(March 2021)

PROTECTING THE NIGHT: Dark Skies and Artificial Light in the City

City dwellers the world over are used to living in an environment where light from streetlamps, neon signs, transport hubs, shop windows, and so on all combine to create a brightly-lit urban environment where the 'sun never sets' and life can continue, unimpeded by darkness, 24/7. But what if that were not good for us?

There is increasing evidence that artificial light at night is harmful to both the environment and human health. Blue-rich light, such as that emitted by many modern LEDs, including the new 4000K street lights being rolled out across the capital, is particularly disruptive.

What can be done? Clearly, problems like unnecessarily bright streetlights require legislation. However, there is much we can already do as individuals, in our own homes and neighbourhoods, to make a difference. It is less about switching off lights and more about using light wisely.

Buying exterior lighting can be difficult, particularly as we tend to do it in daylight so cannot see the impact it would have in the dark. This lighting guide has been put together, with the aim of helping residents make informed, environmentally-sensitive choices that will contribute to protecting the environment and our health. It has been developed with the help of the Commission for Dark Skies (CfDS). We hope that you will find it useful.

To summarise, there are 5 essential principles to good external lighting:

Bath Starlit Skies Alliance

1. DESIGN EXCELLENCE : innovative designs to light responsibly

Well-designed, innovative light fittings prevent light from spilling outside where it is needed. Good lighting practice guidelines recommend that light fittings be downward facing and fully shielded. Some examples are given below. *N.B.* the key is that the light bulb cannot be seen.

Northumberland Dark Sky Park Exterior Lighting Master Plan

2. DOWNWARD AND SHIELDED : Light when and where it is needed

2.a Lanterns

Many of us will have inherited traditional porch lights. These are often lanterns. Whilst they may give a suburb a period look, they allow light to escape upwards into the night sky and outwards into the wider environment rather than concentrating it downwards where it is needed.

Lanterns can be easily modified by :

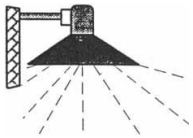
* painting the sides black

* using an E27 to GU10 adaptor and a GU10 bulb on top/down fittings *(see Appendix)*;

* using a low Kelvin, low Lumen light bulb (such as Philips Classic 2.3W, 2000K, 125 Lumen or Philips Lustre 2200K, 325 Lumen) and only using the lights when needed; or

* changing the light fitting to one that directs light downwards and is fully shielded, for example :

Change this …



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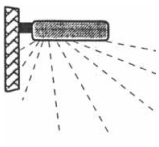
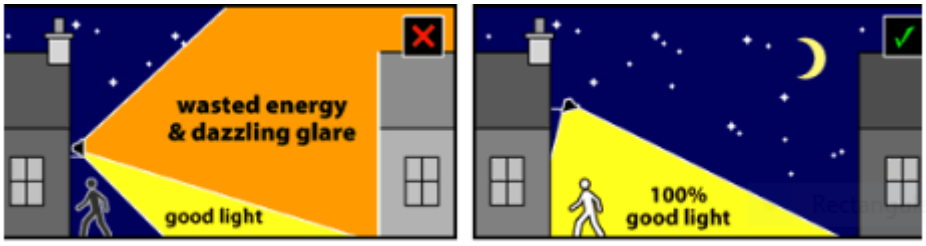


…or this

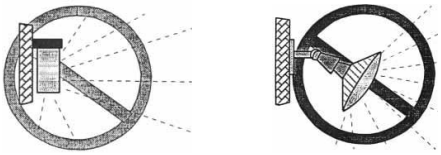
2.b Bulkheads (wall-mounted lights) and Spotlights

Bulkheads and spotlights are often much brighter than needed and are also incorrectly installed by electricians (they should be fitted with light going only downwards). By fitting visors or angling spotlights downwards, light can be spread more effectively with less bright bulbs.

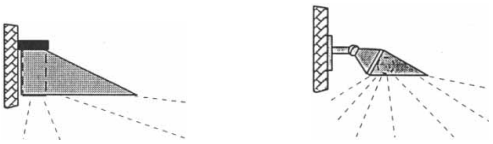


CfDS

Bulkheads and Spotlights can be modified by…



directing the light downwards and



… installing visors

IDA

⚠ (1) Beware when buying spotlights – some on the market cannot be angled and almost all are brighter than necessary *(see **'Security'** below)*. They should be less than 3000K.

