WYLAND FOUNDATION®

Grade: Adaptable to all levels
Type: Physical and Earth Sciences, Environmental Science
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WATER CONSERVATION AND ELECTRICAL ENERGY EFFICIENCY

OBJECTIVE:

This project will examine the actual cost of three household light bulbs by testing energy consumption, as well as demonstrate approximate mathematical equivalencies of green house gas emissions per kilowatt hour of water wasted.

INTRODUCTION:

Energy-efficiency is important to conserve power, our natural resources, and money. According to Energy Star, replacing just one light bulb with an Energy Star rated bulb in every household would save $600 million in yearly energy costs and prevent 9 billion pounds of greenhouse florescent bulbs are said to consume up to 75% less energy than the traditional incandescent bulb. In this study three bulbs will be examined for their energy consumption, cost, and environmental impact. But did you know that billions of kilowatts of energy are used just to treat water wasted in the US due to leaks and the energy used to supply and treat that water?

TIME NEEDED:

60 minutes to 2 hours

RESEARCH QUESTIONS:

- What is the actual cost per kWh hour for each bulb?
- What is the actual electrical output compared to the manufacturer's label?
- Which bulb performed the closest to its labeled energy value?
- Which bulb gave off the most "pleasing" light?
- Which bulb is the best value?

TERMS TO KNOW:

- Incandescent
- Light Emitting Diodes (LEDs)
- Compact Fluorescent
- Voltage
- Wattage
- Kilowattage
- Greenhouse Gas Emissions

MATERIALS:

- Wattmeter
- Lamp stand (e.g. table lamp, desk lamp)
- Incandescent bulb
- Compact Fluorescent bulb
- LEDs bulb

EXPERIMENTAL PROCEDURE:

1. Setup a chart with specifications of each bulb.

Type of Light bulb	LEDs	Incandescent	CFLs
Price			
Life Span			
Voltage (Classroom is usually around 120)			
Wattage (Says on packaging)			
Kilowattage (kwh) (Reported by wattmeter)			
CO2 Gas Emission Equivalency			

Use the EPA GHG calculator to get equivalencies for the CO2 associated with the kwh at http://www.epa.gov/cleanenergy/energy-resources/calculator.html)

2. To test each bulb use the following set up:
    1. Light bulb in lamp - connects lamp cord to the wattmeter - connect wattmeter to the outlet.
    2. Leave the lamp on for 1 hour.
    3. Examine the light. Subjectively describe the light in terms of brightness and color.
    4. Record the following: kWh.

3. Determine the actual cost per kWh for each bulb
    1. Actual bulb consumption (kWh) x cost per kWh = Actual cost per kWh of the bulb.
    2. Assuming the light is on for 5 hours a day, how much energy is consumed over a week? What is the total cost of operation?

4. Discussion - If one bulb is the best value is it worth it in terms of health and the environment?

WATER CONSERVATION EXTENSION:

1) Nationwide, more than 1 trillion gallons of water leak from U.S homes each year due to running toilets, dripping faucets, and other household leaks. That wastes 3.4 billion kilowatt hours of energy used to supply and treat that water (it does not include household heating of hot water). Use the EPA GHG calculator to get equivalencies for the CO2 associated with the 3.4 B kWh http://www.epa.gov/cleanenergy/energyresources/ calculator.html . (Simply plug in the number 3.4 and choose kilowatt hours of electricity from the drop down box on the right and push CONVERT.)

2) Record at least one of the following in the table below:

	Annual greenhouse gas emissions from	CO2 emissions from	Carbon sequestered by
3.4 B kwh			
36.3 B kwh			
11 B kwh			

3) The average American home can waste more than 11,000 gallons of water every year due to running toilets, dripping faucets, and other household leaks – that wastes 36.3 kilowatt hours which is enough energy to power a 60 watts light bulb for 25 days. Use the EPA GHG calculator again to get equivalencies for the CO2 associated with the 36.3 B kwh and record above.

4) A leaky faucet that drips at the rate of one drip per second can waste 3,200 gallons of water per year – that wastes almost 11 kilowatt hours which is enough to power a 60 watts light bulb for 7 days. Use the EPA GHG calculator to get equivalencies for the CO2 associated with the 11 B kwh and record in the table above.

FOLLOW UP:

What have you learned from this activity regarding electricity, greenhouse gas emissions and water conservation?