

Compact Fluorescent Cost – Benefit Analysis

(adapted from the CFL Lesson from www.ctenergyeducation.com)

ENERGY STAR qualified Compact Fluorescent Light Bulbs, CFLs, provide the same amount of light (lumens) as standard incandescent bulbs, but have lower wattage ratings. Lower wattage means less energy use, less waste heat and less pollution. By comparing watts on the product packaging you can compare energy savings. For example, most 60 watt incandescent light bulbs provide approximately 800 lumens. 13 -15 watt CFLs also provide approximately 800 lumens.



Data 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 \$4.00/ 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)

Data Table 2 - Average Electricity Emission Factors

Table 2	CO ₂ Emission Factors			CH ₄	NO ₂
	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: Data represents a three year weighted average for 1998-2000. Connecticut figures vary from the region and the 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.



Student Assignment #1 Lighting Audit Worksheet

	Wattage	Number of bulbs per wattage type	Hours used per day, per bulb	Total Number of hours used/ day	Wattage x Hours	Watts hours / year (Multiply by 365)	Kilowatt hours / year (1000Wh = 1kWh)
Example Room 1	40 W	2 bulbs	0h + 1.5h	1.5 h	60Wh	21,900 Wh	21.9 kWh
	60 W	6 bulbs	0.25h + 3h + 3h + 1h + 1.5h+ 5h	13.75 h	825 Wh	301.125 Wh	30.1 kWh
Living Room							
Dining Room							
Kitchen							
Bedrooms							
Add kilowatt hours/year column							



	Wattage	Number of bulbs per wattage type	Hours used per day, per bulb	Total Number of hours / day	Wattage x Hours	Watts hours / year (Multiply by 365)	Kilowatt hours / year (1000Wh = 1kWh)
Bathrooms							
Hallways							
Family Room							
Outside Lights							
Total kilowatt hours (kWh)/year from previous page							
Total kilowatt hours (kWh)/year for entire house							



CFL Replacement Worksheet: Cost-Benefit Analysis

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

- Determine the 5 most frequently used light bulbs in your home. (From your Lighting Audit Worksheet)
- Calculate the energy savings if the 5 highest use light bulbs were replaced with compact fluorescent light bulbs. Note: the change will be the decreased wattage.

5 Bulb Energy Saving Worksheet

5 Most frequently used existing incandescent light bulbs						Replacement compact fluorescent bulbs				
	Wattage (W)	<u>Hours</u> day	<u>Wh</u> day	<u>Wh</u> year	kWh	Wattage (W)	<u>Hours</u> day	<u>Wh</u> day	<u>Wh</u> year	kWh
1										
2										
3										
4										
5										
Total kWh for 5 incandescent light bulbs						Total kWh for 5 CFL bulbs				
Energy Savings										

- Calculate how many pounds of carbon dioxide and nitrogen dioxide would not be emitted if your 5 highest used light bulbs were replaced with compact fluorescent light bulbs?

5 Bulb Emission Comparison Worksheet

5 BULB REPLACEMENT EMISSION COMPARISON INCANDESCENT vs. COMPACT FLUORESCENT		
	Incandescent	Compact Fluorescent (CFL)
Total kWh for 5 bulb (from above)		
CO ₂ produced @ 0.94 lbs/kWh		
CO ₂ <u>not</u> emitted by switching 5 bulbs		
NO ₂ produced @ 0.0120 lbs/kWh		
NO ₂ <u>not</u> emitted by switching 5 bulbs		



D. Cost –Benefit Analysis

Compare the total price of the purchase and the energy use of your 5 highest used light bulbs.

Note: Incandescent light bulbs last approximately 1000 hours and compact fluorescent bulbs last approximately 10,000 hours.

5 BULB REPLACEMENT COST COMPARISON INCANDESCENT vs. COMPACT FLUORESCENT		
	Incandescent	Compact Fluorescent
Number of Bulbs / 10,000 hours	50	5
Price of each light bulb	\$0.75	\$4.00
Total Cost of Bulbs	\$37.50	\$20.00
Total kWh for the 5 bulbs		
Total Cost of Electricity (\$0.15/kilowatt-hour)		
Total Cost over 10,000 hours (bulbs +electricity)		
Total potential savings from changing my 5 most used bulbs		

