

Must We Pull the Plug?

New programs aim to cut the juice drawn by leaky appliances

By JANET RALOFF

Increasingly, on all but the largest U.S. consumer appliances today, “the ‘off’ switch is a lie,” says Alan Meier of Lawrence Berkeley (Calif.) National Laboratory. The worst part, this energy analyst argues, is that the public is never told.

Depressing the power switch may blacken the television screen, silence the jazz disc on the stereo, or stop the corn popping in the microwave oven, but these appliances continue to draw power—to maintain memory of certain settings or to keep a remote-control sensor alert, for example. Many newer computers, cable TV boxes, video cassette recorders (VCRs), ceiling fans, cordless drills, and video games likewise stay on while ostensibly switched off.

Says Meier, the rule seems to be more and more: If it’s plugged in, it’s on.

Moreover, he argues, the “off” setting is not only a lie, but a costly one. A typical home uses about 50 watts (W) to power devices that supposedly aren’t on, his data suggest, which accounts for 5 percent of the total electricity use. Such unseen consumption, commonly referred to as leaking current, constitutes the electric analog of heat seeping out of poorly insulated homes. In the United States, it adds up to more than \$3 billion worth of electricity annually—the output of four large generating stations. That figure includes only household products. Comparable estimates for electronics in the commercial and government sectors don’t exist, Meier observes.

A report prepared for the European Union in June finds that Europe’s leaking household electricity equals the output of two additional large generating stations. Unless trends change, this demand could more than quadruple over the next 13 years, asserts Olof Molinder of OMvärden Konsult AB in Bromma, Sweden, an author of the report.

Because people in developing nations “tend to buy [consumer] electronics even before they invest in refrigerators and other [more energy-intensive] appliances,” Meier notes, these countries are “leaking even more electricity,” proportionately, than industrial ones.



Electricity to most European TVs can be severed via the sets’ power button. Consumers more often shut them down with a remote, however—which leaves them drawing power.

This drain also poses a growing environmental problem. To supply the estimated amount of electricity demanded by leaking household appliances worldwide, power plants already spew some 18 million tons of carbon into the atmosphere annually, Meier calculates. Such emissions exacerbate the risk of global warming.

To date, there has been little consumer demand for less leaky electronics. The potential savings per product has proved too small to influence purchasing. Consumers also lack a means of comparing the leakiness of competing goods.

Hoping to change that, several organizations plan to launch initiatives in the coming months to raise public awareness of the problem and what can be done to limit it. A few will also target manufacturers and policy makers—especially those bound for Kyoto, Japan, in December, where the United Nations will hold its final scheduled conference aimed at drafting a global climate change treaty.

Most electricity leaks trace to power transformers that cannot be turned off—either because a manufacturer found them less expensive to build that way or because it wanted to provide uninterrupted power to features that enhance a product’s principal function.

Wall packs fall into the first category. Essentially an electric cord attached to a small, black-box transformer that plugs

into the wall, these units allow battery-powered radios, tape recorders, and other appliances to run off household current. A home may have 3 to 10 plugged in, studies have shown, each stepping the residential wiring’s high-voltage alternating current down to the lower (typically 3- to 12-volt) direct current needed by some appliances. At the average U.S. residential rate of 9¢ per kilowatt-hour (kWh), each can use up to \$1.50 in electricity per year.

In most other consumer electronics, electricity leaks stem from a manufacturer’s desire to make a product more versatile. In TVs and VCRs, for instance, the leaking current may power a clock, a digital display, and a memory chip that recalls what station the TV was last

tuned to. In portable phones, rechargeable flashlights, and hand-held vacuum cleaners, it may continuously power a battery charger—long after the appliance is fully charged. For products sold with remote controls, it powers the sensor that awaits the remote’s call.

This second category of intentional leaks arises because these appliances remain in a standby mode when switched off. Even though this state of readiness may draw only a fraction of the electricity consumed when the product is in active use, those leaking kilowatt-hours can add up.

For instance, the increasingly popular compact audio units—stereos that are bigger than a boom box but smaller than component systems—consume about 9 W during standby, observes Jennifer Thorne of the American Council for an Energy-Efficient Economy, a public-interest group in Washington, D.C. Because owners listen to their stereo an average of only 1 hour per day, her new calculations indicate that 93 percent of compact audio energy use in the United States—worth \$369 million annually—occurs when the units are turned off.

Finally, there are some devices whose power draw never varies, such as the satellite receivers that, like cable boxes, can expand the range of stations available to a TV. Of five brands that Meier’s team metered, all consumed roughly the same amount of power, 11 to 18 W, on or off. The only difference seems to be whether the red “on” light is powered.

At least in the United States, Meier finds, how much a product leaks bears little relation to cost, function, or features. Instead, "it appears to reflect some arbitrary design as to which parts are kept 'hot.'"

His team recently monitored new TVs. Noting that the average set is turned on only 4 hours per day, one of the tested units would use 180 kWh annually during active use and an additional 100 kWh while it was off. A competing model with comparable features would draw only 120 kWh per year while watched and a mere 5 kWh the rest of the time.

In Europe, some countries have begun devising a combination of carrots and sticks to make the designs a little less arbitrary.

Two years ago, Switzerland's Federal Office of Energy, a leader in this effort, launched a program for TVs and VCRs.

"We give manufacturers target values to achieve in, perhaps, 3 years," explains Rolf Schmitz, who heads the program. If they easily meet the standby target, "we may decide it was too soft" and lower it. "If we believe the manufacturers didn't put enough effort into making their machines better," he says, "the Parliament allows us to set a minimum business standard"—formal limits.

