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# Comparing Light Bulbs

*This activity is based on the "Comparing Light Bulbs" activity produced by the National Energy Education Development (NEED) Project. For information about NEED's materials, go to www.NEED.org.*

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**Grade Levels**: K-5

**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 this exercise, students will use a light to demonstrate the difference between being energy-efficient and energy-wasteful, and learn what energy efficiency means. After the lesson, they should be able to discuss the following:

- How does using less energy help our environment?
- Do compact fluorescent light bulbs and standard light bulbs create the same amount of light?
- How do you know if one light bulb is more efficient than another light bulb?
- What is one way we can save energy at home?
- Brainstorm: What are other ways we can save energy?

**Background:**
We have all heard about global climate change and know that it is a challenge facing our world. Most people don't 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.

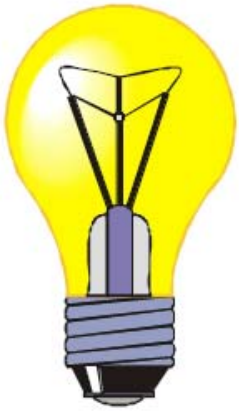
One of the easiest ways to learn about energy efficiency and put it into practice at home is through the light bulb. The most common light bulb today is the incandescent light bulb invented by Thomas Edison 125 years ago. However, new compact fluorescent light bulbs (CFLs) use 1/3 the energy and last as much as 10 times longer. In fact, only 10% of the electricity used 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 70 percent less. CFLs are more energy-efficient than incandescent lights because fluorescent technology does not use a metal filament to create light, but instead use gases that require less electricity to create the same amount of light. Every CFL can prevent nearly 500 pounds of greenhouse gas emissions over its lifetime. To save the most energy and do the most good for the environment, it is best to use CFLs in frequently used areas of the home.

**Possible Hypotheses:**

- Incandescent and CFL bulbs do/do not produce the same amount of heat.
- Incandescent and CFL bulbs do/do not produce the same amount of light.
- One bulb is/is not more energy efficient than the other.

**Materials:**

- One incandescent and one CFL bulb that produce equivalent lumens (light levels). For example, a 60 watt incandescent bulb and a 13 watt CFL will generally produce equivalent light levels. Choose an ENERGY STAR qualified CFL.
- Thermometer
- Lamp, or watt meter comparator (if available)



**Procedure:**

1. Have an adult place the CFL bulb in the lamp and turn it on. Observe the light that is produced. (Or, place the CFL bulb and incandescent in a watt meter comparator, in order to switch back and forth between the bulbs and show the meter speed up and slow down).
2. Hold a thermometer six inches above the bulb for one minute and record the temperature. Turn off the lamp and let the bulb cool.
3. Have an adult remove the CFL bulb, place the incandescent bulb in the lamp and turn it on. Observe the light that is produced.
4. Hold a thermometer six inches above the bulb for one minute and record the temperature.

**Analysis and Conclusion:**

- Could you tell any difference in how much light the two bulbs produced?
- Did one bulb produce more heat than the other?
- Which bulb is more energy efficient?
- Which bulb will prevent more greenhouse gas emissions in our air?

## Extension Activities:

### Using Math

Demonstrate to the class how to 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). Compare the amount of electricity used for the two bulbs for similar amounts of time (have students do this if this is appropriate). Compare the cost of the two bulbs based on the electricity consumed. Compare the 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

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

### Using Language Arts

Have the students discuss the benefits of using more energy efficient bulbs (i.e. saves money, saves time replacing bulbs, helps protect the environment by reducing fossil fuel emissions). Brainstorm about why it is important for them to do their part in helping to improve the environment. Talk about how energy is used in their homes and schools and help them identify other ways that energy is being wasted. Have the students draw a picture or write a short story about the importance of individuals in bringing about larger social changes and illustrate the difference that something as simple as changing a light can make when we all do our part.

# *Who Left The Lights On?*

K

Topic: Energy
Grade: Kindergarten
Duration: 15 – 30 minutes

*Students will be challenged to turn out light in rooms when no one is in them.*

***Curriculum Expectations***

- Ks18: Identify familiar technological items and describe their use in daily life
- Ks20: Work with others in using technology
- Kp29: Share responsibility for planning classroom events and activities

***Background Information***

By remembering to turn lights off when people aren't in a room, you can save energy. It takes 400 kg of coal just to run one 100-watt light bulb around the clock for one year. Turning off lights in a room no one is in is the easiest thing to do.

***Accountability***

Students will know how to be responsible for their actions and will remember to take turns turning lights off.

