



Student Worksheet: Cost – Benefit Analysis

ENERGY STAR qualified CFLs provide the same amount of light (lumens) as standard incandescent bulbs, but have lower wattage ratings. This means they use less energy and cause less pollution. By comparing watts or energy use on the product packaging you can compare energy savings. For example, most 60-watt incandescent light bulbs provide around 800 lumens, 13-15 -watt CFLs also provide around 800 lumens.



Table 1 – Lumen equivalents

Incandescent light bulb	Compact Fluorescent Light Bulb Approximate equivalent	Approximate Lumens (both)
60 watt	14 watts	800
75 watt	18 watts	1200
100 watt	32 watts	1600

Average Bulb Prices – The price of light bulbs varies according to type, wattage, and quality. For this assignment assume the following: Incandescent light bulbs cost approximately \$0.75 / bulb regardless of wattage, compact fluorescent light bulbs cost approximately \$6.00/ bulb regardless of wattage.

Conversion factors – 1 short ton = 2000 lbs; 1 metric tonne = 1,000 kilograms = 2205 lbs. 1,000 Watt (W) = 1 kilowatts (kW); 1,000 kilowatts (kW) = 1 Mega watt (MW)

Table 2 - Average Electricity Emission Factors by state and region updated April 2002, represents a three year weighted average for 1998-2000.

Table 2	CO ₂ Emission Factors			CH ₄	N ₂ O
	lbs/kWh	short tons/MWh	metric tonnes/MWh	lbs/MWh	lbs/MWh
New England	0.98	0.491	0.446	0.0207	0.0146
Connecticut	0.94	0.471	0.427	0.0174	0.0120
U.S. Average	1.34	0.668	0.606	0.0111	0.0192

Source: <http://eia.doe.gov/oiaf/1605/e-factor.html>

Note: Connecticut figures vary from the region and nation because of our use of nuclear power. Coal fired power plants, more common nationally than in the New England region, are a larger contributor to air pollution.

Cost – Benefit Analysis

Assignment 1 – Determining total household lighting costs and emissions

1. a. Calculate the total kilowatt-hours used by the lighting in your home over a period of a year. To determine the lighting portion of a homes' electric bill, you need to count the total number of light bulbs; each light bulbs' wattage, and the average number of hours those bulbs are lit. To do this, use the Lighting Audit Worksheet. Note: In this assignment, light bulbs are considered the individual bulb; light fixtures may include more than one light bulb.
- b. Using the Average Electricity Emission Factors (Table 2), how many pounds of carbon dioxide (CO₂) are produced by the electricity used for lighting in your home for a typical year?
- c. Using the Average Electricity Emission Factors (Table 2), how many pounds of nitrogen dioxide (NO₂) are produced by the electricity used for lighting in your home for a typical year?
- d. Calculate the total lighting energy cost. In Connecticut the cost for electricity is approximately \$0.15/ kWh. (total kWh * \$0.15/kWh)

Assignment 2 – Determine costs and emission savings, by replacing the 5 most used incandescent light bulbs in your home with compact fluorescent light bulbs.

2. a. Calculate the total kilowatt-hours of the 5 most frequently used light bulbs in your home, over a period of a year. (CFL Replacement Worksheet)
- b. Using the Average Electricity Emission Factors (Table 2), how many pounds of carbon dioxide (CO₂) are produced by the electricity used to light the 5 most frequently used light bulbs in your home for a typical year?
- c. Calculate the energy and cost savings if the 5 highest use light bulbs were replaced with compact fluorescent light bulbs for 10,000 hours. Include purchase price of bulbs as well as the energy use for the life of a bulb.
- d. How many pounds of carbon dioxide would not be emitted if your 5 highest used light bulbs were replaced with compact fluorescent light bulbs?

Assignment 3 - Challenge your parents to make the change

1. Write a cost-benefit analysis proposal to your parents supporting changing your 5 most used light bulbs to compact fluorescent light bulbs. Describe how the cost savings were calculated. Describe the benefits of changing the bulbs.