



Light Pollution

Price
20p

Some Background

Light pollution is a relatively new problem in historical terms. Candles were the main source of night time light until the mid 19th century and gas lighting only spread slowly into city areas through that century. It was the invention of 'electric' light and the demand for better lit and safer streets for pedestrians and traffic through the 20th century that caused the blaze of outdoor lighting we see today. This, coupled with light from offices and other buildings, advertising hoardings, stadia and so on, has caused the loss of the glorious night time sky. Astronomers are obviously concerned, but unwanted light also upsets sleeping; unnecessary light wastes resources; and there are concerns for wildlife.

What is light?

'Day' light arises from the electromagnetic waves which radiate at different wavelengths from the sun. In some magical way, waves of one wavelength reaching one of the 125 million 'receptors' in the human eye cause our brains to 'see' the wave as a particular colour - red, say, or green. Violet light has a wavelength of 400 nanometres (nm, 10^{-9} metres) and red light 700 nm. (Longer 'infra red' waves convey heat). 'Sun' light is not a single 'white' colour but many colours, as we see when reflected (and refracted) from the drops in a rainbow. Artificial light produces light of some but not all the wavelengths emerging from the sun.

The light we see is invariably reflected. The colour we see depends on the material or its surface coating. Red paint for example has the property of absorbing all colours except red. Black surfaces absorb most wavelengths, convert the light energy to heat, and grow hotter than white ones. We need colour and light and shade to make sense of the world around us. Our ability to drive at night depends on the way light from street lamps or headlights reflects different colour from kerbs, pavements or hedgerows, tarmac surfaces, and aids such as cats' eyes. We need to see light reflected from dark spaces to illuminate danger.

Curbing light pollution

It is commonly thought light pollution would be eliminated if street lights were simply directed downwards, but it is clear that some light 'bounces' back. The first thing to be done is to eliminate, or at least reduce, the light that, as it were, *starts off in the wrong direction*. Any *direct* light one sees when flying over an urban area is waste. Many street lights, especially old ones, throw some light upwards. One estimate suggested 30% of light is wasted this way. Many domestic security lights are ill directed. Light spills out of

empty offices in all directions. Nearly every house could save electricity by using better curtains.

'Higher tech' solutions

Street lighting is the major cause of light pollution yet there appear to be no regulations to minimise the light (and electricity) required. It is known that high pressure sodium lights are more efficient than low pressure sodium and mercury vapour ones. The Institute of Lighting Engineers has pointed out that many street lights are switched on unnecessarily early and money could be saved with simple adjustment of the photo electric light controls. More sophisticated electronics could dim the light in the early hours of the night where the need is less or provide for alternate lights to be switched off, as some councils are considering. Another option is to make more use of reflectors or cats eyes where the main need is to assist drivers rather than provide security for pedestrians.

In August 2000 an international conference for astronomers was held in Manchester. Its aim was to draw attention to the problem of light pollution and change attitudes. It was recognised that light pollution could not be totally



Dusk over Cape Town. Pretty but wasteful

eliminated but, because street lights emit light at fixed wavelengths, it was thought possible to 'filter out' these unwanted wavelengths. (Low pressure sodium lights emit light at around 590 nm; high pressure sodium has a broader range but peaks at 550 and 630 nm; mercury vapour lights emit from 540-630 nm whereas light from distant stars is predominantly at 495, 500, 656 and 486 nm wavelength). At present such devices are expensive, but a target price of £200 would put

them within the range of both enthusiasts and professionals.

Other problems

Often overlooked is the disturbance light causes to nocturnal creatures and the hazard the hot surface of many lights presents to the insects it attracts. It is feared, though not proven, that artificial light is reducing the numbers of these creatures affecting the whole wildlife food chain.

Conclusion

A typical street light uses a unit of electricity (kWh) in an average night, which doesn't seem much until multiplied by the lights one has. It is thought 10% of the bill could be saved easily if councils agreed to cut power and lighting times to the minimum necessary. Replacing old lights with new is more expensive but would also help. Research into better ways of producing light, illuminating space and reducing the need for artificial light would help even more.

An ALDES Briefing Note

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This briefing note has been written for ALDES by Richard Balmer but the opinions expressed are his own. It should be technically accurate but if you see errors or have comments, please contact him at 79, Links Drive, Solihull, B91 2DJ, or richard_balmer@blueyonder.co.uk