A burning issue

The Code for Sustainable Homes needs to catch up with new lighting technologies, writes **Robin Morris**

"White LEDs are poised to take over the majority of lighting tasks in the next five to 10 years"

Investment in lighting is an essential ingredient for creating energy efficiency and reducing fuel poverty. Yet, despite being the third-largest consumer of energy in the home, lighting is often overlooked.

At a recent retrofitting conference organised by the National Housing Federation, it was argued that investment in low-energy lighting can be more cost-effective than loft insulation.

The independent energy assessors' body National Energy Services found that, in a sample dwelling, moving from 30 per cent to 100 per cent low-energy lamps effectively reduces that dwelling's emission rate by around seven per cent. LED (Light Emitting Diode) lighting can double that saving. But the Code for Sustainable Homes (CSH) needs to catch up, as its modelling tool, SAP, does not recognise new lighting solutions. Indeed, the national body that stimulates innovation, the Technology Strategy Board (TSB), had to develop its own extension spreadsheet to SAP to account for upgraded lighting measures during its own Retrofit for the Future competition.

However, the CHS does reward the provision of dedicated low-energy light fittings. The definition was introduced by Building Regulations, and, at that time, implied compact fluorescent lamps (CFLs). Initially, the code awarded 1.2 points for at least 40 per cent of fittings dedicated to low-energy light fixtures, and 2.4 points for at least 75 per cent. In May 2009, the description was streamlined to give one and two points respectively for these same minimum proportions.

Although regarded by some as a box-ticking measure, it helps the code maintain focus on energy consumption from domestic lighting. But, with the phase-out of incandescent lamps, the definition of dedicated energy-efficient fittings is being lost from the Building Regulations that underpin the code. In a move that is to be welcomed, the 2010 code will reward the whole contribution that efficient lighting makes to reducing dwelling emission rates. However, this cannot be properly represented in the modelling tool, SAP 2005, and even the 2009 SAP revision does not cater adequately for lighting.

Currently relying on the light-source lumens per watt measure, introduction of standard illumination efficacy comparisons (W/sq m/100lux) would bring a marked improvement to SAP. The Energy Efficiency Partnership for Homes is looking at LENI, or Lighting Energy Numerical Indicator (the calculation method for annual lighting consumption), BS EN 15193, as a more meaningful way to recognise the most energy-efficient lighting systems, rather than look at the light emitter's lumens per watt, which is a rather crude yardstick.

Unfortunately, the Department for Environment, Food and Rural Affairs (Defra) Market Transformation Programme, which helped to create the market for CFLs in the UK, and the EU Energy Related Products Directive, expect banned incandescent lamps will be replaced either by CFLs, creating an 80 per cent saving, or halogen lamps, resulting in a 30 per cent improvement. But this restriction to two types of low-energy lamp shows a lack of ambition for further cost-effective energy savings when better alternatives are already available.

There is a plethora of new and emerging technologies that promise radical cuts in energy, although many are not ready for use today. For example, electrode-less fluorescent lights offer efficiencies similar to conventional tubes, but these are recommended as suitable for large spaces in non-domestic settings. Metal halide lights are only used for high brightness applications and get very hot. Electron stimulated luminescence lamps aim to replicate incandescent reflector lamps, but are still in development.

Also under development are lamps that use thin-film, doped silicon oxide emitters of red, green and blue light, in place of the traditional tungsten filament, although details of projected performance are scant and prototypes not expected until next year. OLEDs (organic light-emitting diodes) are still in the early stages of development too, although absolute levels of light output and lifetime still need to be addressed.

Micro-plasma panels are similar to plasma television screens, and light panels could be developed to exceed 100

Used fluorescent lamps are classified as hazardous waste by the Environment Agency.

A stairwell at Cavendish Mill, an apartment block owned by New Charter, before and after LED luminaires were used as part of trials to test the technology.

lumens per Watt, but they might not be very effective in task-lighting, such as for reading or preparing food.

