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## Energy Efficiency Ambassadors

The below activities for teachers to use with students 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](http://www.ase.org), or [www.greenschools.com](http://www.greenschools.com)
- For information about NEED's educational materials, go to [www.NEED.org](http://www.NEED.org).

**Subject:** Science, English, and Technology

**Grades:** 9-12

### 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 up to 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 require less electricity to create 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 for longer periods of time.

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](http://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, or find an alternative way to demonstrate energy efficiency
5. Students will compare the relative value of an energy-efficient product or practice versus an equivalent product or practice that uses requires more energy to do the same job, 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 and save money. These specialists may also provide testing equipment for the project.
2. Form small groups of students (2-3 per group). Each group selects a method or apparatus to display and demonstrate energy efficiency. The project must have a

display showing how the energy efficiency was tested and a poster chart showing the projected energy savings over a set period of time. The chart should be created using a spreadsheet program and enlarged to poster size.

3. A journal detailing the project should include a statement of the research question they sought to answer, documented research, data collection, analysis, and results.
4. 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 and the environment.

### Extension/Alternate Activities

#### For a social sciences or language arts class:

Have the students do the same research as described above, but instead of doing an experiment or comparison project, 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 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
  - \*CFL lifetime is ~6,000 hours
  - Incandescent lifetime is ~750 hours
- Greenhouse Gas Emissions Prevented (pounds CO<sub>2</sub>) = kWh x 1.54 pounds/kWh
- Use the electricity and emission savings (above) and equivalencies (below) to come up with fun facts:
  - Car emissions factor: 11,470 pounds CO<sub>2</sub>/ car / year
  - Tree carbon sequestration (Trees planted):
    - 2,200 pounds C/acre of trees/year
    - 8,066 pounds CO<sub>2</sub>/ acre/ year
  - Annual average household electricity use: 10,660 kWh / year

## **Case Study**

*The case study below describes a simple project on lighting (done by teacher Terry Blanke, Eisenhower High School, Rialto Unified School District, California). Other projects can be more complex depending upon the students.*

**Materials Needed** (The materials below are for this lighting comparison demonstration. For other projects, the materials may vary due to students' selection of topic and how they wish to create their project).

- Internet access
- Spreadsheet software
- Word processing software
- Covered box
- 2 surge strips
- Compact fluorescent bulb
- Incandescent bulb
- Tape
- Light meter
- Poster board

The students formed a group and decided they would demonstrate lighting efficiency. They researched and compared a 60 watt incandescent light bulb to a compact fluorescent light bulb with the equivalent light output (13 watts). A spreadsheet chart was created showing the potential watts used and the cost of energy over their lifetime, as well as the cost of the one fluorescent bulb versus the replacement incandescent bulbs that don't last as long. The students then built an apparatus, using a cardboard box, surge strips, and a light meter, to demonstrate the light output levels of the two types of bulbs and the amount of energy used to produce the light. The students were able to show approximately a \$45 savings with the fluorescent bulb, adding energy and replacement bulb cost savings together.

At a science fair, students demonstrated their project and explained the savings to parents and elementary students. They also handed out energy-efficient bulbs to each family who stopped at the booth. The bulbs were provided by the local electric company.

District representatives, the local paper, and school officials stopped by and were impressed with the display and the students' presentation. Their project was given media coverage in the local paper and throughout the district via the district's publicity email.