

# Energy Efficiency

## OVERVIEW:

In this activity, students will compare the cost of using incandescent, fluorescent and halogen light bulbs and determine which light bulb is more energy efficient.

## CONCEPTS:

### National Science Foundation Standards:

#### Standard B: Physical Science

#### (Transfer of Energy):

- Energy as a property of many substances and its association with heat, light, electricity, mechanical motion, sound, atomic, nuclei and the nature of a chemical.

### Benchmark 4: The Physical Setting

#### E: Energy Transformations:

- Most of what goes on in the universe—from exploding stars and biological growth to the operation of machines and the motion of people—involves some form of energy being transformed into another. Energy in the form of heat is almost always one of the products of an energy transformation.
- Energy appears in different forms. Heat energy is the disorderly motion of molecules; chemical energy is in the arrangement of atoms; mechanical energy is in moving bodies or in elastically distorted shapes; gravitational energy is in the separation of mutually attracting masses.

## OBJECTIVES:

### Students will:

- Recognize the basic concepts of energy efficiency and conservation.
- Calculate the long-term cost of different light bulbs
- Identify the benefits of a CFL light bulb
- Compare and contrast incandescent light bulbs to CFL light bulbs

## PROCEDURES:

- Allow 1 hour to present the background information and to complete the activity.
- Present the background information.
- Complete the activities: (Part A.) “Cost of a light bulb” and “Penny Wise”.
- Follow up activity with discussion questions (see Part B.) These questions may be used for assessment purposes

## MATERIALS:

- Background information
- Light bulb handout
- Incandescent light bulb
- 2 compact fluorescent light bulbs
- 2 light sockets
- Bag of poker chips
- Energy Efficiency Kit: draft stoppers (insulation for sockets), low flow shower heads, refrigerator thermometer, indigo night light

## **BACKGROUND:**

Imagine going to your home at night and having no light at all. How would you feel? Would you feel unsafe, insecure, or even uncomfortable? During the day, the light from the sun makes us feel safe and secure and we are able to achieve much with it.

What is a Watt? This is the amount of electricity a light bulb uses to produce light. The amount of light given off is measured in lumens. One lumen is the equivalent of the light given off by a candle.

The incandescent light bulb was invented nearly 120 years ago by a man named Thomas Edison. The way this bulb works is very basic; electricity heats up a wire filament, which in turn causes it to glow and give off light. One important thing to note is that this bulb works in a similar way to electrical heater, and that is why more than 90% of the energy produced by these bulbs is heat and not light. That means that incandescent bulbs are very inefficient light sources. These bulbs regularly usually last between 750 to 1,000 hours before burning out. Reasons why incandescent bulbs are very popular is the fact that they are very inexpensive, they produce good color light, and they work well with dimmers.

The compact fluorescent light (CFL) bulbs were introduced in the early 1980's. This bulb is a variation on the fluorescent tube, works in the same way, only that the tube has been made smaller and folded in a way to make them fit into spaces designed for incandescent light bulbs. These operate on only a quarter of the energy used by incandescent bulbs, and lasts ten times longer, lasting 10,000 hours or more.

Going back to the definition of a watt, it is basically not an indication of brightness. This distinction is important, because a new 13-watt CFL bulb produces as much light, and as many lumens as a traditional 60-watt incandescent light bulb. Think about this, as much light, while only using one quarter of the electrical energy. One easiest and fastest way to cut your efficiency bill is to improve lighting efficiency. Start by changing 25% of the lights in high-use areas with fluorescent light bulbs. By doing this, you will be saving about 50% of your lighting energy bill.

A CFL will cost more than an incandescent bulb initially, but because it lasts longer and costs so much less to run, it will prove to be a better bargain over time. Other than saving you money, the CFL has some environmental benefits as well. Consider places that burn coal to produce electricity, 500 pound of coal will NOT be burned, which also means that 1,300 pounds of carbon dioxide and 20 pounds of sulfur dioxide will NOT get into the environment.

**Below is a rough comparison of the long-term costs of the two types of light bulbs:**

<b>INCANDESCENT vs. COMPACT FLUORESCENT BULBS</b>		
<b>Bulb Type</b>	<b>100W Incandescent</b>	<b>23W CFL</b>
Purchase Price	\$ 0.75	\$11.00
Life of the Bulb	750 hours	10,000 hours
Number of Hours Burned per Day	4 hours	4 hours
Number of Bulbs Needed	About 6 over 3 years	1 over 6.8 years
Total Cost of Bulbs	\$4.50	\$11.00
Lumens Produced	1,690	1,500
Total Cost of Electricity (8c/kilowatt-hr)	\$35.04	\$8.06
Your Total Cost over 3 years	\$39.54	\$19.06
Total Savings over 3 years with CFL		\$20.50

Source: U.S. Department of Energy, Energy information Administration


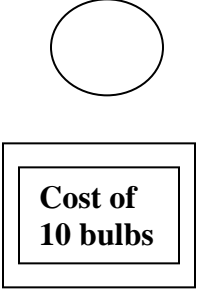
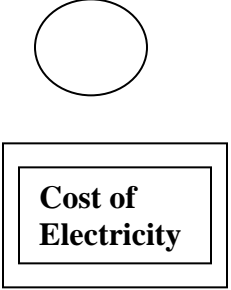
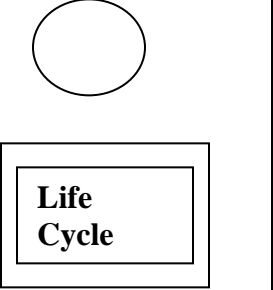

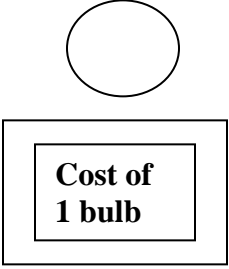
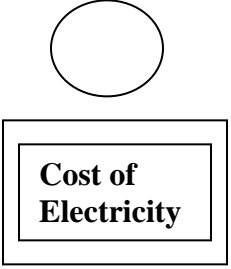
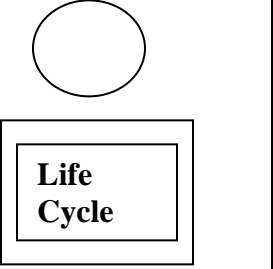
**ACTIVITY:**

**Part A:**

**Activity 1: Cost of Light**

***HOW MUCH DOES 10,000 HOUR OF LIGHT REALLY COST?***

*Energy Disk = \$5.00*

		+		=	
Compact Fluorescent Light Bulb					
		+		=	
Incandescent Light Bulb					



**Part B:**

**Ask the following questions and allow time for discussion.**

**Share:**

Share what you learned from Activity 2?

**Process:**

Electricity is converted into what other two forms of energy when lights are turned on?

**Generalize:**

Are all bulbs created equal? Explain.

**Apply:**

What is the difference between efficiency and conservation?