(2) Spotlights with integral sensors usually only work if the light is angled outwards: it is therefore better to buy a separate light fitting and sensor. If you happen to have a spotlight that cannot be angled, it can be made to point downwards by adding a wedge.

2.c Uplighters and Downlighters

Uplighters send light up into the eyes of passers-by, the night sky and potentially into neighbouring homes. They are best avoided.

Downlighters in eaves create unnecessary, additional illumination and are best avoided.

2.d LIGHT WHEN IT IS NEEDED

Using timers can help to contain the amount of light used. Some people like sensors; however, they can be triggered by passing animals and the wind.

2.e 'SECURITY' LIGHTING : Less is more!

There is a popular misconception (promoted by manufacturers and electricians) that brighter light is better for security. In fact the opposite is true. At night we are dark-adapted and therefore need very little light to see. Bright light can literally 'blind' us by bleaching our vision (think car headlights). It also creates areas of deep shadow where miscreants can hide. The following video and photos illustrate this :

www.darksky.org/light-pollution/lighting-crime-and-safety/
http://www.nachhaltig-beleuchten.de/blog/en/how-to-lit-a-street-safely-and-how-to-effectively-blind-the-people/
https://britastro.org/dark-skies/cfds_advice.php?topic=security
illinoislighting.org/crime.html (listed under the internet heading Outdoor Lighting and Crime Prevention)

2.f SKYLIGHTS

Installing (and using!) blinds on upward-facing windows also helps reduce light pollution.

Left to right : (1) no blind; (2) internal venetian blind; (3) internal and external blind

3. LIMIT BRIGHTNESS : Dazzle is detrimental to safety, health and the environment

The brightness of a bulb is determined by its Lumen output (formerly Wattage). Light bulbs are often sold as being 'watt equivalent'. This is somewhat misleading: one '60W equivalent' can in fact be much brighter than another as old Watts correspond to a range of Lumens and can therefore be more or less bright.

Old Watts	Approx. Lumens
25 W	230 – 270 spotlight
35 W	250 – 280 spotlight 200 – 300 Useful Lumens (spotlight) 390 – 410 lamp
40 W	440 – 460 lamp
50 W	330 – 400 spotlight 350 – 450 Useful Lumens (spotlight)
60 W	800 – 850 lamp
75 W	1000 – 1100 lamp
100 W	1500 – 1600 lamp

HOW MANY LUMENS ARE NEEDED?

The IDA (International Dark-Sky Association) and CfDS recommend that outdoor lighting should not exceed 35 lumens/m² of illuminated target surface and ideally be as low as 10. By way of comparison, the full moon is about ¼ of a lumen per square metre!

Please avoid 'dusk to dawn' light bulbs: in bad weather they can stay on all day!

