Home Light Bulb Use

4-H Youth Development Project

Almost half of the electricity used by industry is for lighting. In homes, up to 25 percent of a consumer's electric bill is for lighting. Electrical light can be produced by several different types of light bulbs with a wide range of electrical efficiency and light bulb costs. This electrical project investigates three types of light bulbs — incandescent, compact fluorescent (CFL), and light emitting diode (LED).

Incandescent Light Bulbs

Incandescent light bulbs use a tungsten metal wire (called filament) that heats up and glows brightly to produce light when electricity flows through the wire. The tungsten wire can be seen in a clear incandescent bulb. Thomas Edison developed this technique in 1879. The glass surrounding the filament also becomes hot and can burn hands if not allowed to cool before touching. These bulbs are surprisingly inefficient, converting up to 90 percent of the electricity they consume into heat. Most incandescent bulbs will operate about 1,000 to 1,500 hours.

Compact Fluorescent Light Bulbs

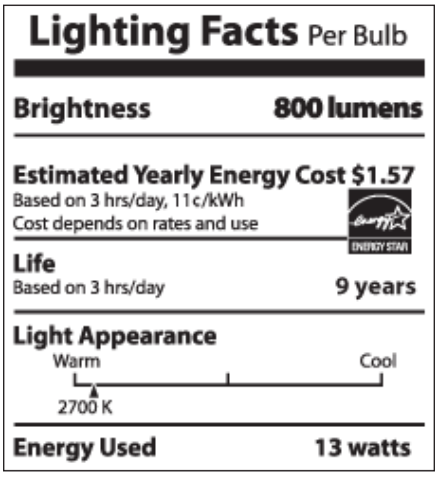
Compact fluorescent light (CFL) bulbs use a different technology to produce light. Electrodes are located at the ends of a glass tube filled with argon and mercury gases. The gases allow electrons to flow to and from the electrodes. The electrons transfer energy to the gases. The gases release energy that reacts with a phosphor coating inside the glass tube, which emits visible light. This reaction is accomplished with very little heat, thus the light source uses much less electricity. The compact fluorescent bulb will operate about 10,000 hours. The small amount of mercury contained in most CFL bulbs is the reason for recommended disposal instructions on the bulb package.

Light Emitting Diode Light Bulbs

Light emitting diodes (LEDs) produce light when voltage is applied to negatively charged semiconductors, causing electrons to combine and create a unit of light (photon). In simpler terms, an LED is a chemical chip embedded in a plastic capsule. Because they are small, several LEDs may be combined to produce a single light bulb. LED is the latest lighting technology. It is more efficient and longer lasting (20,000 hours) than other types of light sources. LED lighting is being developed for many applications within the home.

New Light Bulb Labels

Labels on light bulb packages will give new information about the light bulb. Below is an example of a light bulb label.

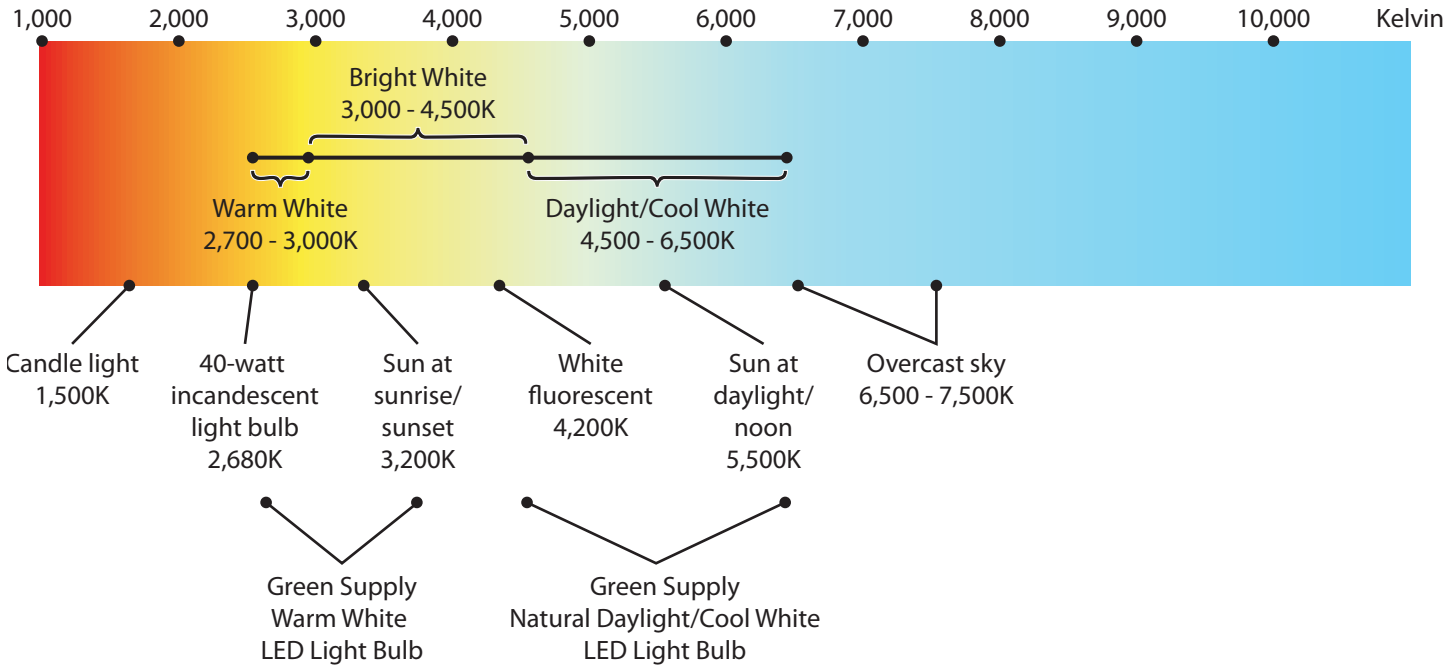


Brightness is a measurement of the intensity of visible light from the light bulb. The unit of light measurement is a lumen. A dinner candle provides about 12 lumens. The higher number of lumens from a light bulb indicates the light bulb will give more visible light.

