce standby power to levels comparable with the Wii U, which would reduce its energy consumption further.

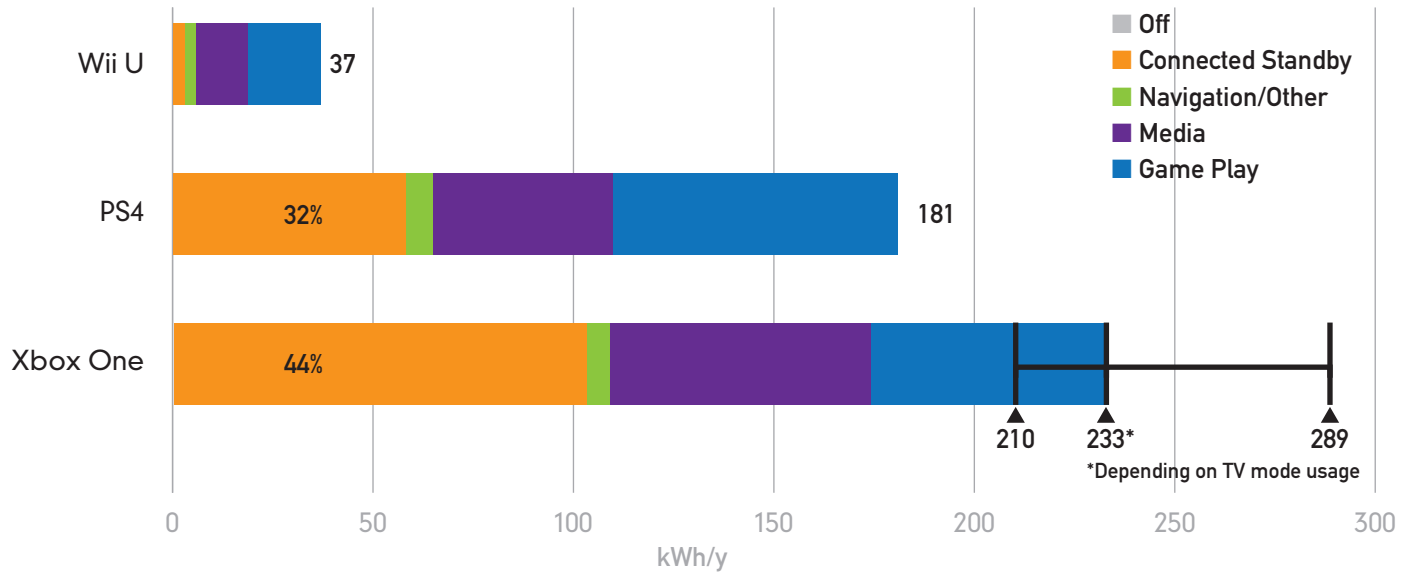
**Xbox One:** Aimed both at serious gamers and at TV viewers who want to control their television through their console, the Xbox One draws less power than the PS4 to play games and watch videos. However, its overall energy consumption of nearly 300 kWh annually when using TV mode is much higher than that of both its competitors, due to its need to remain on all the time when TV is being watched, and to its high power demand when listening for a voice command 24/7, even when in standby.

Although the PS4 draws more power during game play and streaming, when one considers the time spent in each mode the Xbox One consumes more energy annually than its competitors as shown in Figure 2. Almost half of that energy is used in connected standby mode, in which the device consumes 15 watts around-the-clock as it listens for a voice command—even in the middle of the night or when no one is home.

