



Lighting

Introduction

Lighting plays a vital role in enabling people to carry out their tasks safely, efficiently and without discomfort, however electric lighting can account for around 30-40% of a company's electricity bill. An energy efficient lighting system combines low running and maintenance costs, with good effective lighting and can reduce a company's lighting costs by up to a third.


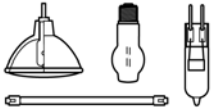
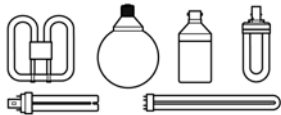
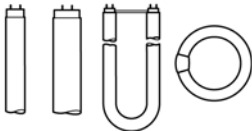
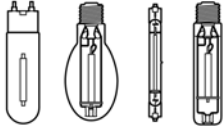
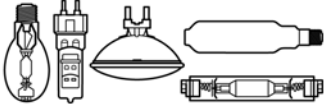
Lighting Types

The main properties of any lamp are the amount of light emitted (Lumens) and the energy they consume (Watts). Combining these values gives what is termed the lamp efficacy (lumens/Watt), which is the amount of light emitted for the amount of energy put in. Therefore, the higher the efficacy the lower the running costs will be.

The table overleaf compares six different lamp types across a number of criteria. The criteria being efficacy, lifespan and the colour rendering quality of the lamp. Colour rendering can be described as how true the lit surface will be to their colours as seen in daylight, as artificial light can accentuate or distort the colours that are seen.

Other things to consider when choosing a lamp type include:

- **Colour appearance** - Combination of colour rendering and how "warm" or "cool" would you want the light to appear
- **Switch on times** - High pressure lamps, like sodium or metal halide may take a while to reach full output levels and will not usually switch on when they are warm. These are unsuitable for switching on and off too often during a day
- **Flicker** - Some lamps flicker on and off at high speeds e.g. fluorescents. The eye cannot see this, but it may cause rotating machinery to appear to be running faster or slower or even in a different direction. Ballasts are used to start and operate such lamps correctly, and high frequency ballasts are available which overcome the problem of flicker and use less energy
- **Lamp life** - Where maintenance is problematic, for example where lights are mounted high up or over delicate areas such as food preparation, long-life lamps should be used
- **Light fittings** - should be selected to screen the lamp and help to direct the light to where it is required. These are often called 'Luminaires' in the trade

Lamp Type	Typical Application/Description	Efficacy (Lumen/Watt)	Average Life (hours)	Colour Rendering
Tungsten filament 	Standard non-energy efficient bulb	8 - 12	1000	Excellent
Tungsten halogen 	Display lighting	12 - 24	2000-4000	Excellent
Compact fluorescent 	Typical saving light bulb	50 - 85	5000-10000	Good
Tubular fluorescent 	Typically found in offices	65 - 100	5000-15000	Excellent - Moderate
High pressure sodium 	External lighting	65 - 140	14000-30000	Good - Poor
Metal halide 	Often found in shopping centres	70 - 100	6000-13000	Excellent - Moderate

Note: Where a range is given this is because there are variations depending on a specific type. For detailed information check with manufacturers.

Opportunities for Savings

Lighting Levels

Suitable lighting levels enable people to work safely and efficiently in a visually comfortable environment. It is the employer's responsibility to ensure lighting levels meet the requirements of the workplace, but everyone in the workplace can help to achieve this.

The amount of light (illuminance) required is dependent on the task involved, but generally the more visually demanding the task the more light is required. A space is either going to be under lit, adequately lit or over lit.

Under lighting can be due to:

- Not enough light being provided for complex tasks, which can be improved by additional task lighting or installing reflective luminaires
- Not enough light on walls and ceiling, can make the space look gloomy. Natural or electric lighting should be directed onto the walls and ceiling. Reflective luminaires in this case will make the walls and ceiling appear even more dark and oppressive.

Adequate lighting may still be inappropriate and uncomfortable if surfaces reflect bright light into the occupant's eyes. This problem is referred to as glare and can result in eye strain, squinting and headaches. If glare from the sun is a problem then shades that block or redirect sunlight should be installed - installing other blinds may not help in reducing glare. Glare from electric lighting may require a change of luminaire, to redirect the light.

