THE DOWNFALL OF THE DOWNLIGHT

A brief assessment of home lighting methods

by Ian Jackson

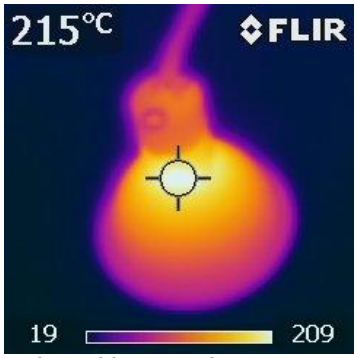
If you have lived in or visited a home built within the past ten years, there's a good chance that the lounge and dining areas were elegantly lit by a fine array of down lights fitted within the ceiling. A bright-yellow incandescent source that illuminates the important parts of the room, without bathing too much intensity on the ceiling and walls. They look great! A big room may have six or eight of these lamps blazing away. But how much does it really cost? How viable are the alternatives and what are the risks? These were questions in my own mind and the results are a little surprising….

First lets examine the standard down-light. It is usually has a 12Volt, 50 Watt lamp in it called an **MR16LV** (The LV stands for Low Voltage). This means that in the roof there is a 240 volt to 12 volt adapter next to the lamp that will deliver the necessary energy. There are two types of voltage adapter in use. One is an earlier style 'iron core' transformer which has no electronic parts in it. The other type is a smaller electronic unit called a 'switch-mode' regulator that efficiently converts the voltage at a much higher frequency.

Typical iron core transformer

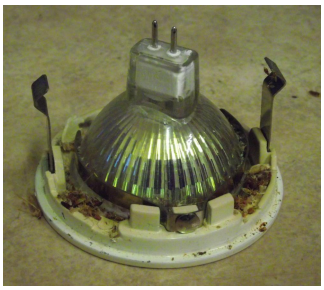
Typical Switch-mode converter

Before going into details, lets look at some of the risk factors with common down-light installations. The 50 watt lamps get hot. Really hot! They sit in the roof space generating quite lots of light, but also lots of heat. Because of their small surface area, the rear of the lamp will often reach 220º C. There has been a lot of problems where home insulation has been placed on top of down lights and the accumulated heat has started fires in the ceiling space. (There should be at least 200mm clearance gap between any ceiling insulation and the lamp fitting and its transformer.)



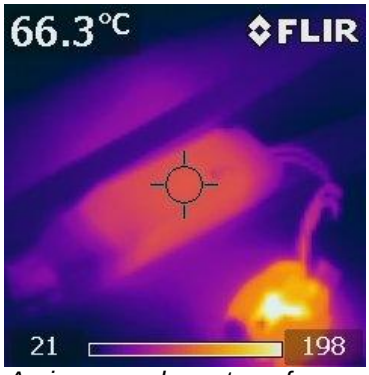
Infrared image of a common 50W halogen down light

A lot of the light is wasted and radiates into the ceiling space. This can attract bugs that get into the ceiling, particularly in homes with tile roofs. These bugs kill themselves against the rear of the down-light and slowly build up inside the fitting. When enough of them gather, they can ignite.



Here are some images showing dry, dead insects that have accumulated around one lamp in just 12 months. As yucky as it seems, lamp fittings should be cleaned regularly if you want to avoid a fire hazard in your roof space..

The lamps are not the only heat source. The iron transformers also waste a lot of heat energy in the roof space. The adjacent infrared image shows a transformer driving a 50W halogen lamp in a ceiling. It reaches over 66º, even on a cool night. In the summer, much higher temperatures would be reached. Should it reach 115º an internal temperature fuse will blow and permanently shut down the transformer.

