Alighting on lighting

Equipment for illumination, both internal and external, is not standing still. Brian Tinham sheds some light on the technologies and their application

Necessity is the mother of invention, as Plato told the Greek empire nearly two and a half thousand years ago. In the 21st Century, that aphorism has been proven again, as industrial lighting has risen to the challenge of factories, warehouses and plant – delivering improvements in fluorescent tubes, for example, where discharge lighting may no longer be required.

High bay lighting used to be the staple of lofty engineering halls, plants and warehouses, but increasingly light industry, with its lower ceiling heights and smaller units, has demanded something more akin to office illumination, albeit with improved efficiency and robustness. That's where, first, electronic high frequency ballasts for fluorescents lights came in – making their debut more than 25 years ago – and second T5 tubes, and most recently high output versions, come in. And now we also have LED-based luminaries.

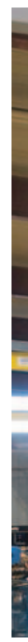
Stepping back a moment, though, discharge lighting still has its place and the technology has not stood still here either. Advantages include high light output, longer life and smaller physical size per lumen – meaning fewer lamps and longer reach for high-bay and external applications. Also, the quality of discharge has long since improved beyond the days of high pressure sodium orange. Now, metal halide units deliver much whiter light with better colour rendering and there are higher grade luminaries, with better optics, to match.

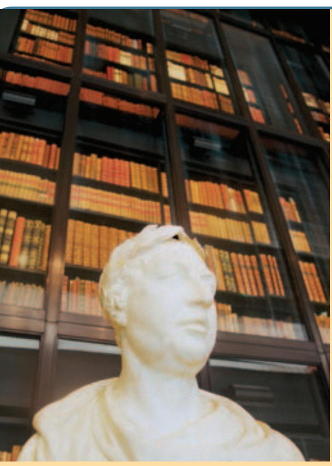
Serious lumen punch

What about fluorescent lighting? First came T8s (replacing the original T12s at various power outputs, with slimmer, more efficient tubes) and then, about a decade ago, T5 tubes, with their five eighths inch diameter. Driven only by high frequency electronic control gear (magnetic switched start ballasts will not work), these units deliver about 20% energy saving and induce less shadowing from the light fittings. And, in the last three years, these have been joined by high output T5s, capable of 80W and even 120W each. Packing four of these into a modern fitting delivers around 23,000 lumens – which starts to match the output of metal halide discharge lamps.

As Hugh King, marketing manager for Thorn Lighting, says, this is real competition. "You need more high-output T5s than the discharge lamps, but the price is comparable; you get a lot of lumen punch for your money, and you can add diming and lighting controls much more easily than on any discharge lamp." That, he says, is why so many warehouses – even those with high bays needing illumination – are now being specified with four by 80W high output T5s.

Most recently, however, attention has shifted to LEDs. "These are fast becoming mainstream lighting technology now – although there are still challenges





NET LED tubes light George III collection

At the heart of The British Library in London, the six-storey King's Library Tower houses books collected by King George III during his reign from 1760 to 1820 – widely considered to be one of the most significant collections of the Enlightenment. The books are on view to visitors behind UV-filter glass, which, together with the environmental control system, helps to maintain correct light, temperature and humidity levels.

After a technical evaluation, NET LED Tubes, supplied by N E Technology in Cambridge, were chosen for lighting this precious collection. Using its solid-state, surface-mount LED technology, six foot NET LED Tubes could achieve the precise colour temperature and lighting levels required by the British Library.

"Unlike fluorescent tubes, the LED tubes produce no UV light, which would be damaging to the books," comments Patrick Dixon, head of building services at The British Library. "They also use only one third of the electricity of fluorescents and last more than three times longer, so also providing significant environmental and financial benefits for the Library."

Portsmouth City Council halves car park lighting energy

Portsmouth City Council has undertaken an energy-efficient lighting installation at its Isambard Brunel car park, using the retrofit 'Save It Easy' device – and is now set to reduce annual electricity charges by £17,573, while cutting 87 tonnes of carbon emissions per year.

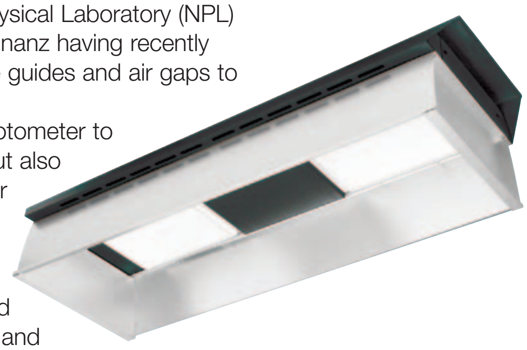
Fully 61% of Portsmouth City Council's carbon footprint comes from running buildings. This car park is open 24 hours a day, seven days a week, and so requires lighting around the clock. When looking to change its fluorescent lamps to energy-efficient equivalents, the council wanted a sustainable solution and reports that the plug-in device from Energys saved it from having to replace the existing light fittings as it upgraded 520 lamps.

Michael Robinson, deputy parking manager at Portsmouth City Council, says that the higher efficiency and better control gear in the new units mean that the site has reduced its lighting energy consumption by 49%. "We expect to achieve project payback in just eleven months," he says.

from the fittings point of view," says King. "There are clear advantages, in terms of efficiency and lifespan – which is around 50,000 hours, with at least 70% of light output before failure. That's 12 years for a street lamp, so there is a lot of potential for applications where maintenance and access are problems. So they're almost 'fit and forget'."

LEDs' colour quality is also superb ["far beyond discharge and better than fluorescent," says King], but higher output LED packages are expensive and do need to be designed to deal with heat from the heat sink. "In office down-lighter applications, that might mean some sort of active cooling, with integral diaphragms that push cooling air across the fittings," explains King.

Expense aside, LEDs' lifespan and maintenance benefits will increasingly appeal in certain applications and there is serious potential for emergency lighting. And if you're worrying about reports of potential retinal damage from LED lighting, that too is being addressed, with, for example, the National Physical Laboratory (NPL) and technology firm Luminanz having recently completed work on wave guides and air gaps to generate diffuse lighting.



NPL used its goniophotometer to measure light intensity, but also monitored light output per unit of electricity consumed, and has coined a new metric for the lighting industry, called 'task efficacy'. Both NPL and Luminanz make the point that the key factor for lighting performance is no longer how well a light illuminates a room, but how effectively it lights a task area. They state that the new metric "will change the way lighting firms design future products and radically change the business model for the industry", to the benefit of the environment. PE

Facts and figures

For lamps on industrial plants, a minimum colour-rendering index of 80 is required to enable comfortable visibility in continuously occupied spaces. An exception is high bay applications where high pressure sodium lamps are also allowed.

In areas containing rotating machinery, stroboscopic effects can be reduced by using high frequency control gear or using different electrical phases on alternate luminaries. Lighting machinery using local luminaries can also solve the problem.

Although emergency lighting is mandatory to aid safe building evacuation, appropriate choices are determined by the type of occupancy, size and complexity of the site and the processes involved.

Luminaries must be chosen with the environmental conditions of the space in mind – such as extremes of heat, cold, vibration or corrosive atmospheres. Information on any airborne chemicals is important, as plastics and rubbers have differing resistance.

In hazardous environments, lighting equipment that does not pose a risk of fire or explosion is essential.

Many industrial environments have impurities in the power supply due, for example, to electrical motors. Where power quality is poor, older technology magnetic ballasts should be considered, instead of electronic ballasts – although industrial high frequency circuits with extra protection may be available.

Lighting maintenance should be considered at the design stage, with technologies and methods chosen carefully to handle any access limitations.