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Is Standby Electric Power Required?



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ABSTRACT

Home electric appliances and gas appliances consume a small amount of electricity even when they are not used. This is called standby electric power. This electricity consumed is low but accumulates over a long period. Additionally, its usage fee is high, at least in Japan. Is the continuous consumption of standby electric power necessary? Should not the outlet be unplugged to reduce the consumption of standby power? In this article, we will introduce our research results and thoughts.



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INTRODUCTION

Household electric appliances can consume a small amount of electricity even when they are not being used for their intended purpose. For example, if a home electric appliance has a clock, it will need electric power to display the time. In addition to electrically generating sparks and igniting gas appliances when in use, they continue to use a small amount of electricity to maintain a pilot fire and to prepare to burn a large amount of gas at any time. Such minute power is called standby electric power¹⁾. If the gas equipment is an instant ignition type, it may not be necessary to maintain the pilot fire. Although the standby electricity consumption is low, it adds to the usage fee over time, particularly in Japan. The ratio may a high percentage of the total electricity consumption, and the cost is estimated to be several thousand yen per year for Japanese households^{1),2)}. Currently, it is recommended to reduce standby electric power consumption of unused appliances to save power. By replacing inefficient appliances with the latest energy-saving models, one can reduce their electric bill and decrease power consumption. However, upgrading to new appliances is costly and, for the betterment of the global environment, households are suggested to continue using the existing appliances to save resources³⁾.

There are various types of products that consume standby electricity. Some consume a small amount of power when simply connected to an outlet, some need to be operated with a wireless remote control without a cable connection, and some require preliminary heating and cooling⁴⁾. Those with a timer function, those with a time display, and those with a lamp indicating energization too consume a small amount of power continuously. However, is so much of continuous standby electric power consumption necessary? Is it possible to unplug the outlet to save power? In this article, we will introduce our research results and ideas.

Notably, for example, this study does not examine refrigerators' cooling function and electric stoves' heating effect. These products' original purposes are to cool food and warm a room; it cannot, therefore, be said that the power consumption is on standby. More power-saving products are being developed with the evolution of home electric appliances. The cooling and heating effects will change depending on the opening and closing of the doors and the

arrangement in the room. Consequently, power consumption would reduce. However, we will not consider such appliances in this study.

When standby electric power is not required

There are four types of home electric appliances: A) Those that do not have a main switch, and, therefore, have no standby electric power consumption; B) Those that do not consume power when their main switch is turned off; C) Those that consume standby power even when the main switch is turned off; D) Those that do not have a main switch and consume standby power⁴⁾. Some home electric appliances currently in widespread use are always on (If an outlet is connected, it corresponds to C) and D) above). Typical examples of home electric appliances (corresponding to A) include the ones that do not cost electricity when not in use, even when the power supply is always possible with the outlet plugged in. Some examples are hair dryers, electric fans (simple functions only), irons, and electric kettles^{2),5)}. A hairdryer is a typical product that does not consume standby electric power even if it is connected to an outlet. It does not need to be pre-heated, and it usually does not have a timer function. Consequently, it does not consume power during standby. Power is not applied with a manual switch-activated fan without a remote control unless the push button switch is pressed. Those with remote control for operation are often designed to insert a dry cell into the remote control unit and emit infrared rays or radio waves (equivalent to D) above). Since the main body has a light-receiving part of the light beam from the remote control and is ready to operate at all times, the remote control and the main body inevitably consume some standby power. Electric kettles often do not consume standby electric power. When the switch is pressed, heat is generated, which is used to boil water. No other element consumes power at that time. The switch directly connects to the product startup and does not need extra functions, such as a timer and a time display. Therefore, even if the outlet is plugged in, it will not consume any electricity⁵⁾.

