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TRI-STATE
Generation and Transmission
Association, Inc.
A Touchstone Energy® Cooperative

Consumer's guide to LED lighting

Let there be light

Although incandescent lighting has been around since the late 1800s and changed the way people live, it has always been a lighting source that gives off more heat than light. About 90 percent of the electricity used by an incandescent bulb goes to heat rather than light! With the variety of Light Emitting Diode (LED) lighting available today, it's a good time to consider replacing your current lighting. This guide is intended to help you navigate your choices.

In this guide the words light, lamp and bulb are used interchangeably. Please use the guide as general information and consult a lighting professional for your more detailed specifications or questions.

Lighting considerations

Save energy, save money

LED lights may cost you more initially, however LEDs use less energy, which will save you money.

Lighting efficacy is the measured amount of light per quantity of energy used, typically measured in lumens per watt. Lighting efficacy is a good indicator of the cost of operation; light sources with higher efficacy will have a lower cost of operation. This table compares energy use and efficacy of several different lighting types and estimates the operating cost of each after 50,000 hours of use. This table does not consider the initial cost of the different bulbs; rather, it looks at the cost of electricity to run your lights.

Operational cost estimate (800 lumen equivalent)

	Halogen Incandescent	Incandescent	LED
Energy use (watts)	43	60	9
Light efficacy (lumens per watts)	19	13	89
Energy used in 50,000 hours (kilowatt-hours)	2150	3000	450
Electric cost for 50,000 hours @ $0.12/kWh ($)	$258	$360	$54
Household cost (based on 25 bulbs/home)	$6,450	$9,000	$1,350

The color of white

With traditional incandescent lighting, electricity is used to heat a filament to about 2,700 degrees Kelvin (K) to create light. While LED lighting uses electricity to make light, it relies on solid state electronics and doesn't generate all the heat associated with a filament.

LED light can replicate the slightly yellow color of an incandescent light, the slightly blue color of natural daylight and everything in between. While some people prefer the look of an incandescent light, which is slightly yellow, our eyes actually see better with light that is more white to slightly blue in color (for more on color scale, see the back page). A white-to-blue daylight color scale also signals our bodies to be awake. If this is a concern, consider a light with a color temperature of 4000K or less.

Lighting controls

Stand-alone lighting controls can be broadly grouped into switching devices like time-clocks, security/occupancy sensors and daylight/photo-sensors or dimmers. Like incandescent lights, LEDs do not require a ballast and are compatible with switching from various control devices. As you dim an incandescent light, the filament cools, resulting in the light going further into the yellow and red light spectrums—this is referred to as color-shift. Because LEDs do not use a filament, they retain their color as they dim. However, to meet customer demand, LED manufactures have designed LED lights that replicate the color-shift of a dimmed incandescent light. These LED lights are sometimes referred to as "sunset dimming" LEDs. Because LEDs use less electricity to create light, they do need an LED compatible dimmer. You can find sunset dimming LEDs at your local retailer or online.

Life expectancy

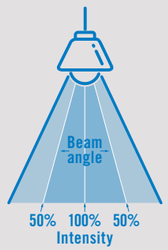
The life expectancy of a light source will vary due to a number of factors, including power quality; orientation; vibration; temperature; etc. The rated life cycle of an incandescent bulb is 750 to 1,000 hours and is based on a mean time to failure of 50 percent of the sample group. The rated life cycle of an LED can be up to 50,000 hours and is determined by when the light output drops by 30 percent from its initial rating. Some life cycle rating labels for LEDs measure the life in years rather than hours and assume three hours of use per day. Shop for bulbs with EnergyStar® labels, which are independently certified, to assure performance.

Outdoor rated bulbs

If you are purchasing a bulb for an outdoor light fixture, make sure to use a bulb that is rated for outdoor use. These bulbs have special enclosures that protect them from outdoor elements. LED lights are good for outdoor applications as they do not require any warm-up period to produce their rated output. When selecting an outdoor light fixture, check with your local building code official to see if there are any lighting ordinances to take into consideration.

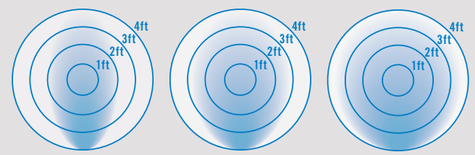
Flood vs. spot

The terms flood light and spot light refer to how much space is illuminated by a bulb. A spot light is designed to only light up a small area, while a flood light is designed to disperse the light over a wide area. Flood lights typically consume more power than equivalent spot lights since they illuminate a larger area.



This lighted area is measured by the beam angle. The beam angle is the angle between the two edges of the beam where the light level drops to 50 percent of the maximum intesity.

However, these angles can differ depending on the type of bulb. To account for this, most bulbs also describe the beam angle qualitatively with descriptions such as NSP (narrow spot), FL (flood), VWFL (very wide flood).



Bulb bases

An alphanumeric code denotes the bulb shape and size of **the base**. The letter refers to base type and the number gives its maximum diameter in millimeters. For example, an E26 base notes an Edison base that is 26 millimeters or 1.03 inches in diameter.