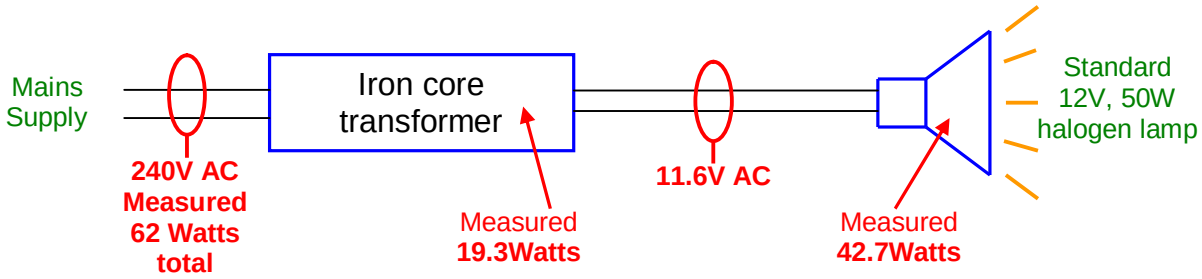


An iron core lamp transformer heating up in the roof space.

While these older iron core transformers are inefficient and become quite hot, the cooler running switch-mode converters often make electrical noise that can badly interfere with AM radio and other services.

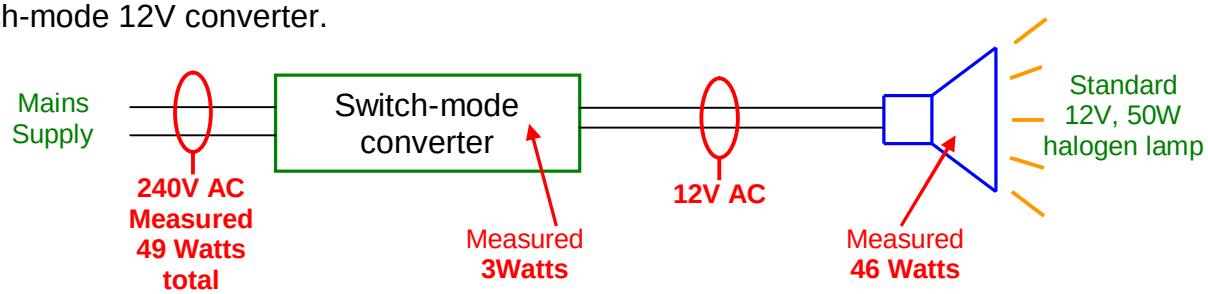
How much is it costing to run Halogen lamps?

This is an important question where every lamp that is operating can have a multiplying effect on power bills around the home. The common lamp may be stamped '50 Watt' but how true is that? I conducted some actual tests on a simple installation to find this out.



This diagram showed that while the lamp only used about 43 watts, the total power consumed was 62 Watts, so *around one-third of the energy was lost inside the power transformer.* If you were running eight such lamps at home on the peak tariff of 21 cents per kilowatt hour, then it would cost approximately 72 cents per day for lighting your lounge (including gst) which is about $65 per quarterly power bill.

Below is the same calculation, but the iron transformer was swapped for the electronic switch-mode 12V converter.



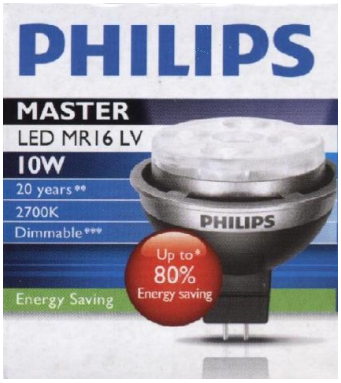
Just by changing the transformer for the newer electronic version, the light increased slightly, the converter ran much cooler and had a 16 watt power saving over the old transformer. If all 8 lamps were changed for electronic converters, the quarterly power bill would fall to about $50 for this room alone. This is better, but remember, as before, similar fire risks exist for the halogen lamps.

What if I change my lamp for a modern LED lamp?