When standby electric power is required

The ratio of equipment that uses standby electric power is shown in Fig.1. The following are typical examples of devices that cost electricity if left plugged: oil fan heater (stove, equivalent to C) in the previous section); personal computer (PC; equivalent to C)), toilet (equipped with toilet seat heating and warm water washing function, equivalent to D)), air conditioner

(equivalent to D)), television (equivalent to C))⁵⁾. An oil fan heater is a heating device that burns kerosene, but it has a timer function (such as starting heating at a certain time) and a temperature measurement function, which consume standby power. The current temperature is often displayed on the liquid-crystal display panel, but power is consumed for that as well and the display is functional even during standby. A PC also uses power to display the time and store data. Toilet seats are also heated even when not in use, and electricity is required to periodically circulate wastewater and water when there are no people to prevent clogging of nozzles through which water flows¹⁾. An air conditioner is operated by a remote control that uses infrared rays or radio waves. Power is required to send and receive this light¹⁾. Televisions are also currently normally remote-controlled. In daily use, these appliances are in a state where the main power switch is continuously on, or when there is no main power switch, and an outlet is connected, the main power is turned on. However, for some devices (air conditioners, TVs, etc.), switches that are generally not used may be installed in places where it is difficult to see them; if you can operate the switch from that spot, you may not need the remote control. Therefore, the device may not consume power on the remote control side. However, the light-receiving part on the main body side continues to be in the standby state, and the situation under which power continues to be used does not change. Even when using an AC adapter, the circuit needs the power to maintain a stable current from AC to DC¹⁾.

Details of standby electric power occurrence

To consider the kind of action that can reduce standby electric power, Fig. 2 shows how the amount of power applied changes depending on the usage mode. Traditionally, several home electric appliances come with wireless remote control. In the past, with TVs and electric fans, for example, it was necessary to approach the main body and operate it by pressing a button or turning a dial, making it indispensable for the user to move to the front of the device. When an air conditioner is installed at a high place, it can be operated with remote control without touching the main body. This indicates that the ceiling is exceptionally high and can be easily operated even when an air conditioner is installed at a place that is out of reach. A small amount of power is always consumed for driving this remote control and responding to the light-receiving part of the main body. Therefore, for the user's convenience, remote control is required. Standby electric power is indispensable for operating the remote control.

Other home electric appliances do not necessarily have a remote control. Nevertheless, in the case of a fan heater, the heating time can be reserved in advance with the timer function. Heating starts automatically, say when the user wakes up or returns home, without any human intervention. The device can be heated up to the set temperature, which can be further controlled by the thermostat function. Alternatively, it is possible to turn on the power and set the temperature using a smartphone, in case the user wants a comfortable temperature when entering the room. Maintaining the temperature does not necessarily consume standby electric power; however, it can be considered standby electric power because it can be preset and stored. In the case of a PC, it is necessary to maintain and read the data in the Random Access Memory (RAM). Since this data is maintained if it is energized, even if the user does not operate the PC directly, turning on the main power and leaving it may cause the PC to read the data. The fact that the built-in battery continuously measures the time can consume standby electric power⁵⁾.

The water supply function of the toilet does not necessarily require electricity, but Japanese toilet makers often add various functions to the toilet seat, such as the heating of the toilet seat that keeps heating the seat even when no one is using it. The other type does not perform this function. Some have an in-built function that washes the user's buttocks, and consume power to inject water at a high pressure. Another type can eliminate odor by generating ozone after use. In some cases, the toilet seat lid is opened and closed by a motion sensor, and it is not necessary to touch due to hygiene considerations. These are intended to supplement the original usability of the home electric appliance and make it more comfortable to use. Nevertheless, even without its function, the minimum purpose of the home electric appliance can be achieved. As described in the previous section, it is considered that such devices have several unnecessary functions for convenience and that it is possible to reduce power consumption. Heated toilet seats are often unplugged and unused, especially in the summer. If one does not want to consume standby electric power, one should utilize only the original minimum functions. Home electric appliances that have only the basic functions have been around for a long time, but are generally difficult to sell or purchase. This is because several consumers want to pursue convenience and prefer the additional functions over the savings in electricity bills.

