



# Home Energy Audit

## Overview

In this activity, students will complete a worksheet leading them to a better understanding of their (and their household's) electricity use. They will consider simple habit changes they could make at home to reduce personal electricity use.

## Objectives

Students will:

- Gain a better understanding of how electricity is measured.
- Learn about the electrical usage of common appliances.
- Use their new knowledge to suggest changes in their behavior that might promote conservation.

## Time Requirements

One-half class period plus two full class periods spread across one week

Two homework assignments

**Class period 1** (one-half class): Distribute the Energy Worksheet and the Homework Worksheet. Have students complete the initial questions on the Energy Worksheet, then handout the Homework Sheet and describe the homework.

**Homework 1:** Allow students as much as one week to complete the homework (except for the final question, the writing assignment).

**Class period 2:** Promote a discussion of their responses from the homework and review their calculations.

**Homework 2:** Have student write letters to members of their household about their energy use and make recommendations about ways they might be able to use less electricity.

**Class period 3:** Have students team edit, rewrite, and share the letters they wrote as homework summarizing what they learned about home electricity use and conservation.

## Materials

Copies of the Energy Worksheet and Homework Sheet for all students.

## Procedure

### Day 1

1. Distribute the energy worksheet. Have your students complete the first two questions individually, listing ten ways they use electricity at home and estimating which ones use the most energy. If they have trouble getting to ten, have the class offer suggestions to each other.





2. Discuss their ideas about the energy consumption of various appliances. What information or beliefs can they identify that provide a basis for their rankings? Note both shared notions and ideas that are widely divergent from the rest of the class.
3. Distribute the homework sheet and explain that they will be looking for ways to save electricity. Explain further that one set of energy choices people make is about PURCHASING appliances (such as which toaster or light bulb or refrigerator to buy) and another is about how the appliance is USED. This activity is about usage habits, not purchasing decisions.

Give your students up to a week to complete their home energy audit.

### **Day 2** (after the students have completed their home audits)

Discuss the outcomes of the audit and review the math. The additive effect of looking at costs or savings from a classroom – school – city – nation show the dramatic impact that each person can have even when saving what seems to be only a tiny amount of electricity.

### **Day 3**

Treat the “Letter” component of the homework as a traditional writing assignment. Have the students edit and evaluate it as you would any other writing assignment.

## **Suggestions for students to explore**

Have students research energy conservation on the web. Can they find sites about energy use habits, or are most of the sites about energy efficient appliances? Start with Con Edison's electricity awareness site: <http://www.coned.com/kids/>

They may also want to check out the NY State Public Service Commission's site at <http://www.getenergysmart.org>

## **Review**

1. What is the purpose of a home energy audit?

*The main purposes of a home energy audit are: to determine where and how a household is consuming energy (in this case electricity), to discover whether some of the energy consumption is wasteful, and to make people aware of how their personal habits may be wasting energy. A more thorough energy audit will also determine how people could save money in the long run by replacing inefficient appliances with more energy efficient ones and by making improvements to the building structure, such as new windows, new heating and water heating systems, or better controls, such as thermostats.*

2. What is a kilowatt-hour?

*A kilowatt-hour is 1,000 watts of electricity being used for one hour. Electricity consumption is measured and billed in units of kilowatt-hours.*

3. Based on your home energy audit, which practice of yours do you think could save the most electricity. Why?

*Answers will vary.*

4. Explain whether you agree or disagree with this statement: “It is important for each household to try to reduce unnecessary electricity use.”

*Answers will vary.*



**Worksheet: Home Energy Audit**

Name: \_\_\_\_\_

1. List up to ten ways you and your household use electric energy at home. Think of all the things you plug in ... but don't get silly by listing the lights in each individual room. Don't worry if you have fewer than ten.

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

2. Review your list and rank your family's electricity uses according to which you think use the most electrical energy (#1) to the least (#10) each day. (There are no "right" or "wrong" answers to this question.)

*1 = most electricity use per day; 10 = least*

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

**Homework: Home Energy Audit**

Name: \_\_\_\_\_



In class you started thinking about your electricity use at home. Here are some questions to help you think more about home energy use and the choices you and your family make every day.

**1. Appliance Use**

Some appliances only use electricity when you turn them on, such as the television, computer, and microwave oven. When they are on, they draw electricity at a steady rate, and when you turn them off, they stop using energy. The table below shows the average lengths of time a family uses an appliance and the approximate cost of operating that appliance each year.

