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Unplug for SAVINGS

A fter years of research, by government agencies, utilities, and others, much is known about energy hogs in the home, such as space heating, space cooling, and hot water. We know a lot less about the collection of so-called plug load devices that include everything from TVs to toasters—due in no small part to the very diversity and rapid evolution of these devices. Energy Center of Wisconsin recently completed a field study designed to address that gap for Minnesota homes. We wanted to know how much energy these devices use and to identify low- and no-cost savings opportunities for these devices.

The study relied on extensive metering and interview data for 50 Minnesota owner-occupied households. These households were recruited from a 1,000-household telephone survey and a 260-household postal survey. The sample was geographically and demographically stratified and was weighted to reflect the larger population of Minnesota homes. The data were collected in four rounds between December 2008 and October 2009, to ensure that the results were seasonally balanced. This article presents some of the highlights of the study and summarizes our findings and recommendations.

How Much Electricity Do Plug-In Devices Use?

Based on monthlong metering of more than 700 devices in 50 Minnesota homes, we estimate that plug-in devices (excluding major appliances and lighting) consume 15–30% of the typical home’s electricity use. Home electronics (TVs, computers, and audio equipment—and their associated peripherals) account for about half of this consumption. Space heaters, dehumidifiers, and other portable space-conditioning equipment account for another quarter. (Look for an upcoming article on dehumidifier energy use.)

Many of these devices use electricity all the time for such functions as display clocks and remote-control response (see “Leaking Electricity,” HE Nov/Dec ’93, p. 33). We estimate that this standby electricity consumption accounts for about 20% of the electricity used by plug-in devices, or about 4% of home electricity use.

What Savings Opportunities Exist for These Devices?

Based on the usage patterns we found during this study, we considered five low- and no-cost ways that people can reduce the electricity used by plug-in devices.

- They can enable computer power management.
- They can manually unplug devices that draw standby power when they are not in use.
- They can manually turn off devices that are left on but not used.
- They can use “smart” power strips to eliminate standby power consumption of peripherals (for example, a DVD player) when the main device (for example, a TV) is turned off.
- They can use timers to turn on and off devices that are used only at certain times of the day.

We scoured the metering data in the 50 homes looking for opportunities that would save at least 25 kWh per year. After extrapolating from devices that we metered to the full population of devices in Minnesota homes, we estimate that implementing these five strategies could save an average of 300–600 kWh per year per home.

Not all of these savings are realistically achievable, given varying levels of homeowner interest and imperfect implementation of strategies, especially those that require habitual action. When these factors are taken into account, a more realistic (though speculative) behaviorally adjusted estimate of the average savings potential per home is about 150–300 kWh per year.

Note, too, that these are only averages. Among individual homes in the study, the estimated savings potential ranged widely, from nearly nothing to 1,500 kWh per year, depending on how many and what kinds of devices people had in their homes.

Computer Power Management—A Significant Opportunity

The single most important opportunity that we identified was computer power management, which accounts for about 40% of the (behaviorally adjusted) savings potential. The data we collected show that about two-thirds of desktop computers in homes either are left on all the time or are idle for long periods each day. Moreover, 80% of desktops do not have sleep.hibernate enabled for the computer (most are set to put the monitor to sleep, however). The end result? Based on our data, it appears that fully 75% of desktop computer electricity use occurs when no one is actually using the computer.
Our analysis—which was based on metering data as well as occupancy sensor data showing when someone was at the computer—suggests that simply enabling sleep/hibernate for these computers could reduce their electricity use by about 50%, or nearly 300 kWh per year. In other words, in two of every three Minnesota homes, simply changing computer settings could reduce home electricity use by about 3%.

Further, we found that many homeowners were unaware that their computers were not optimally configured to save energy, and that many homeowners were willing to implement more aggressive power management. Indeed, in nearly half of the cases where we identified this as an opportunity, the homeowner immediately implemented it with no active encouragement on our part—and the limited follow-up that we conducted suggests that most or all of these homeowners have stuck with the new settings. While our study stopped short of measuring savings from the actual implementation of this strategy, the fact that this no-cost, one-time opportunity is widely available, appears to save a substantial amount of electricity, and is apparently very popular suggests that it is well worth pursuing.

