

## LED vs CFL: Which Has a Better ROI for an Energy Efficient Lighting Retrofit?



Author  
Claire Moloney  
Consultant  
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### LED Lighting

**While CFLs are typically cheaper upfront and have a shorter payback period, LEDs are shown to have a better long-term investment, making them better for an energy efficient lighting retrofit.**

In an average American household, lighting accounts for 20% of the electricity bill. Therefore, replacing your lighting with more energy efficient fixtures could cause a significant decrease in your energy costs.

In general, there are two popular types of energy efficient lighting for a residential retrofit: compact fluorescent lighting (CFLs) and [light emitting diodes](#) (LEDs). CFLs are typically cheaper than LEDs, but LEDs are more efficient than CFLs and have longer lifetimes. That begs the question: are CFLs or LEDs the smarter choice for a lighting retrofit? Will the higher efficiency of the LED outweigh the upfront cost, or will a CFL have a better ROI? Let's investigate.



Long lasting, solid state, LED lighting is the future of high efficiency, consumer and commercial lighting.

Credit: Anton Fomkin via Flickr

### Incandescents vs. CFLs vs. LEDs

First, let's compare the pricing, efficiencies and lifetimes of conventional residential lighting choices: incandescent, CFLs and LEDs. The lifetime is an important factor to consider because the longer the lifetime, the cheaper the replacement costs for lighting over time.

#### Costs:

Incandescent: \$0.50 - \$1.50

CFLs: \$0.50 (in a multipack) - \$9 per spiral CFL, average price for a single lamp is \$4.99 in the Northeastern U.S., average price for a single lamp in a multipack is \$2.75 (According to ENERGY STAR 2010 report)

LEDs: \$25-60 (Consumer Reports)

**Efficiencies:**

Incandescent: 10% efficient (90% of energy is lost as heat, 10% is used for light)

CFLs: About 75% more efficient

LEDs: 85-90% more efficient

**Lifetimes:** Incandescent: 1,000 - 2,000 hours

CFLs: 6,000 - 10,000 hours

LEDs: 25,000 - 100,000 hours

Keep in mind that the rated lifetime of a lighting product may be shorter than the actual lifetime of the bulb. For example, an LED's lifetime is typically determined by the time when the lighting will be at 70% quality. It will still work after this lifetime, but may just provide weaker lighting.

**Return on Investment: Comparing the ROIs**

Now, let's estimate a simple payback and ROI for replacing a traditional \$0.50 60 W incandescent light bulb with either a (1) CFL or (2) LED.

We'll estimate that you use the incandescent light bulb for 3 hours each day. This means that in our example, it will use 180 Watt-hours per day (60 W x 3 hours), or 65,700 Watt-hours per year. This is the equivalent of 65.7 kilowatt-hours (kwh) per year.

If the electricity in your area costs \$0.10 per kWh, then the incandescent bulb costs \$6.57 to run for the year.

The incandescent bulb will last for 1,000 - 2,000 hours, so if it lasted for 1,500 hours. If it is used for 3 hours per day, then it would last a total of 500 days, or 1.4 years.

# From Incandescents to LEDs:



[Watt's The Deal with Lightbulb Options?](#) from [Rob Freeman](#)

## **CFL Replacement:**

Let's assume that the 60 W equivalent is a 15 W CFL, which means it is 75% more efficient. If it runs for three hours per day, it will use 45 Watt-hours per day, or 16,425 Watt-hours per year. This equals 16.4 kWh annually.

At \$0.10 per kWh, the CFL will cost \$1.64 to run for an entire year (for 3 hours per day).

Let's say the CFL lasts 10,000 hours (the average for an ENERGY STAR rated CFL, which you'll learn about more below). This means it will last for 3,333 days, or 9.1 years, if used for 3 hours each day.

Let's take the average cost of a single spiral CFL in the Northeast, \$5 (rounded up from \$4.99).

Money Saved Over Lifetime: The CFL costs \$1.64 in electricity per year, while the incandescent costs \$6.57, which is a savings of \$4.93 per year. Over 9.1 year lifetime, the CFL will save **\$44.86**.