***Teacher Notes***

1. Gather students for circle time just before you go out of the class.
2. Ask students why we keep the lights on when we leave the room.
3. Make the class aware of where the light switches are in the room.
4. Ask what would happen if as a class the lights were turned off as people leave.
5. A new job in the class can be created - "light monitor". The light monitor's job is to turn off and on lights as people come and go in the room.
6. Discuss who else in the school forgets to turn off lights and how can the class help them to remember to turn them off, too.
7. Implement as many of the student's ideas as possible.

***Home Extension***

Check out where light switches are in your house. Look around the house and decide which lights are important to keep on and which ones should be turned off at night and when no one is in that room. Parents should show students where light switches are in various rooms of the house.

# Life With Energy

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**Grade Level:** Elementary School
**Subject Correlation**: Social Studies, Math
**Objectives: Students will be able to:**

1. Describe ways in which technology affects the environment, both bad and good.
2. Identify different forms of energy and the advantages/disadvantages of different forms of energy.
3. Determine the benefits as well as the environmental harms of using energy to improve our quality of life.

**Length:** 40 minutes

**Teacher Preparation**: May want to bring in some electric or battery-powered appliances to demonstrate how we use electricity in our daily lives. To demonstrate the weight of one pound, 20 pounds, and a gallon, the teacher may want to bring in something that weighs a pound and an empty gallon container.

**Outline (with times)**

10 minutes

*Introduction: Life Without Energy*

Energy figures into almost every human activity: it heats our homes, fuels our cars, ploughs our soil and powers our machinery. Harnessing the world's energy supply has brought standards of living to new heights. Americans (western lifestyles) are so accustomed to energy use that one can scarcely imagine surviving at a time before it existed.

Humans have only learned to harness energy in our personal daily lives in the last 150 years or so. As a class, list five to ten ways we use energy in our daily lives. Think about how our ancestors lived without these devices 200 years ago. Examples:

Light bulbs – candles
Heaters – fire places
Air conditioners – open windows
Microwaves – fire powered ovens
Television – read books
Computers – pen and paper
movies – theater
cars – horse and buggies
telephones – letters
radios – live entertainment
synthesizers – pianos and organs
Internet – library

20 minutes

*Activity: Life With Energy*

Students will enjoy the following worksheet which will help them understand how much energy they use in a typical day and where the energy actually comes from. For additional information, please visit EDN's Renew Our Future Teacher's Guide on the Teachers Corner of the EDN Web site. Also see the elementary version of "Renew Our Energy" located in the Energy is Everywhere lesson in the Science section of this curriculum.

# The Energy We Use

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Energy provides us with a means of using fun and convenient appliances. But what exactly *is* energy and where does it come from? Scientists define energy as "*the ability to do work*." For example, we harness energy to run factories, provide heat and light in our homes and schools, power our cars and school busses, and many other things!

People can take energy from different sources: fossil fuels (gas, oil, coal), nuclear power, wind power (windmills), solar power (from the sun) hydroelectric power (water dams) and a few new innovative ways. Energy is very useful to us, but energy costs us money to use in our cars, homes, work, and schools. In addition, most of the energy people use comes from fossil fuels – and this causes a lot of pollution as well as other problems.

Use the chart on the next page to determine how much energy you use in a day by checking each appliance you use and how many hours you use the item. Before you begin, here are some key concepts to keep in mind while doing the exercise. As a class, discuss the following:

Keep in mind:

- A *'watt'* is a unit that measures how much energy is used by a machine or appliance.
- Burning one pound of coal produces 926 watt-hours of energy and emits 2.64 pounds of carbon dioxide into the atmosphere.
- Using one gallon of gasoline (6.5 pounds) will move the average car between 15 and 25 miles and emit 20 pounds of carbon dioxide into the atmosphere.
- Carbon dioxide is a major greenhouse gas, which causes global warming.
- Using natural gas produces half as much carbon dioxide as coal or oil.
- Using renewable energy, such as solar, wind, or water instead of fossil fuels like coal and oil produces no carbon dioxide.

