



Kill-a-Watt

Subject: How much energy do you consume in your household, and how can you reduce your usage?

Grade Levels: Elementary school and higher

Lesson Length: 40 minutes

Author: Mia DelaRosa, Antoinette Brooks

Participants begin to analyze their personal use energy consumption, and how their behaviors correlate to the costs involved with selected lifestyle choices. Working in teams and drawing from the electrical grid, they plug their items into Kill-A-Watt device, take periodic readings, graph the data, report the average, and discuss how much power common electric devices require. They then discuss lifestyle changes based on their analysis of the results.

Objectives

- ➔ *Students will analyze their personal use energy consumption, understand how their behaviors correlate to the costs involved with selected lifestyle choice.*
- ➔ *Students will explain the benefits and drawbacks of using photovoltaic energy to power common everyday household items, and make recommendations for lifestyle changes to encourage responsible energy consumption.*

Materials

- Common household energy using devices such as a hair dryer, Christmas lights (Regular and LED), toaster, cell phone with charger, electric blanket, incandescent lamp, fluorescent lamp, LED lamp (lamps should be of similar luminosity), electric egg beater/mixer, laptop
- Laminated photos of each of the common household energy using devices to stick on Powerline board
- Velcro with one side attached to each photo and the other side attached to the Powerline board
- Extension chords
- Power outlet
- Kill-a-watt meter
- Powerline board

Set Up

Create a Powerline board using this template (large poster-size for group settings). You may also wish to print one smaller copy of the powerline board for each individual or group to work on.

Power Line
How much power do electric devices require?

 Energy Star									 Energy Hog
Lowest output									Highest output

Gather household energy devices in a central location and plug them in. Be sure to check with event organizers ahead of time to be sure you will have access to a power outlet. Safety note: make sure the hair dryer, toaster, and other heat-producing items are not on the same circuit.

This may be a useful video if you need to teach participants how to read the meters:

<http://bit.ly/2nxecRP>

You may also want to show this video on how to measure electricity:

<http://bit.ly/2oy6NTa>

Instructions

Either working alone, in small groups, or as a whole-group, participants take the following steps:

- 1) Gather common electrical devices (at least one per group).
- 2) Predict which appliances use the most energy and place them accordingly on the Powerline board. Be sure to ask participants to justify their answers (e.g., What makes you think the hair dryer will use the most energy? Can you explain why you think that?). Participants should be given the chance to re-arrange the items as a result of the discussion. Save this information to compare data at the end of the activity.
- 3) Plug in the different appliances to the Kill-a-Watt meter and observe the amount of energy used for several seconds. Record the findings.
- 4) Rearrange the board based on findings. If multiple readings are recorded, older participants can calculate the mean and rearrange the board based on the average reading. They can discuss any discrepancies across multiple readings.
- 5) Outreach leaders can lead a discussion of results, asking, for instance, why some appliances used more energy than others. (Generally, any appliance producing heat will require more power). Participants may notice as they compare results that there is a significant increase in power used for appliances that produce heat. Additionally, some participants may be surprised at some of the results. For instance, many chargers will draw power even when the device (cell phone, iPad, etc.) is off and even when the electrical device is not connected to the charger. Students will be surprised to find out that when devices they use are turned off, there is still a power demand. Participants may also be led to understand that almost all devices have a fairly constant power demand (A toaster will change between two values, minimum and maximum).

Assessment Opportunities

Lead a discussion on the question: What are the costs associated with your personal energy consumption habits? How could you be more environmentally responsible by reducing the use of just a couple electric devices? Discuss any changes in lifestyle that students would consider taking based on the results.

Follow up by estimating the energy usage of other common household devices.

Deepen your Knowledge

For a more rigorous recording of results, participants could record the power when the appliance is plugged in and turned off. Instruct them to turn on the device and record the power for a period of several minutes (for example every 30 seconds for up to 3 to 5 minutes). They could then graph the power as it relates to time.

Students could bring their results together to make a complete representation of power use versus appliance/device, for example, by reading a bar graph form of the individual results.

Student teams could bring their own devices from home. They can conduct brief research on their device, focusing on how their device operates, whether or not it generates heat, and how powerful it is.

Students could briefly examine electric bills to predict how much their lifestyle choices cost. The teacher may encourage students to bring in their own power bills or have a selection of anonymous bills prepared for students to use.

Then, they begin to examine the benefits and drawbacks of using photovoltaic energy to power common everyday household items. Finally, students will make recommendations for minor lifestyle changes to encourage environmentally responsible energy consumption.

To extend this activity to photovoltaics, participants can be led to recognize that the graphed data from the electrical outlets (generated by the electrical grid is constant). Teacher asks students to think of times when there was not reliable energy to power their common everyday devices. Students may discuss storms, power outages, experiences in developing countries, or downed power lines. Guide students to considering the need to have a reliable energy source to power devices. They then repeat the experiments outside, using solar panels as the power source. Each team takes periodic readings using the Kill-A-Watt meter, graphs the data, then reports average to class. Students will see fluctuation in reported averages. Students are led to recognize the fluctuation in averages and discuss the need for reliable energy sources to power devices. Student teams make recommendations to the whole group based on the devices they investigated, their own lifestyle preferences, and the trade-offs of using PV cells.

