

The future's bright – or is it?

The humble electric light bulb – a perennial favourite in Top 10 lists of inventions that have changed the world – is truly one of the greatest inventions of all times. Lighting technology has progressed since the first incandescent light bulb changed the way people spend their nights. Today, many countries are actively incentivising the use of light-emitting diodes (LEDs) as they last longer, and are vastly more energy efficient and dynamically adjustable than traditional incandescent lamps.

LET THERE BE LIGHT Here is a look at the three main lighting devices.

Incandescent tungsten filament bulb

What is it
Thomas Edison's first commercial incandescent light bulb – without the threaded base – came out in 1879.
• Cheap to produce and dispose of and easy to install.
• Ideal for small area lighting. It shows colours far more naturally than modern energy-efficient bulbs.
• Susceptible to sudden vibrations.
• Bulb fuses suddenly.



Compact fluorescent light (CFL)

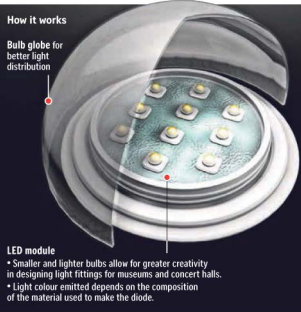
What is it
• In 1976, Edward Hammer and General Electric created the first CFL – a spiral-shaped fluorescent tube.
• Introduced in the mid-1990s and cost US\$25-35/\$25 a bulb. Prices have since fallen drastically.
• Fails more quickly if switched on and off many times.
• Light level and colour diminishes with use.
• Contains trace amounts of mercury. Protocols for recycling or disposing of them are lacking.



Light-emitting diode lamp (LED)

What is it
• First residential LED bulb hits the market in 2002.
• Solid state lighting. Lifespan unaffected by the frequency on-off cycles as the diodes are semiconductors.

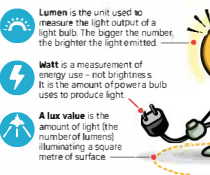
- Light output reduces over time.
- No gases, filaments and no moving parts to fatigue.
- Turns on at full brightness almost instantly with no in-ramp and ultraviolet emissions.



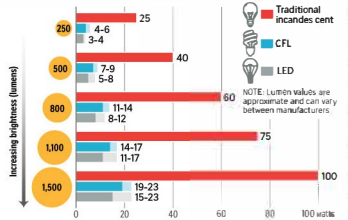
SHEDDING LIGHT ON WATTS, LUMENS AND LUX

Lumens versus watts

Think lumens – not wattage – when choosing a replacement bulb



Lumens to watts conversion chart



How much light for the home?

Well-designed home lighting ensures that all areas are adequately lit. Here is a rough guide.



TIME TO MAKE THE SWITCH?

Comparing bulbs

Since July 1, 2015, incandescent lamps need at least one tick while CFL (with integrated ballasts) and LED lamps need two-tick efficiency to meet Singapore's Minimum Energy Performance Standards requirements.

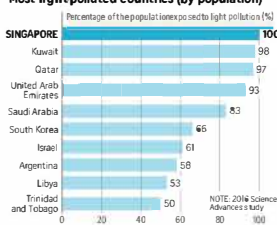
Type	Traditional incandescent	Compact fluorescent light (CFL)	Light-emitting diode (LED)
Power rating*	Tungsten filament 60W	Gas discharge 15W	Solid state 12W
Percentage of energy dissipated at least	90%	80%	79%
Average rated lifespan	1,000 hrs	10,000 hrs	25,000 hrs
No. of bulb needed for 25,000 hrs of use**	25	3	1
Annual energy cost*	\$15.54	\$3.69	\$3.11
Savings over traditional incandescent		Upto 75%	About 75% to 80%

NOTE:
 *Emissions are variable. Typical values are shown here for illustration purposes.
 **For an equal amount of brightness at 100-150 lumens.
 **This translates to about 23 years at three hours of use per day.
 *The bulb. Based on a three hours of use per day at Singapore Power's prevailing electricity tariff of 0.165 cents per kWh (July 1 to Sep 30).

STARRY NIGHT NO MORE?

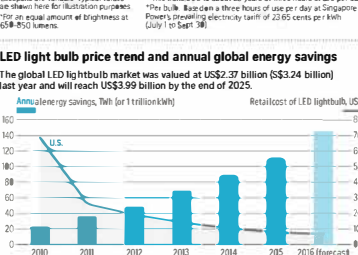
The lighting revolution – read transition to LED technology – is meant to bring about decreased energy usage but a recent study shows that this could be offset by rebound effect of increased usage due to lower lighting cost. Excessive artificial light can also disrupt wildlife's biological rhythms and annual insect migrations.

Most light-polluted countries (by population)



LED light bulb price trend and annual global energy savings

The global LED light bulb market was valued at US\$2.37 billion (\$324 billion) last year and will reach US\$3.99 billion by the end of 2025.



In Singapore

More than 95,000 street lamps worldwide will be replaced with LEDs by 2022. This could mean a net energy savings of up to 45 percent.

About 4 in 5 households use CFL or LED lights**

Lighting is the fifth highest energy consuming product in a typical household*.

NOTE: *Household Consumption Survey 2012. **Household Energy Efficiency Study.

Map of Asia's artificial sky brightness

2.2% per year

Growth in Earth's artificiality lit outdoors rises from 2012 to 2016

Research shows that more than 80% of the world lives under light-polluted skies.

Widespread conversion to cheap blue-white LEDs – which shine brightest in blue-white hues – for outdoor lighting could increase a skyglow notably as the Earth's atmosphere scatters blue light more than other colours of light.