Power saving measures

It is best to unplug a device to reduce standby electric power consumption⁶⁾. However, since it has functions such as the need to preheat the product and automatic cleaning regularly, it may take a long time to start up when needed. Since the timer function also stops, it may impair the wake-up time of the appliance. It should also be noted that the period of misuse might lead to higher product deterioration. Further, frequent plugging and unplugging of the outlet can strain the plug and cord. When an outlet is plugged in, an electric current is suddenly generated, which may damage the electric circuit or the cable. In such a case, it may be better to utilize a power-saving tap that can be turned off with a switch for each plug²⁾. Using an extension cord or a device that has an energization switch for each outlet can be another means of reducing standby electric power consumption. However, the switch port may be accompanied by blinking or lighting of the light, which may consume a small amount of power.

As of 2008, the average annual power consumption of a household in Japan was 4,734 kWh, of which about 6%, 285 kWh, is estimated to be consumed by standby electric power. The cost of this standby electric power in Japan is 6877 yen¹⁾. This has changed to 4,432 kWh, 228 kWh (5.1%), and 6156 yen, respectively, in 2011^{2), 6)}. Although power consumption has decreased due to the evolution of home electric appliances, the degree of decrease in proportion to standby electric power has not changed much; standby electric power is still consumed. This may be due to the convenience demanded by the purchasers/users of home electric appliances. If the main power of unused home electric appliances is turned off, standby electric power consumption will reduce by 19%, and about 1200 yen can be saved on the annual electric bill. It is estimated that if the user unplugs unused home electric appliances or switches off the taps, they can save 49% of their electricity consumption and about a 3,000 yen reduction in electricity bills²⁾.

CONCLUSION

In this study, we examined whether it is necessary to consume the standby electric power generated by home electric appliances and gas appliances. Standby electric power is often required for the convenience of using products through remote control and automated driving in many products. However, standby electric power consumption could be minimized if the user opts for only the minimum functions, the ones found in old household appliances. However,

many home electric appliances on the market in Japan and other countries are not only upgraded regularly to reduce their power consumption efficiently but also so that they can be functionally convenient. The product lineup continues to exclude traditional products. It is now difficult to obtain products with limited necessary functions. Additionally, it is challenging to get a new product in Japan; one can get a second-hand product or import a foreign product. Doing so is laborious, charges shipping fees, and is uneconomical. No matter how much standby electric power is consumed sustainably, there is no advantage in getting such a product at a higher cost. If we were to think about the global environment seriously, we should not only use home electric appliances conveniently but also save electricity even if it is inconvenient.

This study does not consider energy conservation in home electric and gas appliances' evolution. As a fundamental content, we do not consider power consumption due to power transmission. It is thought that a small amount of power will be consumed by simply turning on the breaker of the switchboard of a house, or plugging the extension cord into the outlet, thus generating current and electric costs. If one wishes to eliminate the electricity costs incurred on standby completely, they may need to go back to that point and take adequate measures.

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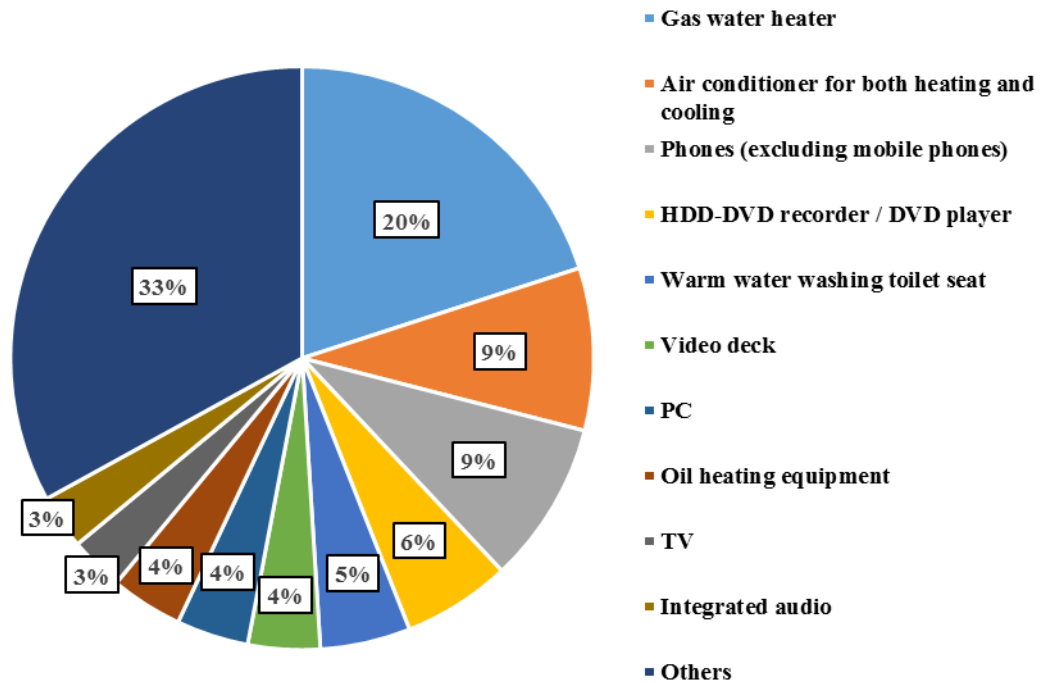