(One note—most of the computers that we encountered were several years old and were probably shipped with sleep/hibernate disabled. New computers have been shipped with power management enabled since about 2007.)

Other Savings Opportunities

About 30% of potential savings are realized by unplugging devices when not in use, to eliminate standby power consumption (see “What Were They Thinking?”). Among the homes we studied, four devices accounted for most of these opportunities. These devices were

- compact stereo systems that drew 5–20 watts or more continuously and were rarely used;
- older CRT TVs that drew 10 watts or more of standby power;
- computer printers drawing 4–8 watts of standby power that were typically used for only a few minutes a week; and
- TV peripherals, particularly VCRs and VCR/DVD players, that were rarely used.

We also identified a number of opportunities that could be realized by turning off devices that were left on for inordinate lengths of time. While some of these opportunities were related to TVs, stereo receivers, and other home electronics devices, unattended or inappropriate use of space heaters and dehumidifiers also played a role. Altogether, we estimate that these opportunities account for about 10% of savings potential.

Timers offer a relatively low-cost way to depower devices on a regular basis. We considered timers for applications such as cable and satellite set-top boxes, computer networking equipment, and tool chargers.
Set-top boxes make up a full quarter of TV-related electricity use and are notable in that they are always on, with no easy way to turn them off (see “Standby for Set-Top Boxes,” HE Nov/Dec ’01, p. 16). While a few households would consider turning off power to set-top boxes with a timer, at night or during working hours, most people were reluctant to interfere with the operation of set-top boxes. This was because it takes set-top boxes a long time to recover settings, because it is difficult to set them up initially, and because many people like to record shows off-hours. Networking equipment and power tool chargers offer other opportunities for the use of timers, however. In all, we estimate that timers account for about 10% of savings potential.

Smart power strips can eliminate standby electricity consumption by depowering peripherals for TVs, computers, and audio equipment when the main device is turned off. Smart power strip opportunities make up about 10% of the savings that we identified, though some of what we classified as a manual unplugging opportunity could also be a smart power strip application.

How Can Programs Best Address These Opportunities?

Many of our study households were interested in saving energy. The energy-saving opportunities they were inclined to implement face two barriers that programs could help to overcome. First, households lack good, easy-to-use information on which of their home’s devices truly matter. And second, most households don’t know which practices would make a real difference.

Much of the energy-saving information to which Minnesotans—or Americans—are exposed is fairly general information. Households hear a barrage of energy-saving tips; everything from “lower your thermostat” messages from utilities to “get new windows” commercials by remodeling firms. For plugged-in devices, households know that turning off equipment is good practice, but they get little feedback on which devices use the most energy when operated, or which ones use significant amounts of energy when they are simply attached to a power source. Finding out takes more effort than most households are willing to invest. It follows that the best way for programs to help households reduce their load from plugged-in devices is to educate them.

Well-designed consumer education with specific messages from credible sources can help to close the awareness gap. We think that mounting an educational campaign to promote computer power management may be the single most effective step programs can take to reduce so-called plug load. The full report suggests ways in which this campaign might be conducted.

In the report, we also discuss additional messaging on devices with consistently high standby loads and easy household strategies to plug these energy leaks; helping motivated households to identify their own specific savings opportunities; and adding a plug load protocol to energy audits and other investigative visits to homes of people who want to save energy, save money, and reduce waste.

Because of the Minnesota study, we now know more about plug load devices and their energy use, how to mitigate that energy use, and how to design programs for consumers to decrease the energy use of plug-in devices in their homes.

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>> For more information:

The report described in this article, Electricity Savings Opportunities for Home Electronics and Other Plug-In Devices in Minnesota Homes: A Technical and Behavioral Field Assessment, is available through Energy Center of Wisconsin at www.ecw.org/plugload.