Estimated Yearly Energy Cost is the cost of operating the light bulb for 3 hours a day for a 365-day year using an 11-cent-per-KWH cost of electricity. Different types light bulbs will normally use the same label information of 3 hours/day/year and the same electricity cost to give a uniform comparison of the light bulb performance.

Life refers to the estimated length of time in years that the light bulb will emit useful light when the bulb is used for 3 hours per day.

Light Appearance is a measurement of the color content from the light bulb, sometimes referred to as light quality. The unit of measurement is connected to temperature of the light source and is given in number of Kelvin degrees, usually a number followed by a capital "K." By convention, yellow-red colors (like the flames of a fire) are considered warm, and blue-green colors (like light from an overcast sky) are considered cool. Higher Kelvin temperatures (3,600 to 5,500 K) are what considered cool and lower color temperatures (2,700 to 3,000 K) are considered warm. Cool light is preferred for visual tasks because it produces higher contrast than warm light. Warm light is preferred for living spaces because it is more flattering to skin tones and clothing. A color temperature of 2,700 to 3,600 K is generally recommended for most indoor general and task lighting applications. A color temperature graph follows that relates the relationship of light bulb color to temperatures.



Energy Used is the required electrical power measured in watts to operate the light bulb. Watts were used as a term to select light choices when incandescent bulbs were the only choice. Now both lumens and wattage are used to select proper light bulbs for efficient lighting.

The label and the light bulb base may also disclose information about environmentally sensitive materials, such as mercury, contained in the light bulb. The light bulb package may also contain information about the use of the bulb, such as dimmer ability, vertical or horizontal position, exterior and interior use, moisture resistant, ventilation requirement, shades/reflectors and electrical control of the bulb.

In January 2014, three types of light bulbs were purchased: incandescent, compact fluorescent, and light emitting diodes. All three types of light bulbs have nearly the same lumen output. The table below compares the information obtained from the labels and the cost of the light bulbs.

Incandescent

CFL
Compact Fluorescent

LED
Light Emitting Diode

Light Bulb Comparison Table

Light Bulb Type	Incandescent soft white	Spiral Compact Fluorescent	LED
Incandescent equivalent (watt)	60 watt	60 watt	60 watt
Brightness (Lumens)	830 lumens	800 lumens	800 lumens
Estimated Yearly Energy Cost (dollars) (3 hrs./day @ 11 cents/KWh)	$7.23	$1.69	$1.26
Life (years) at 3 hrs./day use	1.4 years	9.1 years	18.3 years
Life (hours)	1,500 hours	10,000 hours	20,000 hours
Light Appearance (degree Kelvin)	2750 K	5000 K	3000 K
Energy Use (watts)	60 watts	14 watts	10.5 watts
Cost per Bulb (01/01/2014)	$0.49	$1.74	$9.97
Electrical Cost per hour to use (electric rate of 11 cents/KWh)	$0.0066	$0.0015	$0.0012
Notes:	dimmable no mercury instant on	non-dimmable mercury instant on	non-dimmable no mercury instant on

The U.S. Department of Energy website (*www.energy.gov)* provides information on light bulb efficiency. The agency's Energy Star website offers additional information on potential savings associated with use of new technologies.

- If the country converted to new technologies, the electricity consumed to produce light could be reduced by up to 70 percent. This would lower carbon dioxide emissions equivalent to removing one-third of the nation's cars from the highways. Reducing the electricity consumed by just 1 percent would eliminate the need for an average-sized power plant.
- Recent developments have produced compact fluorescent lights (CFLs) that are four times as efficient as incandescent bulbs and last up to 10 times longer. These new bulbs fit almost any socket, produce a warm glow and, unlike the earlier models, no longer flicker and dim.
- Over the life of the bulbs, CFLs cost the average consumer less than half the cost of traditional incandescent bulbs for the same amount of light. In addition, CFLs and LEDs produce very little heat, reducing the need for air conditioning in warm weather.

4-H Youth Development Projects

- Visit a lighting business to gather lighting information, check prices of light bulbs, and experience existing light bulb displays for building your own display. Visit with sales personnel to learn about questions that are asked by light bulb customers.
- Make a large poster image or slide presentation of the light bulb label and explain the information on the label.
- Purchase three different light bulbs from a store and use the package/label information to create a poster-size light bulb comparison table similar to the previous table in this fact sheet.
- Make a color/temperature chart similar to the one on page 2 and have the different light bulbs available to show the color differences on skin, different fabrics, and colored paper.
- Survey light bulbs in your home and estimate the hours of use and cost of lighting per day or month. Plan to replace older light bulbs with more efficient ones and figure the initial cost and expected cost savings at some future time.
- Visit YouTube videos such as *http://www.youtube.com/watch?v=_ich-LjdqdU* from University of Nebraska to introduce new information, ask members of the audience to commit to using more energy efficient lighting, and use the commitments to reinforce information you want to convey.

James P. Murphy, Kansas State University, Manhattan, Kansas

Joseph P. Harner III, Kansas State University, Manhattan, Kansas

Ron Dickey, Bluestem Electric Cooperative, Wamego, Kansas

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