So far, Schmitz says, the program has been "very successful." Most TVs have met the current 3 W target for standby power consumption, "and a lot are already running at 0.1 W." In comparison, the average U.S. TV consumption while turned off is now 5 W, and older units can burn 20 W.

With VCRs, Schmitz says, "although the industry had said it would not be possible to go below 6 W in standby, already many are now at 1 W."

For most European appliances that don't rely on a wall pack, consumers get an additional option not available on the majority of U.S. appliances: a "hard off" switch. "When we push a TV's [hard] 'off' button, the unit [draws] zero watts," explains Schmitz. Indeed, Molinder told SCIENCE NEWS, such an unequivocal "off" button "is the law" in Sweden.

Because Europeans have a true "off" switch, explains Horace Herring of the Open University in Milton Keynes, England, most standby losses associated with their appliances, except for VCRs, trace to the growing popularity of remote controls. When consumer electronics are shut down with remotes, they do not turn off completely; rather, they enter a dormant standby that allows them to remain sensitive to the remote's command.

In an analysis of standby electricity use last year, Herring surveyed data on the purchasing and use of consumer electronics in Europe. He cited one Finnish study showing that when remote controls were available, consumers ignored the switch that severs all power to a TV. Consumers proved more likely to fully

shut off their VCRs and stereos.

A Dutch survey found that consumers turn TVs completely off half of the time, and 85 percent of stereo owners unplugged their sets before going on vacation.

Short of pulling the plug, what can U.S. consumers do?

"When it comes to wall packs, not much," says Meier. There are new technologies entering the marketplace to reduce the power drained by such transformers, but they won't substitute directly for units now in use.

Moreover, consumers shouldn't settle for units that shave merely 50 percent of the leakiness from current devices, argues Laurence F. Kinney of Synertech Systems Corp., a Syracuse, N.Y.-based consulting firm. "We should look for designs that offer nearly zero leaks," he says. With millions of these transformers in use, "it's scandalous that we can't turn them off."

He envisions a tiny, integrated circuit chip in the wall pack and another in the appliance's power switch. The resulting "smart transformer" would supply current if and only if it sensed an appliance had been turned on. The trick, he says, will be to make the change without adding more than 25¢ to the cost of generic wall packs.

ASPRO Technology of Niederlenz, Switzerland, has developed something akin to this. Its transformer goes into a fitful sleep whenever the product to which it's attached is turned off. At programmed intervals (anywhere from 1 second to 30 minutes), the transformer will wake up briefly to see if the appliance is back on. If so, the transformer supplies it with power. If not, it dozes off again.

Though this transformer doesn't plug into a wall, there's no reason, in principle, why it couldn't be reconfigured as a wall pack, says Felix Kamer, the company's deputy director. It would probably add about \$20 to the cost of an appliance, he says, making it potentially attractive for cellular phones or other relatively expensive devices. However, he says, it's too costly for products retailing at only \$20 or \$30, the market for many wall packs today.

TVs, computers, and VCRs can significantly limit their standby power consumption if their transformers employ "switch mode" technology, explains Rob Frizzell of Power Integrations in Sunnyvale, Calif., a company that shipped 50 million such transformer units over the past year for incorporation in products, such as TVs and VCRs, whose active power use runs at 10 W or higher. This technology essentially switches the power to a device on and off some 100,000 times a second, sensing on each cycle whether power is required and supplying it only when necessary. "This allows you to control how much power is delivered

from your wall socket to the [appliance]," he says, keeping leakage rates low.

Meier and Kinney, however, suspect that truly leakfree solutions may require more creative answers. One idea Meier has proposed would incorporate a rechargeable backup battery into VCRs and other products that need to keep some memory chips or other low-power devices energized. The battery could be recharged by the wall current whenever the appliance is in active use.

The first hurdle, however, will be to build a constituency for such devices, Thorne says. Toward that end, she is drafting a report on leaking electricity for policy makers—especially those who will be participating in the Kyoto conference.

Meier is drawing up a "1 W Action Plan" that he intends to circulate at that meeting. It would call for nations to set a voluntary limit of 1 W on the standby electricity used by any electronics-based product.

In January, at the Consumer Electronics Show in Las Vegas, the Environmental Protection Agency plans to launch its own salvo against the two biggest contributors to leaks within the home products arena. Explains Stephan Sylvan, who is coordinating the effort, the new program will extend EPA's Energy Star program to TVs and VCRs. Any TV, for example, that consumes 3 W or less in its off/standby mode will earn the right to identify this feature by carrying the agency's Energy Star label on its packaging and advertising.

Currently, "Americans spend around \$1 billion a year to power televisions that are idling or shut off," Sylvan notes. The success of this new program could lead to similar programs for other consumer products, he says.

Meier would like to see a complementary program embraced by Underwriters Laboratory, the Northbrook, Ill., center that certifies the safety of electric product designs. This month, he launched a campaign to get UL to limit how much electricity a product can leak—preferably no more than 1 W—and still possess a switch purporting to turn the machine off.

Manufacturers could continue to market leakier products, Meier says, but they would have to make it clear that any power button only switches the products between active and standby modes.

As a matter of honesty, he argues, no manufacturer should be able to label a product that draws 40, 20, even 10 watts day and night as anything other than constantly on. He says, "We need to preserve the integrity of the word 'off.'" □

For leak rates of individual consumer appliances, visit Science News Online at <http://www.sciencenews.org>.