

Energy-efficient light bulbs: How much do you really save?

What's the return on investment for installing energy-efficient lighting, such as halogen, compact fluorescent and LED light bulbs? Here's how to find out.

Lighting does more than dispel the darkness. It helps us accomplish our tasks, and it can affect how things look and how we feel. Since Americans now spend 90% or more of our time indoors, according to the Environmental Protection Agency, it's worth it to give our lighting a little thought.

The good news is that more options than ever are available for better and more efficient lighting, with a broader range of technologies. It's not all compact fluorescents versus incandescents anymore. Much of the learning and early adoption has been driven by the commercial sector, because corporate and government buildings use more lighting than households do as a portion of their respective energy budgets. But smart homeowners can take advantage of technologies that commercial building managers have used for years, and enjoy falling prices and rising reliability.

When it comes to our pocketbooks, "greener" lighting can make a real impact. Improving lighting efficiency is typically one of the easiest changes someone can make, with some of the quickest payback periods and best ROIs (returns on investment). It is partially in that spirit that Congress passed new lighting standards that will begin to take effect in January.

A new analysis by the Natural Resources Defense Council found that the standards will save the country more than \$12.5 billion annually when fully implemented in 2020. Each household would see its energy costs drop by an average of 7%, or about \$85 per household each year, when the standards are in place. Overall, the standards would eliminate the need for 33 large power plants.

Replacing incandescent bulbs

Fortunately, there are a number of ways to get improved lighting, including better bulbs and other efficiency technologies. Let's first take a look at a typical annual home energy bill, which totaled \$2,200 in 2009, according to the Energy Star program. An average of 12% of that goes to home lighting, or \$264. Let's say that you are a typical homeowner and use only standard incandescent light bulbs, and that you currently spend \$264 a year to illuminate them.

The trouble is, regular old incandescent light bulbs are inefficient beasts, and up to 98% of the energy they consume is wasted as heat, not light. Compact fluorescent light bulbs, on the other hand, are on average 75% more efficient than incandescents. So if you made a complete switch over, you might cut your lighting energy bill by three-fourths, from \$264 to \$66. (CFLs like the Philips bulbs pictured here cost about \$2.)

Quite a few households have made such a wholesale switch, and they do start saving energy right away. However, there are a few cases where fluorescent tubes and CFLs aren't optimal and will wear out quickly, so a somewhat more measured approach will give the highest payback, as well as the most attractive and flexible lighting.

By the way, if you decide to go for more expensive LED (light-emitting diode) lights, which are up to 90% more efficient than incandescents, you would end up with an annual lighting bill as low as \$26.

When you are shopping for lighting, always look for the EPA's Energy Star logo, which certifies a wide range of quality criteria, as well as a minimum efficiency. Among other specifications, an Energy Star CFL can't emit an audible noise, it must

turn on in less than a second and reach at least 80% of its output within three minutes, and it cannot contain more than 5 milligrams of mercury. The EPA estimates that each Energy Star CFL, when properly used, saves about \$40 over the lifetime of the bulb compared with an incandescent, and the payback time can be just months, depending on how much it is used.

CFL light bulbs

Let's first take a look at a typical home fixture for general lighting. Let's say you currently have a 60-watt incandescent bulb and that you use it six hours a day. The average U.S. home electricity price is 12 cents per kilowatt-hour, according to the most recent data from the U.S. Energy Information Administration. (If you live in a state with appreciably different electricity rates, you should adjust your own calculations accordingly.) So if you pay 12 cents per kWh, and that light bulb uses $60 \text{ watts} \times 6 \text{ hours} \times 365 = 131.4 \text{ kWh}$ a year, that's costing you \$16 a year.

Of course, you'll also have to buy the bulb itself, which isn't the most expensive part of the equation when it comes to lighting. If you buy them in a six-pack, you can get an Energy Star-rated, major-brand CFL for \$2 each, like the Philips CFLs pictured above. Get them in a two-pack from brands like GE for \$3 each at your local big-box store. Regular old incandescents still go for around 75 cents each. But you'll need a lot more of them, since they only last around 1,000 hours, as opposed to around 10,000 hours for most good CFLs. If the light is used six hours a day, you'd go through two incandescents in one year, or 10 in five years. In the latter period, you'd spend \$7.50 for 10 incandescents, versus \$3 for one CFL.

If you put a 13-watt CFL in the fixture, you'll get the same amount of light, but use only $13 \text{ watts} \times 6 \text{ hours} \times 365 = 28.5 \text{ kWh}$ a year, which costs nearly \$3.40. So you save \$12.60 a year versus having an incandescent. Divide that by 12 to get a monthly average of just over \$1. That means the payback period for a light bulb that is between \$2 and \$3 more expensive than an incandescent upfront is somewhere between two and three months.

Multiply that result by how many general-use fixtures you have in your house to see the savings grow. Of course, not all fixtures are general. But there are now good CFL replacements for several key areas, including bathroom vanities, candelabra-style fixtures, outdoor floodlights, outdoor post lamps and even ceiling-fan fixtures (avoid putting a regular CFL in a fan, because the vibrations can shorten its life and increase risk of breakage).