| Appliance | Watts per hour | X | Hours per day | = | Total |
|---|---|---|---|---|---|
| Refrigerator | 700 | | | | |
| Freezer | 700 | | | | |
| Dishwasher | 1450 | | | | |
| Microwave | 2100 | | | | |
| Toaster | 1200 | | | | |
| Oven | 1600 | | | | |
| 24 inch TV | 125 | | | | |
| Video Games | 20 | | | | |
| VCR/DVD player | 30 | | | | |
| CD Player | 30 | | | | |
| Stereo | 55 | | | | |
| Cell Phone | 20 | | | | |
| Radio | 20 | | | | |
| Electric Clock | 4 | | | | |
| Clock Radio | 5 | | | | |
| Electric Blanket | 400 | | | | |
| Washing Machine | 1150 | | | | |
| Dryer | 5750 | | | | |
| Vacuum | 900 | | | | |
| Air Conditioner | 4500 | | | | |
| Ceiling Fan | 75 | | | | |
| Electric Fan | 50 | | | | |
| 14 Inch Computer Color Monitor | 100 | | | | |
| Ink Jet Printer | 35 | | | | |
| Laser Printer | 1200 | | | | |
| 60 Watt Bulb (each) | 60 | | | | |
| Hair Dryer | 1500 | | | | |
| Electric Toothbrush | 6 | | | | |
| **TOTAL** | | | | | |

10 minutes

*Questions for follow up:*

1. How many pounds of coal are burned to produce the watts used in one day? How many pounds of carbon dioxide are produced from burning this amount of coal? What are the consequences of this?
2. How can you change your daily routine to use less energy? Try to save at least 100 watts.
3. Why do some appliances use more energy than others?
4. Describe some advantages of using less energy in your daily routine – like walking or riding your bike to a friend's house down the street instead of having a parent drive you.

# DRAFT-O-METER

Linda Gregory
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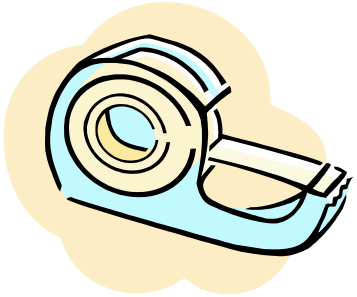
Adapted from the Tennessee Valley Authority

**Objective:** Students will:

1. Learn an easy technique to measure the presence of drafts in their homes and classrooms.
2. In a follow-up exercise, students can create draft guards (see Worm Warmers lesson).

**Materials:** Pencil, tape, plastic food wrap



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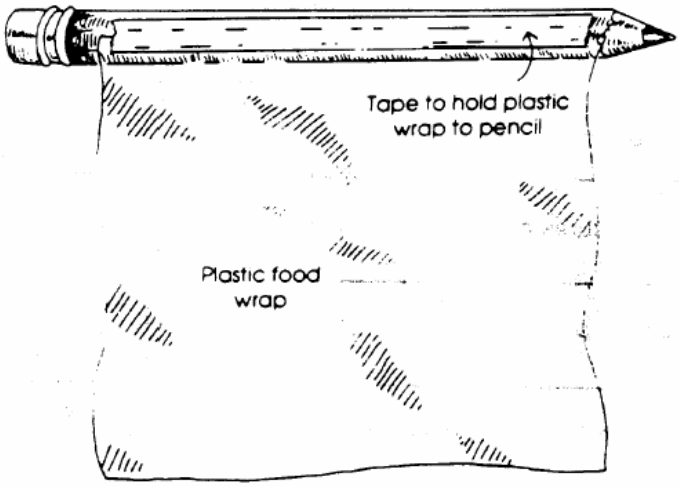
## PROCEDURE

1. Cut a 12cm by 25cm strip of plastic wrap.
2. Tape the shorter edge of the wrap to a pencil and let the rest hang freely.
3. Blow plastic wrap gently and note how sensitive the wrap is to air movement. Drafts mean that air is leaking into or out of a building. This means either a loss of heat in winter or a loss of air conditioning in summer.



## FOLLOW UP

A. Students can complete the following "Home Draft Checklist" to assess where drafts are in their homes.

B. Have students complete the "Worm Warmers" activity to guard against the drafts they detected in this exercise.

# HOME DRAFT CHECKLIST

Check each of the locations where drafts are likely. Where your draft-o-meter detects drafts, rate them by checking the right column. Rate drafts as 1 (strong), 2 (moderate), or 3 (weak). If there is no draft, check the "no draft" column. If your home does not have a listed location, just draw a line through that location.

| DRAFT LOCATIONS | NO DRAFT | DRAFT RATINGS | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| 1. Exhaust fans in bathrooms and kitchens | | | | |
| 2. Dampers in fireplaces and woodstoves | | | | |
| 3. Doors | | | | |
| 4. Windows | | | | |
| 5. Light fixtures attached to walls and ceilings | | | | |
| 6. Attic door | | | | |
| 7. Window air-conditioning units left in place in winter | | | | |
| 8. Mail chutes or slots in walls or doors | | | | |
| 9. Cracks in the foundation of the house or holes where pipes pass through | | | | |
| 10. Where porches and steps meet the house | | | | |