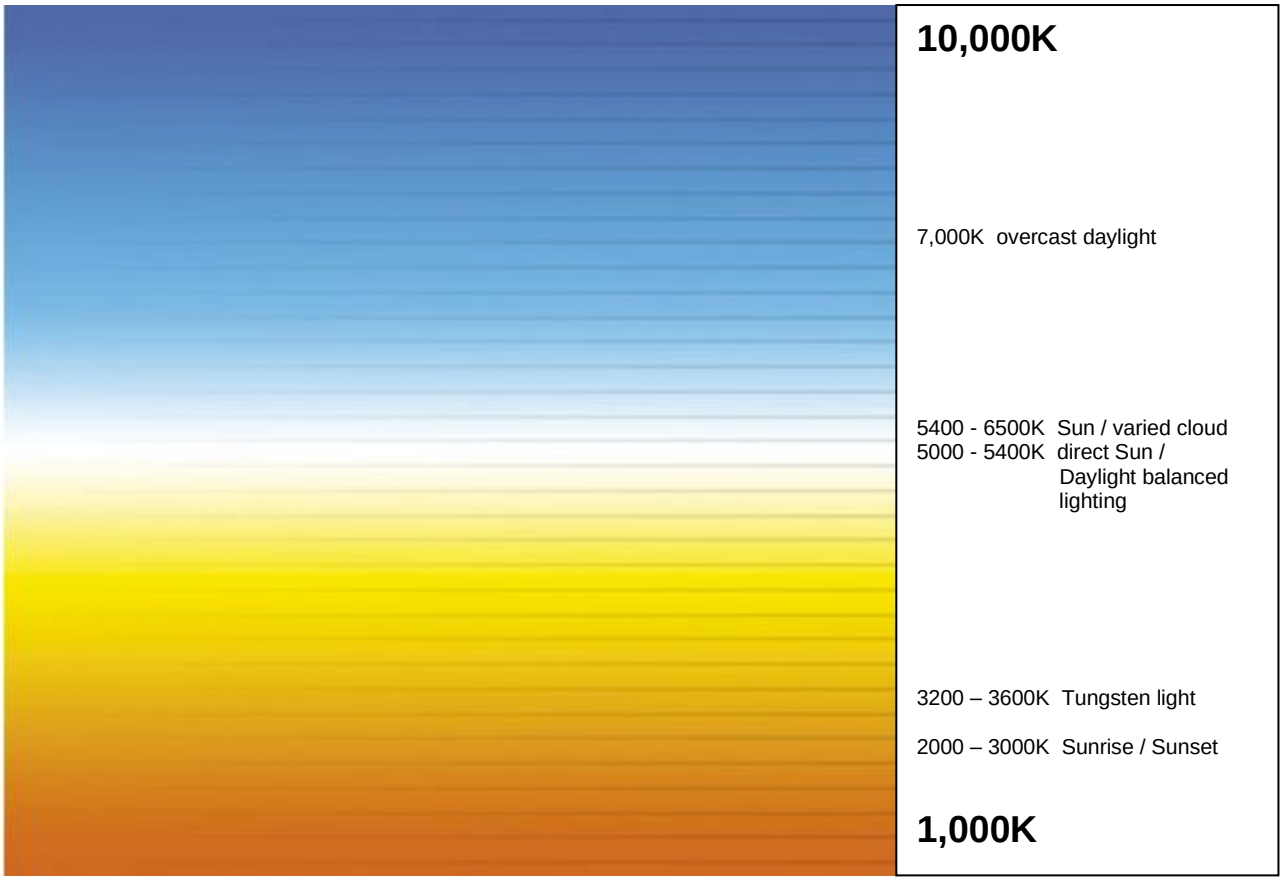
GLOW STONES

An intriguing lighting option are Glow Stones. These are solar-powered stones that can be used to delineate a garden path and steps. Someone at CfDS even uses two green ones as starry 'eyes' to keep deer out of his garden! For further information go to : https://www.glowstones.com/

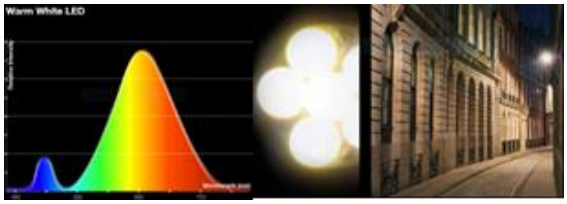
4. USE WARM LIGHTING HUES : LEDs and Colour Temperature (aka Kelvins)

⚠ Beware! - nowadays, many light fittings come with integral LEDs that are startlingly white (in excess of 3000K). These LEDs contain a significant amount of blue that is detrimental to the environment (fauna and flora) as well as human health.

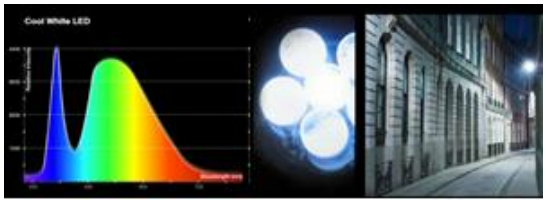
If you are unable to find an LED light fitting with less than 3000K then either choose a fitting with amber LEDs (bearing in mind the number of Lumens - *see 3 above)* or, better still, one where you can change the bulb. Choosing lighting with a colour temperature of less than 3000K (and preferably as low as 2000K) is being good to the environment and good to ourselves. It still provides adequate lighting. *(see* **D. 'SECURITY' LIGHTING** *above)*:



Kelvins : the theory



Kelvins : "Warm White" less than 3000K



Kelvins "Cool White" more than 3000K

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5. ACTIVELY MANAGE

LED lighting is changing rapidly and new technology is coming on the market all the time. We all need to keep abreast of developments and be willing to re-assess our exterior lighting from time to time.

6. LIGHT BULBS AND ADAPTORS

Subject to modification

When buying light bulbs, it pays to go to a big brand name such as Philips, Osram, Sylvania, Bell or General Electric as the quality of light (strength and colour) is more consistent from light bulb to light bulb. Look for the CRI number, it should be no less than 80.

