



#7 ELECTRONICS

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Home office equipment, audio and video systems, and miscellaneous electronics consume almost 20 percent of all electricity used inside the average home and can cost as much as \$175 per year.¹ While buying more efficient electronic devices can save some of this energy and money, changing how you use the equipment is more effective. For example, most devices consume electricity even when they are turned “off.” By changing your patterns of use with the equipment (e.g., unplugging instead of just turning off the equipment when it’s not in use), you can often save more energy than if you replaced the item with a more efficient one. Moreover, saving energy does not compromise the quality and performance of the equipment, or your experience with it. You can easily have the best of both worlds: great product performance *and* low energy use.

This Brief will be your guide to reducing your home energy bills related to electronic devices, in addition to giving you new insights into the environmental damage electronic products do. Topics discussed include:

- **Energy efficient** office equipment and Energy Star®;
- **Power management** for your computer and other pieces of home office equipment;
- **Standby mode:** Leaking energy while you sleep;
- **Paper use** by electronic equipment;
- **Options to reduce energy consumption** in devices from cell phones to waterbeds; and
- **Life-cycle cost of electronics:** Going beyond the electricity consumed in your home.

ENERGY EFFICIENT OFFICE EQUIPMENT

Energy Star is a government program designed by the U.S. Environmental Protection Agency (EPA) to support the introduction and use of energy efficient products. As one of the original products Energy Star was created to support, the home computer has come a long way in terms of the amount of energy it consumes. In fact, researchers now suggest that Energy Star guidelines need to be raised, as most modern computers

are now Energy Star compliant. Yet, keep in mind that even among Energy Star-compliant computers, the difference in energy consumption can be great. It should also be noted that the Energy Star standard for a computer simply means that the equipment has power management options (e.g., sleep mode), which do not actually affect on-mode power usage. While consumers should always look for the Energy Star label when making a purchase, they should realize that energy costs are determined by their operating habits, which include things as simple as making sure the power management system is properly programmed and enabled (switched on).

Computers

One of the reasons that computers consume so much electricity is that their power management options are often disabled. Enabling such options can save as much as 60–80 percent of the energy that would simply have been wasted. The U.S. EPA’s Energy Star website offers instructions on how to enable power management systems for most PC operating systems, and includes links for Mac users.²

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- No. 2 Lighting
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- No. 6 Cleaning Appliances
- No. 7 Electronics
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- No. 9 Whole System Design



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Energy Star also offers a free web-based software tool that, if installed on your computer, will enable the monitor to go into sleep mode after a designated time interval (say, 10, 15, or 20 minutes).

Simply engaging the power management system on your computer is a good start when it comes to saving energy; turning the unit completely off when it is not in use is even better. Contrary to popular belief, turning a computer on and off frequently is not harmful. In fact letting the unit cool down is beneficial to the durability of the components. Table 1 shows different energy consumption levels and the corresponding electricity bills for different patterns of computer use.

Desktop computers

Desktop computers can draw anywhere from 25 to 110 watts while turned on (computers made in 1998 or earlier pull even more power: between 80 and 160 watts). An increase in power consumption is not directly correlated with processor speed. For example, one type of 1,400-MHz processor pulls 117 watts while a particular 1,800-MHz processor pulls only 63 watts.³ Most new computers are designed with speed-stepping,

which slows down or switches off different parts of the computer when they are not in use. Speed-stepping must be activated, but it can reduce the power draw to just a few watts, depending on the applications being used. Besides actual "on" power consumption, energy consumption of different power management modes can also be a large source of saved or wasted energy. Current Energy Star requirements state that a computer must consume less than 35 watts in sleep-mode. Presently, there are many models available that pull only 2 watts during their sleep-mode.⁴

Power consumption of **computer monitors** depends on the type of monitor. **LCD** (liquid crystal display) screens typically use 57 percent less power than equally sized **CRT** (cathode ray tube) screens. Also, the average power draw in sleep mode for a CRT is 7 watts compared to 2 watts for an LCD monitor.⁵ (Just enabling power management on your desktop computer and monitor could save you about 900 kilowatt-hours per year in electricity and 1,500 pounds in carbon dioxide emissions, assuming the energy saved displaces coal generated electricity. That's equivalent to the carbon dioxide emitted from driving a medium sized car over 2,000 miles.)

Is your computer really going to sleep?

Keep in mind that screen savers are not a form of sleep-mode and they do not save any energy. Thus, you should select a short screen-saver time so that the sleep mode kicks in more quickly.