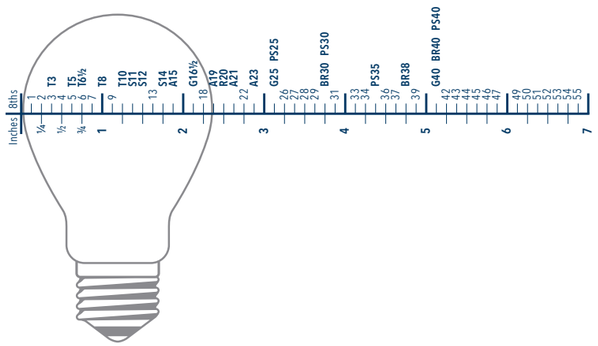
Common bases

E (Edison Base) These are the standard screw type base. Most standard light bulbs use the E26 base.

B (Bayonet Base) These use pins on the outside of the base that slide into slots in the socket, holding the bulb firmly in place.

G (Bi-pin base) These bases use two pins that slide into the socket and are often found on MR style bulbs. The number indicates the distance between the two pins in millimeters.

GU (Twist Lock Base) This is a variant of the bi-pin base that use heads on the pins to lock it into the socket. These are typically used with MR bulbs.



Bulb shapes and sizes

An alphanumeric code denotes **the shape and the size** of the bulb. The letter refers to the shape of the lamp while a number gives its maximum diameter in multiples of ⅛-inch. For example, an A19 lamp denotes the arbitrary (standard) shape with a diameter of (19 x ⅛-inch = 2-⅜ inches).

Common bulb shapes

A (Arbitrary) Standard bulb shape used in wide variety of household fixtures. A19 is the typical incandescent bulb.

C (Candelabra) Usually lower wattage/brightness bulbs. Typically used in chandeliers, night lights and small lamps with E12 or E26 bases.

PAR (Parabolic Aluminized Reflector) Uses a special reflector on the inside to direct light outward and increase brightness. Typically used in recessed fixtures or larger track lights.

BR (Bulged Reflector) Similar shape as a PAR, although it is typically a little longer than an equivalent diameter PAR lamp. Often used in recessed lighting fixtures.

MR (Multi-faceted Reflector) Smaller than PAR or BR lights with a narrower, more focused beam. Often used in track lighting.

G (Globe) A spherical bulb often used around mirrors or light bars to provide general lighting.

Look for the LED lighting facts℠ label

1 Light output (lumens)
Measures light output. The higher the number, the more light is emitted.

2 Watts
Measures energy required to light the product. The lower the wattage, the less energy used. Reported as "Input Power (Watts)" on LM-79 test report.

3 Lumens per watt (efficacy)
Measures efficiency. The higher the number, the more efficient the product. Reported as "Efficacy" on LM-79 test report.

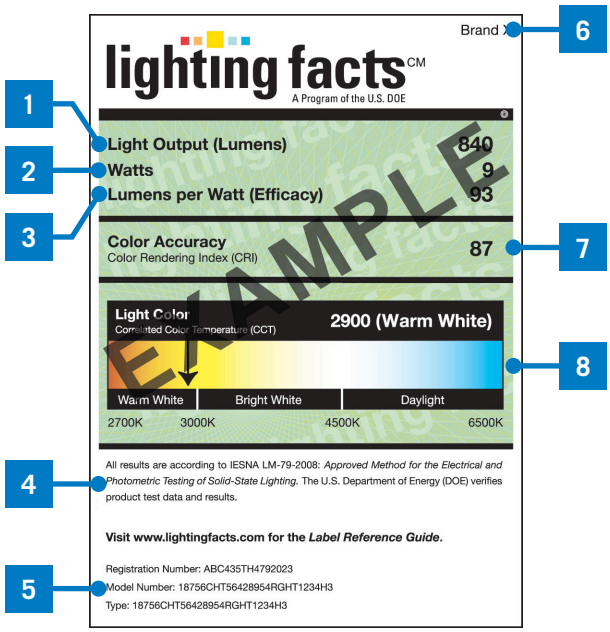
4 IESNA LM-79-2008
Industry standardized test procedure that measures performance qualities of LED luminaires and integral lamps. Allows for a true comparison of luminaires regardless of the light source.

5 Registration Number/Model Number/Type
Unique manufacturer's numbers for the product.

6 Brand
The brand under which each product is available.

7 Color Rendering Index (CRI)
Measures color accuracy. Color rendition is the effect of the lamp's light spectrum on the color appearance of objects.

8 Correlated Color Temperature (CCT)
Measures light color. "Cool" colors have higher Kelvin temperatures (3600–5500K). "Warm" colors have lower color temperatures (2700–3500K).



Choosing the right LED wattage to replace your old bulbs

General purpose residential light bulb (A19 medium base)		
Incandescent lamp (watts)	**Light output (lumens)**	**LED lamp (watts)**
25	200	2–3
40	450	6–8
60	800	9–13
75	1100	12–15
100	1600	16–20
150	2600	25–28

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