ENERGY VAMPIRES: DON'T BE A SUCKER

The Science

Energy vampires are electrical devices that use a small amount of electricity, even when turned off. For example, your television uses electricity when it is "off" so it can receive the signal from the remote control and turn on immediately when you press the "On" button on the remote.

This small amount of energy is called a *phantom load*. It can be easy to spot an energy vampire - look for devices that have a remote control, a rechargeable battery, or a digital display status light or clock.

There are several ways to slay energy vampires. You can plug devices into a power strip and turn off the power strip when not in use. Even better (and it is free), you can unplug the device when not in use. This chart shows the most common devices that are energy vampires and their energy use per year.

Benefits

- Using a power strip can turn off several devices at one time.
- Costs nothing to unplug the devices.

Possible Drawbacks

- If you unplug a device that has a timer, such as a coffee maker, you have to reset the clock each time you plug it in to use the timer.
- If you unplug a device with a rechargeable battery, such as a rechargeable drill, eventually the battery will lose its charge.

Amount of Energy Saved

- 1) Let's assume your household has all four of these devices and you unplug them when not in use.
- 2) In one year, you would save **292 kWh** of energy.
- 3) Since one kWh/year takes 0.14 pounds of CO₂ to produce, your elimination of energy vampires would result in **40.9 fewer pounds of CO₂** being released into the atmosphere, just in the first year alone!

The Power of New Mexico Middle School Students

Use information in the "Amount of Energy Saved" section above to answer the following questions.

If every middle school student in New Mexico (75,500 students) unplugged just these four energy vampire devices, how much energy could be saved in a year?

How many pounds of carbon dioxide could be prevented from being released in a year?



kWh per year

2 kWh

250 kWh

30 kWh

10 kWh

Energy Vampire

Desktop computer (in idle mode)

DVD player (on but not playing)

Cell phone charger (with cell

phone unplugged)

Microwave oven

COOK IN A SOLAR OVEN

The Science

Solar cookers work by converting the UV rays of the sun into thermal energy that cooks the food. There are many types of solar ovens, but they generally all have the same basic parts:

- 1) A reflector to help concentrate the sun's rays. This may include pieces of metal or other reflective surfaces that are shaped or positioned to direct the sun's rays.
- 2) A dark surface to absorb the energy. In a box cooker, this usually consists of a dark bottom of the box and/or a dark pot.
- 3) Insulating features to retain the thermal energy. This might be as simple as a plastic bag around the pot or a piece of glass on the top of the box cooker.

The Benefits

- Solar ovens can be used to cook a variety of foods without using <u>any</u> electricity or natural gas.
- Box cookers (one type of solar ovens) produce slow, even cooking.

Possible Drawbacks

- Solar cooking doesn't work at night, and it doesn't work well during times of heavy cloud cover.
- It generally takes about two or three times as long to cook using a single-reflector box cooker as it does in a conventional oven.

Amount of Energy Saved

- Let's assume you cook just one meal per week (lasagna!) in a solar oven instead of in a traditional oven. Lasagna cooks for approximately one hour in traditional oven set at 325° F. It takes about 3 hours in a solar oven.
- 2) Assume your oven uses 2400 Watts (2.4 kW) to keep the temperature at 325° F.
- 3) In one year, you would save approximately 125 kWh of energy.
- 4) Since one kWh/year takes 0.14 pounds of CO₂ to produce, your one weekly meal produced in a solar oven rather than a conventional oven would result in **17.5 pounds of CO₂** NOT being released into the atmosphere!

The Power of New Mexico Middle School Students

Use information in the "Amount of Energy Saved" section above to answer the following questions.

If every middle school student in New Mexico (75,500 students) switched from a traditional oven to a solar oven for just one meal per week, how much energy could be saved in a year?



LINE DRY!

The Science

The first clothes dryer was invented in 1935. A dryer consists of a rotating tumbler that holds the clothes and an electric (or gas) powered heater that heats air that is drawn through the clothes as they tumble. As the clothes are exposed to the warm air, the water in them evaporates. Then an exhaust vent passing out of the dryer and the house vents the humid air. Dryers have a timed cycle (you can set it to run for a set number of



minutes). Newer dryers have a moisture sensor that detects the dryness of the clothes and turns off the heater when the clothes are dry. The average household dryer is electric and takes approximately 45 minutes to an hour to dry a single load of clothes. However, there is an option that takes no electricity! You can hang clothes on a clothesline and let them air dry.

The Benefits

- Air drying is more gentle on clothes, allowing them to last longer. Tumbling in a dryer can cause wear on clothing fabric due to stress on seams, and snags from buttons and zippers. Excessively high heat in the dryer can ruin some fabrics.
- The ultra-violet rays in sunlight help to bleach and disinfect laundry. This is particularly beneficial for white sheets, towels, and cloth diapers.
- Clothes dryer fires account for about 15,600 structure fires, 15 deaths, and 400 injuries annually in the US. The yearly costs in the United States for fire loss due to clothes dryer fires is estimated at \$99,000,000. Not using a clothes dryer would eliminate this fire loss.

Possible Drawbacks

- For dark colored clothes, excessive sunlight can cause some harm such as fading.
- Weather, such as high humidity or rain, can affect how fast your clothes dry.