Also, be aware that a computer can be kept awake if it is constantly getting feedback from exterior sources, such as a network or a fax machine.

Table 1: Power management (PM) energy savings for computers					
Level of usage:	24/7	Home office use (48 hours/week)		Light use (10 hours/week)	
Status:	PM disabled	*PM enabled	**Off when not in use/ PM enabled when in use	*PM enabled	**Off when not in use/ PM enabled when in use
Desktop unit (65W on/ 2W PM)					
energy use per year (kW/year)	567.84	80.37	67.89	43.68	27.25
energy bill per year @ 8.5 cents/kWh	\$48.27	\$6.83	\$5.77	\$3.71	\$2.32
17" LCD Monitor (35W on/ 2W PM)					
energy use per year (kW/year)	305.76	50.42	37.94	31.20	14.77
energy bill per year @ 8.5 cents/kWh	\$25.99	\$4.29	\$3.22	\$2.65	\$1.26
17" CRT Monitor (61W on/ 7W PM)					
energy use per year (kW/year)	532.90	115.07	71.39	83.62	26.10
energy bill per year @ 8.5 cents/kWh	\$45.30	\$9.78	\$6.07	\$7.11	\$2.22
Laptop (15W on/ 1W PM)					
energy use per year (kW/year)	131.04	16.47	16.47	14.56	6.34
energy bill per year @ 8.5 cents/kWh	\$11.14	\$1.40	\$1.40	\$1.24	\$0.54
PM = Power management/sleep-mode options * Computer never turned off but PM is enabled ** Computer turned off when not in use, PM is enabled when computer is on					
Source: RMI analysis					

Energy Star®

Buying a computer with an Energy Star label does not necessarily mean it is going to use less energy while in use than a comparable model. What it does mean is that the computer will use less energy in the sleep-mode options than a comparable model.

Laptops

Laptops are big energy savers compared to desktop computers, and current models are fully capable of performing more than the average tasks required by home offices. They draw from 14 to 25

watts while on, and most go down to 1 or 2 watts during sleep mode.⁶ Using a laptop could save anywhere from 40 to 100 watts, depending on the desktop unit it would replace.

Printers⁷

Although they also produce higher quality prints in less time, **laser printers** consume much more power than **inkjet printers**. If high quality prints are needed, you can still reduce energy consumption by using low-speed laser printers. Such printers average 43 watts whereas high-speed color laser printers use over 100 watts. Inkjet printers use roughly 60 per-

cent less energy than laser printers. When power management is enabled, an Energy Star low-speed black and white laser printer and both black and white and color inkjet printers use 10 watts or less, while a color laser printer uses 35 watts. Table 2 shows the energy-saving benefits of power management in computer peripherals—such as printers—under different scenarios. If you have an older printer that does not have a power management system, there are external control devices that can, for example, switch the printer off after a preset time and then switch the unit back on when a print signal is received. Energy Star has a comprehensive list of such controls on its website (www.energystar.gov).

Copiers⁸

Copy machines can be the largest energy consumer of all your home office devices. Currently, low-speed copiers, which are the type commonly used in homes, pull an average of 115 watts. That can use more than twice as much energy as your desktop computer. Home copiers over eight years old can require up to 400 watts, while some Energy Star copiers use less than 60 watts in low power modes.

Fax machines

Home office fax machines that draw only 10 watts are widely available today. Older units draw well over 30 watts. Combination phone-faxes are particularly efficient for home use, since they only slightly increase the amount of electricity already consumed by telephone answering machines. If you use a fax modem with your computer or have a fax card installed in your printer, you may not need a fax machine at all, and these devices allow you to view