Complete the last two columns in the table by working with the adults in your household. First, make an estimate or best guess of your family’s daily use of each of these appliances, and then calculate your annual cost. Don’t worry if your home does not have all of the appliances listed; many homes do not.

To find **YOUR annual cost**, use the following formula:

$$\frac{\text{YOUR use per day}}{\text{Average use per day (from table)}} \times \text{Average cost per year*} = \text{Your annual cost}$$

**Example 1:** Suppose your TV is on an average of three hours per day. Your average cost per year would be

$$\frac{3 \text{ hours (your use)}}{6 \text{ hours (average use)}} \times \$50 \text{ (average cost per year)} = \$25 \text{ per year (your annual cost)}$$

**Example 2:** Suppose you cook with your microwave about 30 minutes per day.

$$\frac{30 \text{ minutes}}{15 \text{ minutes}} \times \$15 = \$30 \text{ (your annual cost)}$$

Appliance	Average use per day*	Average cost per year**	YOUR use per day	YOUR annual cost
Computer	3 hours	\$25	____ hours	\$
TV	6 hours	\$50	____ hours	\$
Microwave	15 minutes	\$15	____ minutes	\$
Dishwasher***	1 hour	\$70	____ hours	\$

\* Average use per day is based on broad national averages of appliance use.

\*\* Average cost per year is a broad estimate based on the cost of electricity in the Con Edison service territory, 16 cents per kilowatt hour.

\*\*\* The cost of running the dishwasher shown here does not include the cost of the hot water, which may be heated by gas, oil or electricity. It only includes the cost of running the mechanical parts of the appliance. The actual total cost includes the cost of water of water heating.



**Doing Laundry** Regardless of whether you wash clothes at home or go to a laundromat, doing laundry uses energy. Electricity operates the machinery, and energy from electricity, gas, or oil heats the water and dries the clothes. Laundry is one of the largest energy uses in the home. One way you can save energy is to be sure you always have full load before running a dishwasher or clotheswasher.

**Appliance Settings** Some electric appliances turn on and off by themselves depending on how you adjust their settings. An electric heater, for example, will stay on for more of the time if you set the temperature control to “warmer” instead of “medium.”

If you adjust it to warm the room to 72°F on a cold day, it will operate more of the time than if you set it to 68°F.

Could you adjust the settings on your electric heaters or air conditioners so that you would use less electricity and save money? If so, what would you do?

## 2. Lighting

Some electricity uses, like home lighting, depend on two things: 1) how many lights you turn on and 2) how many hours you leave them on. To complicate matters, the length of time you use lights changes depending on the time of year because there are more hours of darkness in winter than in summer.

Calculating the cost of using light bulbs is easy because the wattage is marked right on the bulb. Figuring out the cost of lighting your house is hard, though, because of two factors: 1) each light in your house may use different wattage, and 2) it is hard to measure exactly how long each light is on. So for this assignment, we are going to help you make some reasonably good estimates.

*Background:* Electricity is measured in kilowatt-hours, or kWh. One kilowatt is 1,000 watts, and one kilowatt-hour is one thousand watts burning for one hour. One kilowatt-hour of electricity in New York costs 16¢. With that information, you know that a 100-watt bulb that burns for 10 hours uses one kilowatt-hour of electricity and costs 16¢ to operate.

Here is a simple survey for you to do yourself:

1. Look at a few lamps in your house to see the wattage of the bulbs.  
(Don't try to look at the bulbs in the overhead fixtures because they are too hard to reach.)  
(A.) On average, the lamp bulbs in my house are about \_\_\_\_\_ watts.



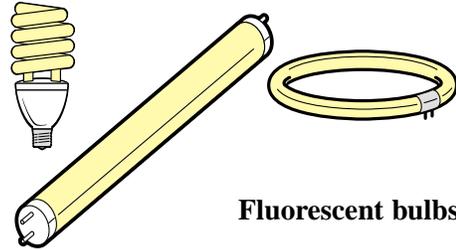


2. Count roughly how many of your lights use fluorescent bulbs instead of incandescent bulbs. Incandescent bulbs glow brightly and get very hot. Fluorescent bulbs have a softer light, get less hot, are often tube-shaped, and sometimes take a few minutes to warm up to full brightness. On average, fluorescent bulbs use about 1/4 as much electricity as incandescent bulbs to deliver the same amount of light.

In my house, we have about \_\_\_\_\_ incandescent bulbs and \_\_\_\_\_ fluorescent bulbs.