Amount of Energy Saved

- 1) Let's assume your dryer uses 3 kWh per load of laundry.
- 2) An average American household does 5 loads of laundry a week.
- 3) If you line dried just one of these loads per week instead, you would save 156 kWh in one year.
- 4) Since one kWh/year takes 0.14 pounds of CO₂ to produce, line drying one load of your laundry per week would result in **21.8 fewer pounds of CO₂** being released into the atmosphere, just in the first year alone!

The Power of New Mexico Middle School Students

Use information in the "Amount of Energy Saved" section above to answer the following questions.

If every middle school student in New Mexico (75,500 students) line dries just one load of clothes per week, how much energy could be saved in a year?

SWITCH TO LED BULBS

The Science

A Light-Emitting Diode (known as LED) is a semiconductor, meaning it has an electrical conductivity value falling between that of a conductor and an insulator. Impurities are added to change the electrical properties of the material, creating two different regions:

- 1) N-type region contains extra electrons with extra charge
- 2) P-type region has extra "holes" that can be filled with charged electrons

When voltage is applied to the leads within the LED, electrons from the N-type region combine with electron holes in the P-type region, and energy is released in the form of photons (light).

Traditional incandescent bulbs convert about 10% of their energy output into light, while the remaining 90% is lost as heat. LED bulbs are much more efficient than either incandescent bulbs or other high efficiency light bulbs (such as compact fluorescents), so much less energy is needed for the same amount of light production. These short videos have more information:

- Minutephysics "How Modern Light Bulbs Work" <u>https://www.youtube.com/watch?v=oCEKMEeZXug</u> (2:58)
- "How does an LED work" <u>https://www.youtube.com/watch?v=BH9LI973H8w</u> (1:17)

The Benefits

- LEDs use 70-90% less energy than incandescent (traditional) lighting.
- LEDs can last 25 times longer than traditional bulbs.
- LEDs come in many different shapes, sizes, and colors.

Possible Drawbacks

- LEDs have a larger initial cost than incandescent bulbs. However, this cost is decreasing rapidly. You can now purchase a 60-watt-equivalent LED light bulb for less than \$5.
- LEDs produce directional light that may not distribute as evenly as other types of lighting.

Amount of Energy Saved

- 1) Let's assume you replace just one 60 Watt incandescent bulb with a 9 Watt LED (which produces the same amount of light).
- 2) You use this light for an average of 3 hours a day.
- 3) In one year, you would save **56 kWh** of energy.
- 4) Since one kWh/year takes 0.14 pounds of CO₂ to produce, your one bulb switch would result in **7.84** fewer pounds of CO₂ being released into the atmosphere, just in the first year alone!

The Power of New Mexico Middle School Students

Use information in the "Amount of Energy Saved" section above to answer the following questions.

If every middle school student in New Mexico (75,500 students) switched just one bulb to an LED, how much energy could be saved in a year?



TURN DOWN THE WATER TEMPERATURE

The Science

Water comes into your home through pipes as cold or cool water. In order for you to have hot water, the water must travel through a hot water heater. The most common hot water heaters consist of a large tank with a heating element on the inside. The water goes through the tank, gets heated, and travels to your faucet in your sinks, shower, dishwasher, and washing machine. The average hot water heater runs for about 15 minutes an hour, all day long (a total of about 6 hours per day), to keep a fresh supply of hot water ready.

Hot water heaters have a thermostat that regulates the temperature of the water. The maximum temperature of the hot water can be changed by adjusting the thermostat. New hot water heaters come pre-set with a temperature of 140 $^{\circ}$ F. The water does not have to be this hot, and for most people, it is too hot. You can adjust the thermostat down to 120 $^{\circ}$ F.

The Benefits

- Lowering the thermostat is free.
- There is less chance of the hot water being too hot and scalding someone.
- Heating water to a lower temperature uses less electricity.

Possible Drawbacks

• If you have a dishwasher without a booster heater, your dishes may not get fully clean.

Amount of Energy Saved

- 1) Let's assume you turn down your hot water heater from 140 °F to 120 °F.
- 2) Your hot water heater runs for 6 hours a day (to keep the water hot).
- 3) In one year, turning down the temperature would result in saving 985 kWh of energy.
- 4) Since one kWh/year takes 0.14 pounds of CO₂ to produce, turning down your water heater temperature would result in 137.9 fewer pounds of CO₂ being released into the atmosphere, just in the first year alone!

The Power of New Mexico Middle School Students

Use information in the "Amount of Energy Saved" section above to answer the following questions.

If every middle school student in New Mexico (75,500 students) turned down their hot water heater thermostat to 120 °F, how much energy could be saved in a year?



	Energy Saved	CO ₂ NOT released
Turn down water temp.	74,367,500 kWh	10,411,450 lb.
Energy vampires	22,046,000 kWh	3,086,440 lb.
		or
		3,087,950 lb.
Line dry	11,778,000 kWh	1,645,900 lb.
		or
		1,648,920 lb.
Solar oven	9,437,500 kWh	1,321,250 lb.
LED bulb	4,228,000 kWh	591,920 lb.

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		1,648,920 lb.
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LED bulb	4,228,000 kWh	591,920 lb.

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