Even so, there are still some places where CFLs aren't the best. Rapid switching greatly reduces their life span, so you may not want to use them in areas where you frequently will be turning them off after short periods. For many people, this means they may not be the best choice for closets, halls and rooms we rarely use. Instead, you may want to rotate through old incandescents to "use them up," or read about halogens in the next section.

Halogen light bulbs

If you can't stand CFLs, even if you've given the newest generation an honest try, if you need something that offers very smooth dimming or that can tolerate rapid switching, or if you want to avoid any mercury, you may want to consider halogens. A halogen light bulb is an incandescent bulb with some added technology, namely the presence of halogen and a quartz envelope around the inner chamber to sustain the higher temperatures they operate through.

In past decades, halogens were available mostly for specialized uses, such as in car headlights and in track lights and torchieres, and they had dedicated pin bases. However, over the past few years, manufacturers have been churning out "hybrid" bulbs that use halogen technology in familiar bulb shapes that can be screwed in to standard sockets. Halogens are

typically 10% to 40% more efficient than incandescents, they can be switched and dimmed as much as you want, and they give off the soft, yellow light we are used to.

A typical example is the Philips Halogena Energy-Saver 40-watt bulb (pictured above) for general home use. A two-pack costs as little as \$10 at some big-box stores and is designed to replace a standard 60-watt incandescent. So if we use our formula from above, we see that using one for six hours a day would give us $40 \text{ watts} \times 6 \text{ hours} \times 365 = 87.6 \text{ kWh}$. At 12 cents, that's \$10.50 a year to use. That saves \$5.50 a year versus an incandescent. At a retail price of \$5 for the bulb, it's going to take a little less than a year to pay back (because we have to subtract the \$1.50 a year for the cost of two incandescent bulbs). Philips says the Halogena lasts for an average of 3,000 hours, which is roughly a year and a half for our use, or three times that of the regular incandescent

Dimmer switch

Another win-win when it comes to lighting is a dimmer, which gives more flexibility and control, can enhance mood and saves energy. Modern dimmers use simple electric circuitry to limit the amount of energy that is sent to a bulb. Most designs knock off 2% to 5% of the energy all the time they are installed, even if they are never turned down.

But let's say for argument that you have your lights dimmed to 50% as an average over the year. So for that fixture with the incandescent bulb that you use six hours a day, you would be spending half as much for energy, or \$8 a year instead of \$16. And you will be doubling the life of your bulb, too, so you will go through one incandescent a year, instead of two.

Sound good? So how much does the dimmer cost? They can get quite fancy, with remote controls, LED displays and other bells and whistles. But standard wall dimmers can be inexpensive. You can get a toggle-switch dimmer from Lutron, the biggest manufacturer, for \$15 at Home Depot. The payback period for that would be less than two years, since you save \$8.75 a year -- \$8 in energy plus 75 cents in light bulbs you didn't need.

Motion sensors

As commercial building managers have known for years, another great way to save energy is with motion sensors. When it comes to your home, a motion sensor can be a good idea for hallways, porches and outdoor spaces. How much you save depends on how often you use the light, but let's say you are a typical user, and putting a motion sensor on your hall light means it is on for only a few minutes after someone walks by.

Let's say this cuts down the amount of "on" time by 90%. Instead of \$16 a year for our fixture, we are spending only 10% of that, or \$1.60. We would also be vastly extending the life of our bulb, so that saves us an additional 75 cents in the first year (more later). A basic motion sensor kit from a big box starts at \$15, so this pays for itself in a shade over one year.

Note that for many fixtures, the motion sensor comes built in, so you may want to calculate based on the specific price premium over an equivalent unit without the feature. We find that \$15 is a reasonable estimate if you don't have the numbers available.

LED light bulbs

If you want to consider an LED bulb for your fixture, you'll get even better efficiency and longer life. For a 60-watt replacement, one popular choice right now is the Philips 12-watt Ambient LED, which produces remarkably soft, yellow light.

It's also fully dimmable, and is rated to last 25,000 hours. It costs \$40, which we know is more than you're used to spending on a bulb. But let's calculate potential savings.

For a lamp that's on six hours a day, that would give us $12 \text{ watts} \times 6 \text{ hours} \times 365 = 26.3 \text{ kWh}$. At 12 cents per kWh, that's \$3.12 a year to operate. Subtract that from \$16, and that's a savings of more than \$12.80 a year. With a lifespan of 25,000 hours, it should theoretically last for about 12 years in this application. Over 12 years, we would otherwise have to buy 24 incandescents, for a cost of \$18, or about \$1.50 each year. With the annual savings of \$12.80 in energy and \$1.50 in bulbs, the LED will pay for itself in just under three years.

That's not bad, when you consider that many upgrades take longer than that (solar panels, a geothermal system, a wind turbine, a hybrid car), and most things we buy never pay for themselves. For years, you'll enjoy high-quality light and you won't have to worry about changing bulbs or disposing of harmful materials.

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