Table 2: Power management (PM) energy savings for computer peripherals

Level of usage:	24/7	Home office use (28 hours/week)		Light use (3.5 hours/week)	
Status:	PM disabled	*PM enabled	**Off when not in use/ PM enabled when in use	*PM enabled	**Off when not in use/ PM enabled when in use
Laser Printer (43W on/ 10W PM)					
energy use per year (kW/year)	375.65	125.80	53.00	92.16	6.62
energy bill per year @ 8.5 cents/kWh	\$31.93	\$10.69	\$4.50	\$7.83	\$0.56
Inkjet Printer (17W on/ 10W PM)					
energy use per year (kW/year)	148.51	95.51	22.71	88.38	2.84
energy bill per year @ 8.5 cents/kWh	\$12.62	\$8.12	\$1.93	\$7.51	\$0.24
Copiers (115W on/ 60W PM)					
energy use per year (kW/year)	1004.64	588.22	151.42	532.17	18.93
energy bill per year @ 8.5 cents/kWh	\$85.39	\$50.00	\$12.87	\$45.23	\$1.61
Fax Machine (10W on)					
energy use per year (kW/year)	87.36	NA	NA	NA	NA
energy bill per year @ 8.5 cents/kWh	\$7.43	NA	NA	NA	NA
PM = Power Management/Sleep-Mode Options * Computer never turned Off but PM is enabled ** Computer turned Off when not in use, PM is enabled when computer is on					
Source: RMI analysis					

your fax messages on-screen. However, pay attention to how a fax card might affect your computer's power management system as it could prevent the hard drive from going into sleep mode.

Multifunctional devices⁹

Machines that can print, scan, fax, and copy are popular today, and the quality of these integrated machines continues to improve. The standby energy of these integrated systems is substantially lower than the sum of several separate units. An Energy Star multifunctional device producing ten images per minute or fewer will use less than 25 watts in sleep mode. The active power for multifunctional devices averages about 82 watts. In addition, the total amount of material and energy consumed in manufacturing is greatly reduced by incorporating up to four devices into one.

OTHER ELECTRONIC EQUIPMENT

Standby mode

The American Council for an Energy Efficient Economy (ACEEE) calculates that "the average U.S. household consumes 50 watts of standby and off-mode power constantly, amounting to about 440 kilowatt-hours per year [per household]."¹⁰ Nationwide, this amounts to about 44 billion kilowatt-hours per year, or the electricity production of five nuclear power plants. And for what? Often it's merely to power little light displays and "instant-on" features! The only way to completely cut power to most electronic devices is to unplug the item or switch off the external power strip. If completely switching off the device is not an option, there are many electronic devices being manufactured today with low standby power requirements. A list of these products can be found on the Energy Star website (www.energystar.gov).

More tips¹¹

There are many other little energy wasters around the average home in addition to those already mentioned. Some tips for reducing these losses are listed below.

- **Waterbeds:** Covering your waterbed with a comforter can cut the power consumption of the heater by 30 percent. Also consider insulating the sides or putting the heater on a timer.
- **Large home appliances other than computers,** such as cable TV boxes, VHS and DVD players, portable stereos, bread and coffee makers are equipped with internal power supplies. These and external DC power supplies of other appliances such as cordless phones, dust busters, and electric toothbrushes can consume 2–6 watts even when the appliance is not in use or fully charged. Although power supplies drawing 1 watt are on the market, there is currently no active labeling program such as Energy Star to tell consumers which ones are most efficient. Efficient power supplies do not affect equipment performance or quality. These devices should be unplugged when not in use.
- **Consider plugging all your entertainment equipment into a power strip which, when switched off, will eliminate any standby draw from these devices, not to mention protect the devices from possible power surges.** If there is a device that must be kept on, plug it into a separate power strip.

Paper use

Manufacturing a piece of paper requires 10–70 times as much energy as the electricity it takes to print on it.

The following are some suggestions that can help reduce your paper use by as much as 75 percent:

- Use narrower margins and smaller (but still readable) typefaces;
 - When possible, edit drafts of documents on-screen and print only final versions;
- Print or copy on both sides of the paper. Most printers and copiers are available with duplex (two-sided printing) options;
- Use the flipside of scrap paper for printing draft documents; and
 - Consider using recycled paper.

LIFE-CYCLE COST OF ELECTRONICS¹²

Whether you work at home or just use your computer to balance the household budget, your patterns of use and choice of equipment can make a big difference—to the environment and to your utility bills. Since more energy goes into manufacturing the typical computer than into operating it, along with power consumption while in use at home, it is important to weigh such considerations as recycled/recyclable material content, upgradability, and end-of-life disposal.

The Silicon Valley Toxics Coalition (SVTC) and Basel Action Network (BAN) point out that electronic waste, or “E-waste,” is the fastest growing type of household waste (at 3–5 percent per year) and accounts for most of the toxic waste stream in the industrialized world. Included in the 1,000+ ingredients of E-waste are large quantities of lead, mercury, cadmium, and brominated flame retardants, along with many other toxic substances. In fact, almost 70 percent of the heavy metals found in landfills are from E-waste.