This is an important question, but there are a lot of factors surrounding the LED lamps to consider. While LEDs may last 30,000 hours and the halogen lamps may only last 2000 hours, many of the so-called MR16 substitutes are pretty weak and don't produce any more than about 25-30 watts of equivalent Halogen lamps. Some of them cheat by having a narrow angle of light, so that a spot on the floor may be bright, but the room is still pretty dull. Another important variable is the colour temperature. If you like your lounge in the warm 'yellow' light that is produced by halogen lamps, you may be disappointed if your new

LED lamp produces a sterile blue-white light. The 'warm-white' LED lamps with a colour temp of 2,700K are nicer in the home than the whiter 5,000K blue-white, even though the blue-white leds are 15% more efficient than warm-white.

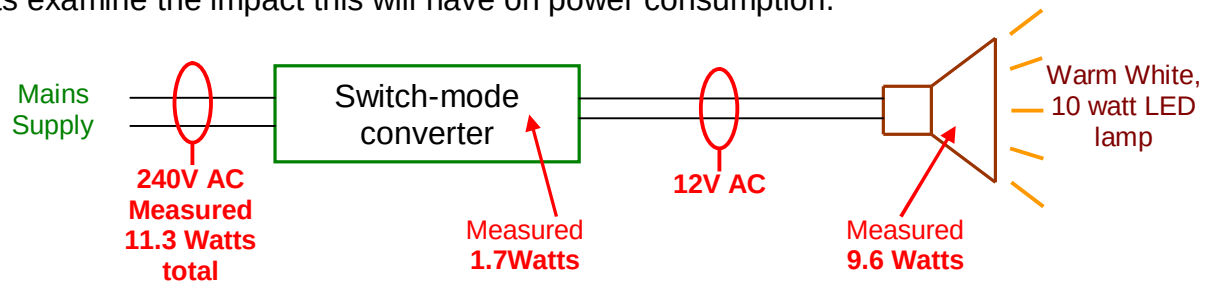
For the exercise, the 50 watt halogen lamp was swapped with a Phillips 12V, 10 watt LED unit. These are a good quality 4-led lamp with a 50Watt equivalent output and good light colour. They are a direct plug-in replacement for the MR16LV and cost about $50 each.



The Philips LED substitute

The first advantage is that very little light shines behind the lamp, up into the ceiling space, reducing the insect problem. They also run much cooler at only around 48º which pretty much eliminates the fire hazard aspect. Consuming only 10 watts also ensures that the 12V transformer or converter will run cooler too.

Lets examine the impact this will have on power consumption.



The energy use has fallen greatly and of course the fire risk is significantly reduced. Quarterly power consumption for 8 lamps would fall to about $12. (assuming the lamp fitting was already driven by an electronic converter.) However at $50 for each LED unit, it would still take ten years to reach the break-even point if expense is the only consideration.

What about other alternatives?

The Compact Fluorescent lamps are quite a popular down-light substitute that can be purchased at a supermarket for about $8 to $10 and they work directly from 240V. These consume only about 11 watts, but they have issues. Full brightness is only about 60% of a 50 watt halogen and they can take five to ten minutes to reach that intensity. They may last four times longer than the halogen, but only if they are not turned on and off too often. They don't work well with lamp dimmers, but they can still perform a useful role in some situations.

Larger multi-LED light fittings are now obtainable that have an integral 240V converter. These have greatly increased in popularity. To fit these, the entire light fitting must be replaced and the ceiling hole enlarged. A 12 x 1 watt LED unit will produce a lot of attractive light, operate at a low 55º and can spread to wide angles. The unit shown here consumed a total of 30 watts.

At present retail prices these units may cost anywhere from $60 to $100 each, which would make for a long payback time if replacing an existing lighting installation.

So there are many pros and cons with home lighting. If a lighting shop sales rep tries to convince you that spending $120 on a 'quality' LED fitting makes good commercial sense, then think again, as even on peak power tariff's the payback time would easily exceed the life of the lamp. We're presently in a transition stage and the cost of LED lighting is still likely to fall. Still, the best saving can be achieved when some or all lights are turned off when they're not in use.