

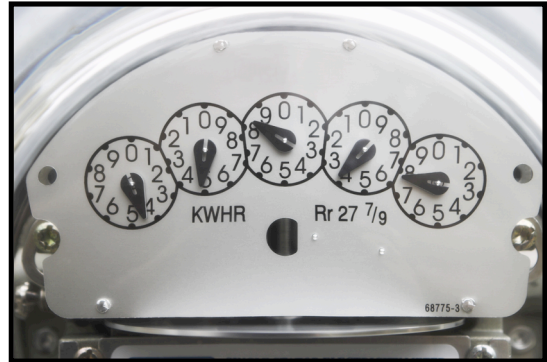
# It's Electric!

**H**ave you ever stopped to think about how many things around you use every day that run on electricity? Things like light bulbs, computers, hairdryers, kitchen appliances, televisions, and so many other things we use all the time are powered by electricity.

Chances are, someone has reminded you to shut off one of these devices when you aren't using it in order to save energy. But why should we care about saving energy? For starters, electricity is expensive. Perhaps more importantly, though, saving energy is good for the environment.

One of the leading causes of climate change (or **global warming**) is thought to be extra carbon dioxide in the atmosphere. Carbon dioxide is a **greenhouse gas**, which means that it traps heat and keeps it from escaping out into space. So what does that have to do with electricity? According to the Environmental Protection Agency, about 40% of carbon dioxide emissions in the United States come from making electricity in power plants that burn **fossil fuels** like coal. So, if we use less electricity, we can reduce the amount of carbon dioxide we pump into the atmosphere.

In this investigation you will estimate how much electricity you use at school and come up with ways to reduce your carbon emissions and energy costs.



## Vocabulary

- **kilowatt-hour (kWh):** Measure of electricity usage that is the equivalent of keeping ten 100-watt light bulbs lit for one hour (10 bulbs x 100 W x 1 h = 1000 Wh = 1 kWh).
- **fossil fuel:** Fuel that comes from the compression of ancient plant and animal life formed over millions of years (coal, oil, natural gas, etc.).
- **global warming:** An average increase in the Earth's temperature, which in turn causes changes in climate.
- **greenhouse gas:** Any gas that traps the sun's heat in the atmosphere. Greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, ozone, and chlorofluorocarbons.

## The Experiment

1. Use the data table at the end of this lab to record information about electrical devices in your classroom. Start by making a list of all the things in your classroom that use electricity (lights, computers, etc.).
2. Figure out the amount of power (in Watts) used by each item on your list and record the values in your data table. Power ratings are usually printed right on the device, but if you are not able to find them or can't reach them, use the values from the chart below of average power ratings of common electric devices.

Device	Typical Power Rating (Watts)
Light bulb (incandescent)	60-100
Light bulb (compact fluorescent)	13-29
Overhead fluorescent tube lamps	15-40 per tube
Desktop Computer + Monitor	270
Laptop Computer	50
TV	19" = 65-110 27" = 113 36" = 133 53"-61" Projection = 170 Flat screen = 120
VCR	17-21
DVD Player	20-25
Window Fan	200

3. Convert the power used by each device to kilowatts (kW) by dividing the power in Watts by 1000. Record the values in your data table.

$$\text{Power in kW} = \text{Power in W} \div 1000$$

4. Estimate the number of hours each device gets used in a day and write the values in your data table.
5. Estimate each device's daily energy use in kilowatt-hours (kWh) using the formula below. Record the values in your data table.

$$\text{Power (kW)} \times \text{Hours Used Per Day} = \text{Daily Energy Use (kWh)}$$

**Example:** window fan used for approximately 3 hours each day  
 $200 \text{ W} \times 3 \text{ hours/day} \div 1000 \text{ kW/W} = 0.6 \text{ kWh per day}$

6. Add up your classroom's total energy use (in kWh) for one day and record it in the box at the bottom right of your data table.

## Analysis

1. Calculate approximately how much it costs to power all of the electrical devices in your classroom for one day, using the current (June 2009) Somerville, MA residential rate of 12.7 cents per kWh.
  
2. Find out how many classrooms there are in your school. If you assume they all use exactly the same amount of electricity as your classroom:
  - a. What is the total energy use (in kWh) for all the classrooms in your school?
  
  - b. Approximately how much does it cost to provide the electricity for all classrooms in your school for one day?
  
  - c. How much would the electricity for all the classrooms cost for a whole year?
  
  - d. Besides the electricity used in classrooms, where else is electricity used in your school? How do you think the school's total electricity bill compares to what you calculated in Step c? Explain your reasoning.
  
3. Most electricity in Massachusetts is still generated using fossil fuels. According to the 2007 Energy Information Administration's "Annual Electric Generator



## **Real Life Connections**

What are some things you can do to reduce the amount of electricity you use in your classroom? Explain how these actions would lower energy usage, cost, and carbon dioxide emissions.

Try some of your ideas at school and at home. Ask your principal or parents to show you electric bills for several months to see if your energy-saving ideas were successful. How much were you able to reduce your electricity usage? 5%, 10%, even more?

## **Connections to Capuano**

Energy-efficient features at Capuano were designed to cut electricity usage by 38%. Take a virtual tour of the Capuano building to find out how they do it. What are specific steps that Capuano has taken to reduce energy use and costs?