More work is needed by manufacturers for there to be an appropriate selection of low CCT bulbs. In the meantime, the following are various light bulbs and adaptors currently available: some would need dimming. With the exception of the E27 to GU10 adaptor, they are all made by Philips. Further information on available light bulbs can be found here: https://www.lighting.philips.co.uk/prof/led-lamps-and-tubes/led-bulbs/classic-filament-ledbulbs

The CCT of any outdoor light source should not exceed 2700K and dimmable bulbs should ideally be dimmed to the lowest CCT possible.

a) BAYONET B22 FITTING

1. **Extra Warm White : Philips Classic LED A60 Non-dimmable Light Bulb, B22, 2.29W, Gold** 2000K, 125 lumens https://www.amazon.co.uk/Philips-LEDclassic-Lamp-Glass-Flame/dp/B073FNDD2C

2. **Warm White : Philips CLA LEDBulb DT 5-40W B22 CR190 A60 CL**
Dimmable 2700 – 2200K 470 lumens https://www.lighting.philips.co.uk/consumer/p/led-lamp--dimmable-/8718699771102/specifications

3. **Warm White : Philips LEDBulbs DT5-40W B22 CR CR190 A60 FR**
Dimmable 2700-2200K / 470 lumens https://www.lighting.philips.co.uk/consumer/p/led-lamp--dimmable-/8718699771164/specifications

b) SCREW E27 FITTING

1. Warm White : Philips LED Lamp (Dimmable) 3.5W-15W E27 Flame Dimming
2000K / 136 lumens https://www.lighting.philips.co.uk/consumer/p/led-lamp--dimmable-/8718699774912/specifications

2. **Warm White : Philips LED Lamp (Dimmable) 5.5W-25W, E27, Dimming**
2000K / 250 lumens https://www.lighting.philips.co.uk/consumer/p/led-lamp--dimmable-/8718699774837/specifications

3. Warm White: Philips LED Lamp (Dimmable) 5W E27 Flame Dimmable / Replaces 32W
2200K, 350 lumens https://www.lighting.philips.co.uk/consumer/p/led-lamp--dimmable-/8718696814116/specifications

4. CLA LED Bulb DT 5-40W E27 CR190 A60 CL
2700-2200K / 470lm https://www.lighting.philips.co.uk/prof/led-lamps-and-tubes/led-bulbs/classic-filament-ledbulbs/929002391602_EU/product

5. CLA LED Bulb DT 5-40W E27 CR190 A60 FR
2700-2200K / 470lm https://www.lighting.philips.co.uk/prof/led-lamps-and-tubes/led-bulbs/classic-filament-ledbulbs/929002392202_EU/product

c) E27 to GU10 ADAPTOR (available from : https://www.ledkia.com/uk/)

Downward-facing E27 screw fittings can be adapted for use with GU10 bulbs. This has much the same effect as having a downward-facing, fully-shielded light fitting.

d) GU10 BULBS

Philips LED Spot 2.6W-35W GU10 Warm White, Dimmable
2200K to 2700K, 230 Lumens https://www.lighting.philips.co.uk/consumer/p/led-spot--dimmable-/8718699774110/specifications

Philips LED Spot (Dimmable) 3.8W-50W, GU10 from warm to extra warm white, Dimmable
2200K to 2700K, 345 lumens https://www.lighting.philips.co.uk/consumer/p/led-spot--dimmable-/8718699776459/specifications

NOTES :

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FOR LIGHT BULBS :

https://www.lighting.philips.co.uk/consumer/choose-a-bulb
http://www.cp-lighting.co.uk/
https://www.amazon.co.uk/
https://www.any-lamp.co.uk/
https://www.ledkia.com/uk/

FOR FURTHER INFORMATION :

American Medical Association : https://www.ama-assn.org/press-center/press-releases/ama-adopts-guidance-reduce-harm-high-intensity-street-lights
Biological Conservation : https://www.sciencedirect.com/science/article/pii/S0006320719307797?via%3Dihub
Campaign to Protect Rural England (CPRE) : www.nightblight.cpre.org.uk/
Commission for Dark Skies (CfDS) : www.britastro.org/dark-skies/ and https://britastro.org/dark-skies/pdfs/CfDS_booklet_Rev07.pdf
International Dark-Sky Association (IDA) : www.darksky.org/
***** Starlit Skies: starlitskies.org.uk/

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