Facts of Light

Ten years ago, we used a lot of energy in the form of electricity to make light to be able to see. Thirty percent of the electricity schools used was for lighting, and homes used about 14 percent of their electricity consumption for lighting. That's because homes, schools, and other commercial buildings used a lot of incandescent lighting. These inefficient bulbs were perfected by Thomas Edison in 1879 and didn't change much for the next 125 or more years! These bulbs were surprisingly inefficient, converting up to 90 percent of the electricity they consumed into heat.

The Energy Independence and Security Act of 2007 changed the standards for the efficiency of light bulbs used most often. As of 2014, most general use bulbs must be 30 percent more efficient than traditional, inefficient incandescent bulbs. What do the new standards mean for consumers? The purpose of the new efficiency standards is to give people the same amount of light using less energy. Most incandescent light bulbs have since been phased out and are no longer available for sale. This has resulted in significant energy savings for homes and schools. Newer, efficient lighting now accounts for only 17 percent of the electricity used in schools, and eleven percent used in homes.

There are several lighting choices on the market that meet the new efficiency standards. Energy-saving incandescent, or halogen, bulbs are different than traditional, inefficient incandescent bulbs because they have a capsule around the filament (the wire inside the bulb) filled with halogen gas. This allows the bulbs to last three times longer and use 25 percent less energy.

Compact fluorescent light bulbs (CFLs) provide the same amount of light as incandescent bulbs, but use up to 75 percent less energy and last ten times longer. CFLs produce very little heat. Using CFLs can help cut lighting costs and reduce environmental impacts. Today's CFL bulbs fit almost any socket, produce a warm glow and, unlike earlier models, no longer flicker and dim. CFLs have a small amount of mercury inside and should always be recycled rather than thrown away. Many retailers recycle CFLs for free.

Light emitting diodes, better known as LEDs, are gaining in popularity. Once used mainly for exit signs and power on/off indicators, improved technology and lower prices are enabling LEDs to be used in place of incandescents and CFLs. LEDs are one of the most energy-efficient lighting choices available today. LEDs use 75 percent less energy than traditional incandescents, and have an average lifespan of at least 25,000 hours. The cost of LEDs has dropped in the last five years and may continue to drop. They use even less energy than CFLs, save more electricity, and produce fewer carbon dioxide emissions. The U.S. Department of Energy estimates that widespread adoption of LED lighting by 2027 would reduce lighting electricity demand by 33 percent. This would avoid construction of 40 new power plants.




	INCANDESCENT BULB	HALOGEN	COMPACT FLUORESCENT (CFL)	LIGHT EMITTING DIODE (LED)
Brightness	850 lumens	850 lumens	850 lumens	850 lumens
Life of Bulb	1,000 hours	3,000 hours	10,000 hours	25,000 hours
Energy Used	60 watts = 0.06 kW	43 watts = 0.043 kW	13 watts = 0.013 kW	12 watts = 0.012 kW
Price per Bulb	$0.50	$3.00	$3.00	$8.00

Comparing Light Bulbs

The graphic on the previous page shows four light bulbs that produce the same amount of light. You might use bulbs like these as a bright overhead light. One bulb is an incandescent light bulb (IL), one is a halogen, one is a compact fluorescent light (CFL), and another is a light emitting diode (LED). Which one is the better bargain? Let's do the math and compare the four light bulbs using the commercial cost of electricity at $0.10/kWh.

1. Determine how many bulbs you will need to produce 25,000 hours of light by dividing 25,000 by the number of hours each bulb produces light.
2. Multiply the number of bulbs you will need to produce 25,000 hours of light by the price of each bulb. The cost of each bulb has been given to you.
3. Multiply the wattage of the bulbs (using the kW number given) by 25,000 hours to determine kilowatt-hours (kWh) consumed.
4. Multiply the number of kilowatt-hours by the cost per kilowatt-hour to determine the cost of electricity to produce 25,000 hours of light.
5. Add the cost of the bulbs plus the cost of electricity to determine the life cycle cost for each bulb. Which one is the better bargain?
6. Compare the environmental impact of using each type of bulb. Multiply the total kWh consumption by the average amount of carbon dioxide produced by a power plant. This will give you the pounds of carbon dioxide produced over the life of each bulb. Which one has the least environmental impact?

All bulbs provide about 850 lumens of light.




COST OF BULB		INCANDESCENT BULB	HALOGEN	COMPACT FLUORESCENT (CFL)	LIGHT EMITTING DIODE (LED)
	Life of bulb (how long it will light)	1,000 hours	3,000 hours	10,000 hours	25,000 hours
	Number of bulbs to get 25,000 hours				
x	Price per bulb	$0.50	$3.00	$3.00	$8.00
=	**Cost of bulbs for 25,000 hours of light**				
COST OF ELECTRICITY		**INCANDESCENT BULB**	**HALOGEN**	**COMPACT FLUORESCENT (CFL)**	**LIGHT EMITTING DIODE (LED)**
	Total Hours	25,000 hours	25,000 hours	25,000 hours	25,000 hours
x	Wattage	60 watts = 0.060 kW	43 watts = 0.043 kW	13 watts = 0.013 kW	12 watts = 0.012 kW
=	Total kWh consumption				
x	Price of electricity per kWh	$0.10	$0.10	$0.10	$0.10
=	**Cost of Electricity**				
LIFE CYCLE COST		**INCANDESCENT BULB**	**HALOGEN**	**COMPACT FLUORESCENT (CFL)**	**LIGHT EMITTING DIODE (LED)**
	Cost of bulbs				
+	Cost of electricity				
=	**Life cycle cost**				
ENVIRONMENTAL IMPACT		**INCANDESCENT BULB**	**HALOGEN**	**COMPACT FLUORESCENT (CFL)**	**LIGHT EMITTING DIODE (LED)**
	Total kWh consumption				
x	Pounds (lbs) of carbon dioxide per kWh	1.23 lb/kWh	1.23 lb/kWh	1.23 lb/kWh	1.23 lb/kWh
=	**Pounds of carbon dioxide produced**				