Issues with early LEDs include low brightness and poor colour rendition, which made them unsuitable for illumination applications. But white LEDs are now comparable in efficiency with fluorescent tube lighting, and there is no hazardous waste issue with LEDS. But in lamp format, it is tough to conduct heat away from the LED chips, compromising both efficiency and lifetime.

In the last couple of years, commercial and high-end residential projects have used LED chips built into dedicated light fittings. LED thermal management and performance (light output, lifetime) can be optimised by integrating LEDs within the luminiare. This offers higher system efficacy and typical projected lifetimes of 50,000 or more operating hours (lifetime being defined as a drop to 70 per cent of the initial light output – a change barely detected by the eye).

Until about six months ago, LED lighting was considered too costly for homes. Today, in many cases, there is cost-parity with code-compliant CFL downlights. LED lighting was installed in an award-nominated Decent Homes refurbishment of 54 flats in Danesthorpe, Doncaster, by Chevin Housing Association last year. Maintenance had been identified as a key concern for residents, coming top of tenants' priorities in an informal consultation.

Although the lighting products were initially more expensive, Chevin calculated that it would make worthwhile long-term savings because of reduced callouts to replace fixtures and fittings. Tenants would also benefit from operational savings. Chevin is monitoring maintenance savings, with an eye to rolling out dedicated LED fittings throughout its stock.

Now white LEDs are poised to take over the majority of lighting tasks in the next five to 10 years. They have a number of strong advantages and are already delivering a competitive solution in retrofit and new-builds. Trials are being carried out in communal areas of social housing in England, with support from an Environmental Transformation Fund programme being administered by the Energy Saving Trust.

The TSB's Retrofit for the Future programme embraces a number of projects that incorporate LED illumination solutions. It's true that there are cost issues with LEDs. CFLs are generally available with a continuing subsidy in place, such as the Carbon Emissions Reduction Target (CERT) scheme, but there is no such subsidy available to support the introduction of LED lamps. Yet prices are falling. The April issue of *Chemistry World*, published by the Royal Society of Chemistry, reported that LED lamps intended to replace 60W incandescent bulbs were $100 (£66) last year. They are more like $50 (£33) today.

Following a very similar price trajectory, one can purchase a complete integrated LED fitting with better performance. It is in this retrofit and new-build context that LEDs have their place today. Fittings that cost £20 could be achieved with a possible CERT subsidy, increased performance and growth in scale. ●

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Shining light on technology

Electrode-less fluorescent lights: Offers efficiencies similar to conventional tubes; suitable for large spaces in non-domestic settings.

Metal halide lights: For high brightness applications; generates excessive heat; requires complex electronic ballasts; incompatible with occupancy sensors.
In electrode-less plasma lighting, radio frequency excitation of the metal halide salt can produce light more efficiently. Directional output can be used to realise useful energy savings; domestic versions are said to be in development and timing and likely pricing are not clear.

Electron stimulated luminescence lamps: Replicate incandescent reflector lamps; accelerated electrons stimulate light emission from phosphor coated inside the lamp; still a prototype. Projected to produce around 600 lumens, require less than 15 watts of power to replace a 60 watt reflector lamp. The colour rendition is expected to be very good and they offer instant-on capability, with dimming capability said to go all the way down to zero per cent.

Thin-film, doped silicon oxide emitters of red, green and blue light: To replace traditional tungsten filament; details of projected performance are scant; prototypes not expected until next year.

OLEDs (Organic Light Emitting Diodes): Still in developmental stage; concerns over absolute levels of light output; questions over lifetime.

Micro-plasma panels: Similar to plasma TV screens; homogenous white light can be produced, depending on phosphor; claimed output of 30 lumens per watt currently is ultimately projected to rise to 100 lumens per watt.

Light panels: Developmental stage; may exceed 100 lumens per watt; not expected to be very effective in task-lighting, such as for reading or preparing food.

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