Simple payback period: The CFL costs \$4.50 more than the incandescent bulb (\$5 - \$0.50). The amount of time for the CFL to pay for itself is approximately **11 months**, because it costs \$4.93 more per year to run the incandescent light bulb, which is greater than the additional cost of the CFL (\$4.50). (Calculation:  $\$4.50/\$4.93 = 10.95$ , or 11 months).

Of course, the payback period would be shorter if the light bulb were used more frequently (more than 3 hours), cost less money (less than \$5), or if electricity were more expensive (greater than \$0.10).

ROI: The return on investment (ROI) is calculated as the (Gain from Investment - Cost of Investment)/Cost of Investment. In this case, the gain from investment is the money saved in electric bills over the lifetime of the bulb, or \$4.93 per year for 9.1 years, or \$44.86. We must also include cost of replacing the incandescent bulbs multiple times over the lifetime of the CFL, since the CFL lasts much longer. Since the CFL lasts 10,000 hours and the incandescent lasts 1,500, the incandescent

bulb would need to be replaced about 6.5 times over the course of the CFL's lifetime. This adds \$3.25 to the gain on investment.

Therefore, the ROI =  $(\$44.86 + 3.25 - 5)/\$5 = 8.6$ .

### **LED Replacement:**

For the LED example, let's assume that it is a 12 W model (60 W incandescent equivalent), or 5 times more efficient. This will use 36 W-hours per day if turned on for three hours, and will use 13,140 Watt-hours per year. This is the equivalent of 13.1 kWh annually.

At \$0.10 per kWh, the LED will cost \$1.31 per year in electricity costs.

The LED costs \$30 in our example, but lasts for 30,000 hours. This means it would last 27.4 years if used for 3 hours per day.

Money Saved Over Lifetime: The LED costs \$1.31 in electricity per year, while the incandescent costs \$6.57, which is a savings of \$5.26 per year. Over 27.4 year lifetime, the LED will save **\$144.12**.

Simple payback period: The LED costs \$29.50 more than the incandescent bulb ( $\$30 - \$0.50$ ). The LED costs \$1.31 in electricity per year, while the incandescent costs \$6.57. The amount of time for the LED to pay for itself is approximately **5.6 years**, because it costs \$5.26 more per year to run the incandescent light bulb. The additional price of the LED pays for itself after this amount of time. (Calculation:  $\$29.50/\$5.26 = 5.6$  years).

ROI: The LED's gain from investment is the \$5.26 saved in electricity per year times 27.4 years (the lifetime of the fixture), or \$144.12. Then, we must add the cost of the incandescent bulb replacements over the LED's lifetime, which is 20 times, or \$10 ( $20 \times \$0.50$ ).

Therefore, the ROI =  $(\$144.12 + 10 - 30)/\$30 = 4.1$

So, should you replace your incandescents with CFLs or LEDs? Essentially, CFLs are a better financial investment in terms of the savings you are receiving for the money invested, because it has a higher ROI. This means you are paying less money for every dollar that you are saving. However, long term, you will save more money with LEDs - it will just take much longer to see the fruits of your investment. Therefore,

## **What to Look for When Buying Energy Efficient Lighting**

Whether you're buying CFLs or LEDs, it's always a good idea to find ENERGY STAR rated models. The U.S. Environmental Protection agency runs the program, which ensures the quality and energy efficiency of the products it rates.

ENERGY STAR rated CFLs have a minimum lifetime of 6,000 hours, though their rated models have an average lifetime of 10,000 hours. They are at least three times more efficient and produce 75% less heat than incandescents. The models must have manufacturer-backed warranties and must turn on in one second or less. They must meet requirements for color quality and consistency.

ENERGY STAR rated LEDs last 10,000 - 50,000 hours and use a quarter of the energy of traditional lighting. They must be at least 75% more efficient than incandescent bulbs and must be durable (won't break easily). They light evenly and have good light quality, and can save \$70 per year in energy costs.

A good example of an ENERGY STAR rated LED for residential use is the Philips [A-Shape EnduraLED](#) (the 12.5 W and 8W are qualified). The 12.5 W was the first residential LED to become qualified under the ENERGY STAR program.