

Do things use electricity even when they are turned off?

A laboratory experiment from the
Little Shop of Physics at
Colorado State University



Overview

You may have heard it called by many different names: shadow loads, phantom load, idle current, vampire power.

These names refer to power used by appliances and other electronics that are plugged into the wall, but not powered on.

Some appliances use power even when they are turned off. Some sources estimate that up to ten percent of a household's use of electricity is used by items that are turned off but still plugged in and still drawing power.

This demonstration will give students an idea of which items are the ones that can be unplugged when not in use to save on power and which appliances do not draw power when turned off.

Theory

A power meter measures the power consumption or total energy use by appliances. If you plug a device into this meter, you can measure the power it uses, just as the electric utility measures the energy used by your household. What devices use power when they are plugged in but turned off? Look for things that have remote controls, continuous digital displays, rechargeable batteries, soft-touch keypads, things that are warm to the touch even when turned off, and devices that have power "bricks" or power packs. These are devices that have internal electronics in sleep mode, or transformers that draw power as long as they are plugged in.



This CD/radio/tape player uses energy even when it is turned off. The energy it uses depends on the function chosen.

Necessary materials:

- Power meter
- Power strip
- Small appliances such as hair dryer, microwave, battery chargers, televisions, radios

A power meter can be purchased for around \$25. We got ours from www.p3international.com. You may want to check with your local power company to see if they have a program to lend these to customers.

Not everything left plugged in draws power. Hair dryers and toasters, for example, typically do not draw power when left plugged in and not in use.

It may be possible to eliminate five to ten percent of the energy costs of a household

by unplugging or turning off a power strip when appliances are not in use. The Cornell Cooperative Extension estimates that United States households are using the “...equivalent of seven electrical generating plants just to supply the amount of electricity needed to support the standby power of our vampire appliances when they are off.”(1)

Doing the Experiment

We’ve had a good deal of fun trying out different devices. Some of the surprises we found:

- A radio/CD player/tape player used about 4 watts all the time, whether it was being used or not. When the CD player was in use and the volume was all the way up, it used about 7 watts. This is a player we only use once in a while, so we estimate that, during its lifetime, it has used 100x as much power as it would if we unplugged it when it wasn’t in use—something we now do.
- Cell phone chargers may or may not use power when they are plugged in. Some use 3 or 4 watts.
- As a test, we turned off every device in a whole house and looked at the electric meter. It was still spinning at a reasonable rate. Shadow loads at work!

As a classroom experiment, you should have your students explore:

- Have your students plug in different devices and measure the power used when they are turned on and turned off. This is a good chance for open exploration!
- The power meters can also measure cumulative energy use for a device over time. You can easily measure how much energy a device uses during a 24 hour period and then compute the true cost of a shadow load.
- Do some calculations! Estimate how much energy a household might use to support such shadow loads. How much does this come to on a national—or a global—scale?
- Have students brainstorm what things in their own houses they could unplug to make a difference in their own energy use.

Summing Up

Just because something is turned off doesn’t mean that it is not using electricity! It’s worth looking around your home to find the shadow loads lurking there....

For More Information:

(1) <http://www.news.cornell.edu/releases/Sept02/vampire.appliances.ssl.html>

CMMAP, the Center for Multi-Scale Modeling of Atmospheric Processes: <http://cmmmap.colostate.edu>

Little Shop of Physics: <http://littleshop.physics.colostate.edu>