Fig. 1 Breakdown of standby electric power (by equipment)

Based on the 2008 Standby Electric Power Consumption Survey Report (Energy Conservation Center) and reference 1).

In 2011, it changed as follows: gas water heaters, 19%; TVs, 10%; air conditioners for heating and cooling, 8%; phones, 8%; HDD / DVD recorders, 6%⁵⁾.

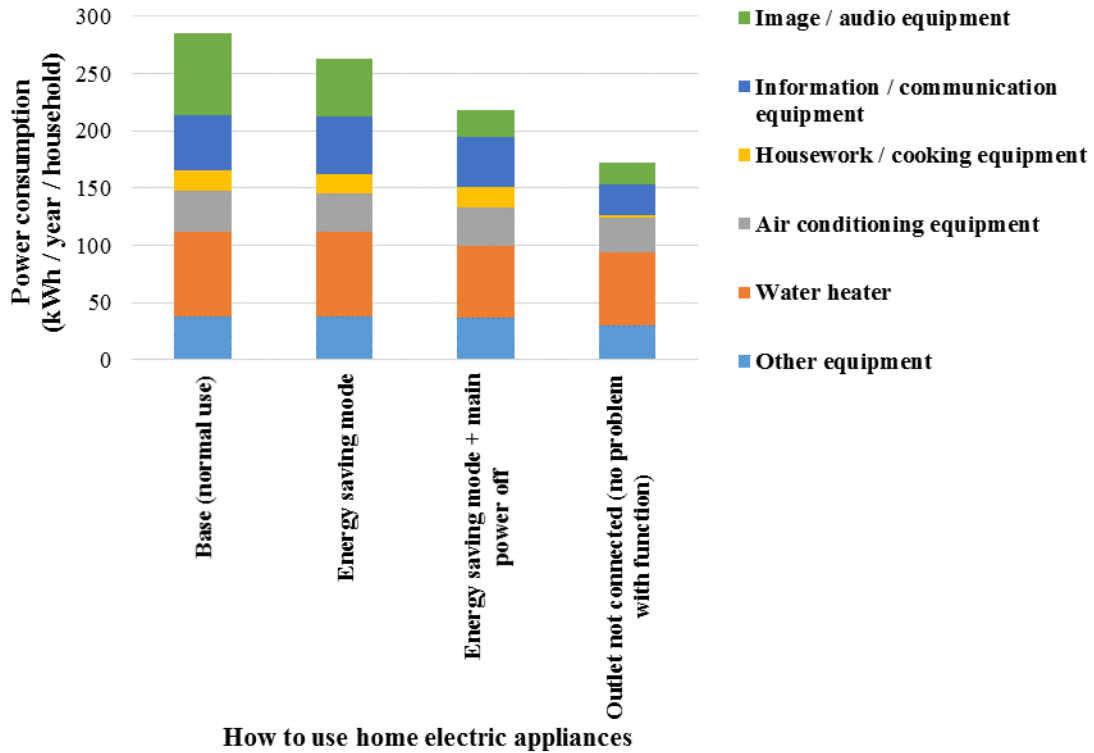


Fig. 2 Standby electric power saving effect by energy saving mode, main power off, and unplugging

Based on the 2008 Standby Electric Power Consumption Survey Report (Energy Conservation Center) and reference 1).