Figure 1: Power demand in the most common operating modes



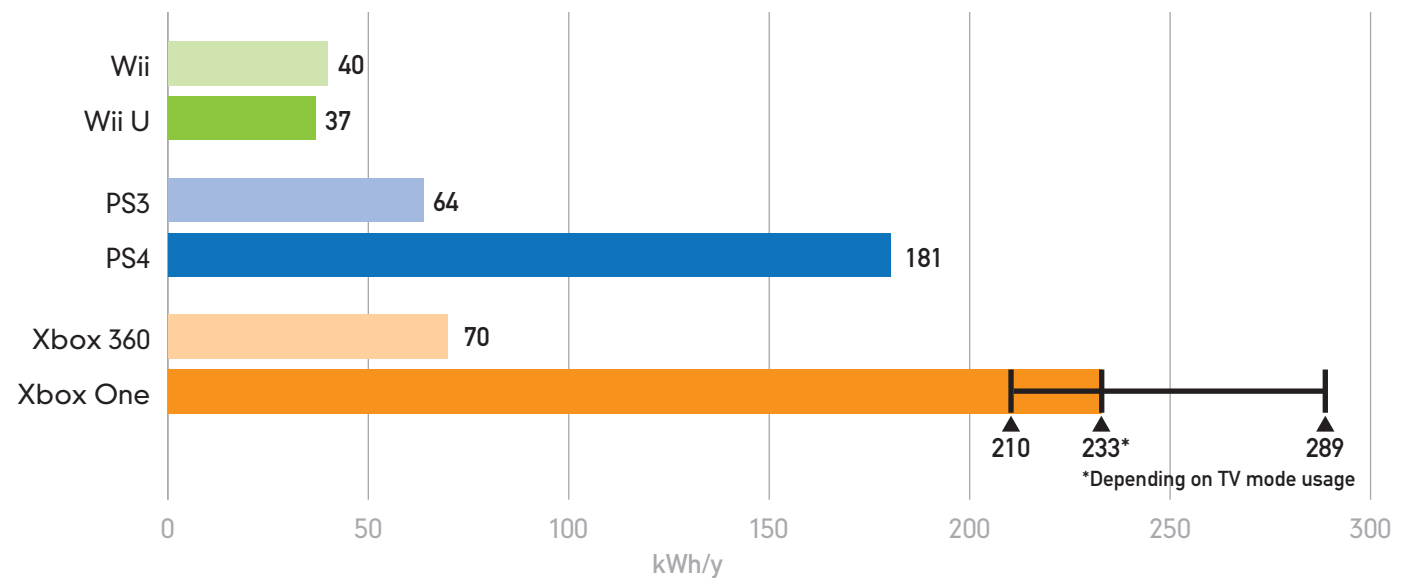
**Figure 2: Annual energy consumption**



Other key findings:

- The newest generation consoles, on average over the course of a year, gobble up more energy when showing videos and in standby mode than when playing games.
- If left unchanged, Xbox One's always-listening voice command feature alone would be responsible for \$400 million in annual electricity bills and consume the equivalent annual output of a large, 750-megawatt power plant, once all older Xbox 360 have been replaced by new Xbox One consoles.
- Almost one-third of PS4 energy consumption takes place in standby mode, due in part to higher power than necessary to keep USB ports always active in standby, even when no peripheral is charging.
- When set up for TV viewing, Xbox One uses an average of 289 kWh/y. This is 79 kWh/y more than in traditional non-TV viewing setup. 233 kWh/y represents a weighted average. If all Xbox One owners in the United States used their consoles for watching TV, this mode alone would add an extra \$300 million to their annual utility bills. The 3 billion kilowatt-hours of electricity consumed would be equal to the annual output of a large (500-megawatt) power plant—enough to power all the households in Boston for a year.
- The PS4 and Xbox One draw 30 to 45 times more power to stream a movie than dedicated media players such as Apple TV, Google Chromecast, or Amazon Fire TV.

**Figure 3: Newest vs. previous generation (annual energy consumption)**



## CONCLUSION AND RECOMMENDATIONS

There are many opportunities for game console manufacturers to substantially reduce the energy consumption of the newest-generation models right now. They should do so as soon as possible to avoid locking in higher than necessary utility bills for their owners for the life of the consoles. While higher performance and new features may require some additional power, this does not justify wasting significant amounts of energy when providing little or no function.

NRDC is making a series of improvement recommendations to manufacturers that could reduce electricity use by another 25 percent beyond natural trends in increasing semiconductor efficiency. **This would save U.S. consumers an additional \$250 million annually in electricity bills and conserve enough energy to power all the households in San Jose, the 10th-largest city in the United States.**

Some of these recommendations only require settings or user interface changes; they can be implemented rapidly on new products and even on existing products via software updates. Others require hardware design changes and will need more time, but work should begin on them without delay.

We urge manufacturers to:

- Allow users to opt out of Xbox One's "instant-on" and voice-command, and PS4's standby features, in their initial setup menus so these high energy-consumptive modes are used only when chosen.
- Reduce Xbox One power draw when in connected standby with voice command enabled.
- Reduce PS4 power draw in standby.
- Reduce Xbox One TV-mode power, and give users the option to watch TV when the console is off or in a very-low-power state.
- On both the Xbox One and PS4, reduce video-streaming power to levels closer to that of a dedicated video player.

### How to Save Energy in Your Own Home Immediately

While it is first and foremost the manufacturers' responsibility to implement design best practices to minimize energy waste, gamers can make some minor changes to the settings of their new consoles to reduce electricity consumption in the meantime. Here's how:

#### **Set your console to auto-power down when inactive.**

With the new Xbox One and PS4, go into the unit's system menu to ensure the automatic power-down feature is enabled and set for one hour of inactivity or less.

#### **Avoid instant-on and other connected standby modes until manufacturers make them more efficient.**

Even with automatic power-down enabled, Xbox One's "Instant on" and PS4's standby modes are configured by default to remain connected to the Internet and perform various other functions, which can represent a third to almost a half of their total energy consumption, so consider disabling those features.

#### **Beware of Xbox One's high-energy TV mode.**

Xbox One can be set up to allow TV control from the console, including the use of voice command to change channels, but that means the console has to be on whenever you watch TV—adding 72 watts to TV viewing. To put this into perspective, it's more power use than that of a new 42-inch TV.

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## Endnotes

- 1 Testing was performed on launch units with system updates up to mid-April 2014. The effects of any system updates and hardware improvements released after that date are not reflected in this report.
- 2 This estimate also accounts for efficiency improvements likely to be achieved via advances in semiconductor design in the coming years.
- 3 Noah Horowitz, *Lowering the Cost of Play: Improving the Energy Efficiency of Game Consoles*, NRDC, November 2008, [www.nrdc.org/energy/consoles/files/consoles.pdf](http://www.nrdc.org/energy/consoles/files/consoles.pdf).
- 4 [www.nrdc.org/energy/game-consoles/default.asp](http://www.nrdc.org/energy/game-consoles/default.asp)

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