Energy Efficiency Ambassadors

The below activities are for teachers to use with their students and are based on the Alliance to Save Energy's Green Schools Program activities. The activity also incorporates materials from the "Comparing Light Bulbs" activity produced by the National Energy Education Development (NEED) Project.

- *For information about the Alliance to Save Energy, go to www.ase.org, or www.greenschools.com*
- *For information about NEED's educational materials, go to www.NEED.org.*

Subject: Science, Mathematics, English, and Technology

Grades: 6-8

Brief Description:
Too many greenhouse gas emissions are collecting in our earth's atmosphere and are causing our climate to change. People at any age can help by using less energy. In these activities, students will compare two products that provide the same function (in this case, providing light) but require different amounts of energy to do their job. Students will research and demonstrate energy efficiency in action and learn how it applies to different technologies.

After the activities, students should be able to discuss the following:

- How does using less energy help our environment?
- What are the primary differences between compact fluorescent light bulbs and incandescent light bulbs?
- What are other examples of energy-efficient technologies or energy-saving practices?

Background:
We have all heard about global climate change (also referred to as global warming) and know that it is a challenge facing our world. Most people do not know that the average home is responsible for twice as many greenhouse gas emissions as the average car. Most of the electricity we use at home comes from burning fossil fuels like coal and oil, which releases greenhouse gas emissions into our earth's atmosphere. What this means is that we can each play a role in reducing these emissions by using energy more efficiently.

One of the easiest ways to learn about energy efficiency and put it into practice at home is through the light bulb. The most common light bulb today is the incandescent light bulb, invented by Thomas Edison 125 years ago. New compact fluorescent light bulbs (CFLs) use 75% less energy than an Edison bulb and last 10 times longer. In fact, only 10% of the electricity required by an incandescent bulb is used for light, and the other

90% escapes as heat. CFLs create the same amount of light, but generate a lot less heat – about 75 percent less. CFLs are more energy-efficient than incandescent lights because fluorescent technology does not require a metal filament to be heated to create light, but instead uses contained gases which need less electricity to produce the same amount of light. To save the most energy and do the most good for the environment, it makes sense to use CFLs in areas of the home where lights are typically left on the longest.

Because CFLs contain a small amount of mercury, about 5 milligrams, they should be disposed of responsibly, ideally recycled; and, if they should break, cleaned up using EPA's guidelines. Learn more at energystar.gov/CFLsandMercury.

There are many other appliances and technologies where energy efficiency comes into play. For example, two different refrigerators may keep food cool equally well, but the amount of energy they use to do so may vary significantly. Or, two different houses of similar size may both have indoor air temperatures of 75 degrees Fahrenheit, but depending on how well each house is insulated, the amount of energy used to heat or cool that house could mean a difference of $100 dollars or more a month in electricity and gas bills, signaling a large amount of wasted energy. Appliances and other technologies are considered energy efficient when they provide as good or better performance as other technologies but use less energy to do the job.

While a few kilowatt hours of energy wasted here or there may not seem like a large enough amount of energy to worry about, they add up quickly in the form of greenhouse gas emissions in our atmosphere. Consider that using a CFL instead of an incandescent light bulb can prevent more than 200 pounds of coal from being burned, and that lighting accounts for about 20 percent, or one-fifth, of total residential energy use. The potential savings is enormous, and that's just with one technology - lighting.

Objectives:

1. Students will learn the connection between energy use and global climate change (also referred to as global warming)
2. Students will learn that different appliances and technologies with similar output vary in the amount of energy they consume
3. Students will identify and list technologies and other practical ways to be more energy efficient in a home
4. Students will build or display an apparatus or energy-efficient device that demonstrates its practical application for energy efficiency
5. Students will compare the relative value of an energy-efficient product or practice versus an equivalent product or practice that uses energy less efficiently, and use specific data, facts, and ideas to support their findings
6. Students will convey information and ideas from primary and secondary sources accurately and coherently

7. Students will report information and convey ideas logically and correctly

Lesson Plan:

1. Brainstorm with students how energy is wasted in homes and how they might help stop the waste. Students will do Internet research on current methods recommended for home energy efficiency. Students may also contact local energy specialists in the community and interview them about methods and/or technologies that would reduce energy waste, save money and prevent greenhouse gas emissions. These specialists may also provide testing equipment for the project.

2. Conduct the following demonstration project in class using a thermometer and lamp (or watt meter comparator), and one each of a CFL and incandescent bulb that produce equivalent lumens (light levels). A 60 watt incandescent bulb and a 13 watt CFL will generally produce equivalent light levels.

Have an adult place the CFL bulb in the lamp (or watt meter) and turn it on. Observe the light that is produced. Then, hold a thermometer six inches above the bulb for one minute and record the temperature. Turn off the lamp and let the bulb cool. Have an adult remove the CFL bulb, place the incandescent bulb in the lamp and turn it on. Observe the light that is produced. Again, hold a thermometer six inches above the bulb for one minute and record the temperature. Ask the students if they could tell any difference in how much light the two bulbs produced, which bulb produced more heat than the other, and which bulb is more energy efficient.

3. Have the class compute the actual electricity consumption of the two bulbs for varying time periods of use; have the students approximate how long they leave lights on (i.e. one hour of use, how many times a week, how much over the year). Have the students compare the amount of electricity used for the two bulbs for similar amounts of time. Compare the life cycle costs of the two bulbs based on the cost of electricity consumed and the purchase price of the bulb. Have the students compare the amount of amount of greenhouse gases produced based on the electricity consumed.

Electricity used (kWh) = hours of use x (wattage of bulb divided by 1000)

Cost = kWh x electric rate

Lifecycle costs = bulb price + lifetime electricity costs
= bulb price + (electric rate x bulb lifetime x wattage of bulb / 1000)
*CFL lifetime is 6,000 hours
*Incandescent bulb life time is 750 hours, so it takes 8 incandescents for every 1 CFL

Greenhouse Gas Emissions (pounds of pollution) = kWh x 1.54 pounds/kWh

Extension/Alternate Activities

For a social sciences or language arts class:

Have the students do the same research as described above, but instead of or in addition to doing the mathematical comparison above, have the students write a persuasive essay promoting the importance of using energy efficiently at home. Or, students could take the material they learned in the research phase and create a children's book that explains what energy efficiency is, why it is important, and how individuals taking energy-saving steps can help.

For a science or technology class:

Form small groups of students (2-3 per group). Each group selects a method or apparatus to display and demonstrate energy efficiency (like the demonstration lighting project done above). The project should have a display showing how the energy efficiency was tested and a poster chart showing the projected energy and greenhouse gas savings over a set period of time. The chart can be created using a spreadsheet program and enlarged to poster size. The students should also submit a journal detailing the project that includes a statement of the research question they sought to answer, documented research, data collection, analysis, and results. The group should create a script from which each member is able to explain the project, how it works, and the significance of the results with regard to energy efficiency.

For a science or environmental club:

Encourage club members to prepare a presentation for a lower grade level class about the importance of using energy efficiently and our environment, using the CFL to demonstrate. Students can do the math to calculate the difference it would make in energy and environmental benefits if everyone in their class changed one light at home to a CFL, if everyone in their school did the same, and then everyone in their city followed suit.

Electricity saved (kWh) = bulb lifetime hours x (wattage difference of bulbs divided by 1000) x number of bulbs

Greenhouse Gas Emissions Prevented (pounds of pollution) = kWh x 1.58 pounds/kWh

Emissions equivalency in trees planted (acres of trees) = emissions prevented ÷ 8,066