**Incandescent bulb**



**Fluorescent bulbs**

3. Make a best-guess estimate of the total number of hours per day you are burning light bulbs. Do this by adding together the number of hours per day EACH bulb is on. You will call this number “bulb-hours.”



For example:

5 bulbs	operating for	1	hour per day	=	5-bulb-hours
3 bulbs	operating for	2	hour per day	=	6-bulb-hours
3 bulbs	operating for	3	hour per day	=	9-bulb-hours
6 bulbs	operating for	5	hour per day	=	30-bulb-hours
					_____
Total					= 50 bulb-hours

If you have a lot of fluorescent bulbs in your home, you are saving energy and money. Fluorescent bulbs use about one-fourth as much electricity as incandescent bulbs. So, if about half of your bulbs are fluorescent, divide your bulb hours by two. If almost all of your bulbs are fluorescent, divide your bulb hours by four.

(B.) Each day, all of the bulbs in my house added together are burning approximately \_\_\_\_\_ bulb-hours.

4. Calculate the cost of burning all the light bulbs over the course of one year.

(A.) On average, a light bulb in my house is \_\_\_\_\_ watts.

(B.) All together, they burn for about \_\_\_\_\_ bulb-hours per day.

\_\_\_\_\_ watts X \_\_\_\_\_ bulb-hours = \_\_\_\_\_ watt-hours per day

(C.) \_\_\_\_\_ watt-hours ÷ 1,000 = \_\_\_\_\_ kilowatt-hours per day



(D.) \_\_\_\_\_ kilowatt-hours per day X 365 = \_\_\_\_\_ kilowatt-hours per year

(E.) \_\_\_\_\_ kilowatt-hours per year X \$.16 = \$ \_\_\_\_\_ cost of electricity for lighting per year.

Each year, my family spends approximately \$ \_\_\_\_\_ on electricity for lighting.

5. Are there ways you could use fewer lights or use them for less time during the day? If so, how many hours per day of lighting could you save?

My household could save \_\_\_\_\_ hours per day in lighting.

6. If you and your household saved that many hours of lighting, how much money would you save each year?

My family would save \$ \_\_\_\_\_ per year.

7. If the households of everyone in your class saved as much as they could on lighting each year, how much money would the whole class save?

My entire class would save \$ \_\_\_\_\_ each year.

*An average household burns roughly 10 75-watt bulbs for about 6 hours per day (averaged for the year), which amounts to about 4.5 kilowatt-hours per day, or 1,650 kilowatt-hours per year. That much electricity in New York costs more than \$260.*

#### 4. Refrigerators

On average, a refrigerator in the Con Edison service territory costs about \$180 per year to operate. Analyzing refrigerator electric use is complex. It runs every day, even if no one opens the door. Every time someone does open the door, though, the warm air that enters forces the refrigerator to work harder and use more electricity. Putting warm food in the refrigerator also makes it work even harder.

Have you ever stood in front of an open refrigerator for a few minutes wondering if there might be something good inside to eat? Have you ever left the door open while you got out all of the makings for a good sandwich? Each time you do, you waste electricity!

What steps might you take to reduce refrigerator electricity use in your home?

#### 5. Heating and Air Conditioning

People use a lot of energy to heat and cool their homes. The amount of energy they use depends on such things as the age and efficiency of the equipment, how well the insulation and windows keep heat in during the winter and out during the summer, and the weather.

Generating heat uses a lot of energy, much more than powering a computer or stereo, for example. That energy usually comes from gas, oil, or electricity. Can your household control the temperature in your home? If so, at what temperature do you set the thermostat?



In the Con Edison service area, air conditioners are one of the most significant uses of electricity in homes. Fans do not cool as well, but they use much less electricity. How might you be able to use less electricity to cool your home?

#### **6. Phantom Loads**

Have you noticed how some appliances and chargers have lights that stay on all the time? Those devices draw very small amounts of power, and they are called “phantom loads.” Since they draw electricity all the time, even when the appliance is not running, their electricity use adds up. Could you unplug some of them?

#### **7. Summary**

Look back at your original list of ten electricity uses. Can you think of other ways that you may be able to save electricity (and money) on some of them? List your ideas.

#### **8. Writing Assignment**

Write persuasive a letter to your household about electricity use. Does your household use electricity wisely or wastefully? Make recommendations about what everyone could do to use less electricity at home or compliment your household for being so energy efficient and wise. Remember that people will be more likely to respond if you give them positive suggestions rather than if you scold them.