One would think recycling should be the golden rule when it comes to dealing with E-waste, right? Wrong. SVTC and BAN have found that 50–80 percent of E-waste is exported to Asia, merely transferring the problem elsewhere.

Figure 1: Exported electronic waste in New Delhi, India



Source: BAN & SVTC

Recycling operations are extremely polluting, and because countries such as China, India, and Pakistan have low environmental and occupational regulations, recycling operations in such places can damage human health. In fact, China has banned the importation of E-waste, yet firms in the United States continue to export it there.

In contrast, European nations and Japan are already implementing legislation to deal with this problem. Through take-back and end-of-life management laws, they are placing responsibility for the product after its useful life on the manufacturers. This pushes companies to design for durability, upgradability, and ease of disassembly, which are, in fact, qualities being more and more required by law. Another important trend is the phasing out of hazardous materials in electronic devices. This will help reduce toxicity at the end of a product's life and make it even easier to recycle.

Currently there are no enforced regulations of these types in the United States. In fact, U.S. companies are developing products to meet foreign requirements (and to sell in foreign markets), but they are not making them available in the United States.

Consumers usually spend more time researching electronic devices than they do higher priced items. Along with looking up a device's cost and performance specs, a little research about a particular product's life-cycle footprint could prevent unnecessary environmental damage.

Some companies are making

A mere change of habit

For all home office devices, the best way to reduce power consumption is to get in the habit of turning them on for only as long as you need to use them.

Your printing or copying can be done in one large batch. The fax machine could be turned on only if you are expecting a document. Would-be “faxers” could be asked to call ahead of time.

changes to their products, which should be considered when making a purchase. However, there is not yet a labeling system in the United States that offers third-party verification of electronic devices' environmental footprints that would help consumers make sound choices.

On a final and related note, between the mid-1980s and 2001, the number of cell phone users in the United States jumped from 340,000 to 128 million. As most of these phones are used for less than two years, cell phone waste is becoming a big problem. To reduce the size of this waste stream, cell phone users should look into recycling options and phone donation programs available in their areas. Also, disposable cell phones are on the horizon; be wary of them unless the manufacturer is reusing the phone. And, of course, the rechargeable batteries should be recycled as they also contain several very-toxic substances.¹³

SUMMARY

Great economic and energy savings can be found by simply changing our patterns of use with electronic devices. Turning a piece of equipment off or unplugging it when it's not in use is the easiest way to save energy and money. In addition, Energy Star product listings are a great place to look for energy efficient devices. Keep in mind that even among the products that qualify for Energy Star certification, some are a lot more efficient than required by the Energy Star guidelines. Also, a little extra research when purchasing new electronic devices will help you find products that give you the performance you want with a small ecological footprint.

ADDITIONAL RESOURCES

U.S. EPA's Energy Star — Provides information on available lighting and fixtures whose performance is backed by the government entity. Their website will point out products such as screw-based CFLs, dedicated fixtures, solar powered outdoor lighting and efficient halogen torchieres that can be found in many well-known retail outlets (www.energystar.gov/index.cfm?c=lighting.pr_lighting).

Earth911 — This site is designed to help you find a local recycling center for old appliances or beverage containers, along with many other items. This website will also provide mail-in sources if there is not yet a recycling center near you (www.earth911.org).

SVTC — The Silicon Valley Toxics Coalition's website contains information on E-waste and links to manufacturers' environmental webpages (www.svtc.org or www.svtc.org/cleanc/pubs/2002report.htm#urls).

Inform — This website contains information on recycling and programs going on in other countries (www.informinc.org).

NOTES

1. A. Wilson, J. Thorne & J. Morrill, *Consumer Guide to Home Energy*, 8th ed. (Washington, DC: ACEEE, 2003).
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12. Basel Action Network, "Exporting Harm The High-Tech Trashing of Asia," (California: Silicon Valley Toxics Coalition, February 2002).
13. Bette Fishbein, *Waste in the Wireless World: The Challenge of Cell Phones*, (New York: Inform, Inc, May 2002).

Contact your local utility or energy office for information on rebates that may be available in your area on the purchase of new energy-efficient appliances. This publication is intended to help you improve the resource efficiency of your home. You should use your best judgment about your home, and seek expert advice when appropriate. Rocky Mountain Institute does not endorse any products mentioned and does not assume any responsibility for the accuracy or completeness of the information in this Brief. Written by Sarah Goorskey, Andy Smith, and Katherine Wang. © Rocky Mountain Institute 2004.

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