Over lighting is caused by too high an illuminance and is best dealt with by:

- Installing dimming controls
- Reducing the number of lamps
- A new installation may look too bright but illuminance will drop as the system ages.
- Replacing lamps with lower wattage varieties should only be considered for tungsten or plug in CFL lamps.

Good Housekeeping

- **Ensure** lights are switched off in unoccupied areas. This includes fluorescent lamps which do not use more energy when being switched on and off
- **Keep** windows clean and blinds open whenever it is practical to do so, but use of blinds may be necessary to reduce glare and heat gains from the sun
- **Keep** lamps and fittings free from dust and dirt
- **Replace** lamps at the end of their useful life, e.g. when tubes start to flicker or lighting levels fall

Lighting Controls

Lighting controls can be used to adjust lighting levels, providing only what is needed, when it is needed and thus save money. Described below are the different types of lighting controls commonly available along with some good practice advice on their use.

Local switches

Local switches are those most common in the work place and home, typically located by the entrance of a room. A local switch can be either a simple on/off switch, dimmer or a remote control device which transmits signals to switch or dim the lights.

- **One switch** should not control too many lights as the smaller the area covered by a switch the better
- **Switches** should be clearly labelled as to the lights they control
- **Control** lights in groups parallel to windows to maximise daylighting wherever possible

Time Controls

Time controls as the name suggests, switch lights on and off at set times during the day.

- **Check** and adjust the times set to reflect occupancy times and check regularly, especially when the clocks change
- **Switches** can have timers installed to turn lights off after a set period, which are commonly used in corridors and storerooms where their use is sporadic. In this case time controls are best used to switch lights off, with local switches used to turn them on
- **If employees** arrive at work in the dark the lights would be switched on, but without automatic switch off, these lights may remain on all day. Try setting timers to switch off lights at convenient times during the day when it is expected that either there will be sufficient daylight, or when rooms will be unoccupied such as at lunchtime or set break times
- **Outside** lights could have a combination of light sensor and time switch. This would allow lights to be switched on at dusk but off at midnight. They could then come on again at 06.00 for example and switch off at dawn.

Occupancy Sensors

Occupancy sensors detect a presence in the sensor's 'line of sight', which triggers the light to switch on or off, and often has a delayed switch off timer to prevent an area plunging into darkness when an occupant stops moving.

- **An effective** method of control is a manual switch, to turn the lights on and an occupancy sensor to switch off the lights after a designated period
- **Keep** sensor clear to ensure an uninterrupted line of sight exists across the area requiring illumination
- **Occupancy** sensors are most effectively used in intermittently used rooms, such as store rooms, toilet areas and corridors

Photo-Sensitive Sensors

This type of control responds to light levels at the level work takes place, and adjusts these levels accordingly to ensure optimum lighting throughout the day.

- **Keep** sensor free from dust and dirt and ensure sensors monitor lighting levels at the working plane blow the lights that they control
- **Clearly** label controls and the lights that they control
- **Control** lights in parallel to windows to allow as many lights as possible to be switched off when sufficient daylight is available

Improving Existing Lighting

Opportunity	Action	Saving
Incandescent bulbs (lamps)	Replace with plug-in CFL of same light output (but of lower Wattage)	Around two thirds of the energy and because CFLs have a longer life they can save £20-30 over their lifetime
Old type tubular fluorescent lamps of 38mm (1½") diameter	Replace with 26mm (1") diameter lamps if you have switch start fittings	Improved colour, up to 10% energy savings
Incandescent spot lamps	Replace with tungsten halogen lamps	Around 50% more efficient in terms of energy consumption with improved optical control and at least twice the lifetime
For situations where display lighting is left on for long periods	Replace with high pressure discharge spot lamps (metal halide or sodium)	These save up to 80% energy and have a much longer lifetime

Opportunity	Action	Saving
Permanently discoloured (yellow) diffusers and prismatic controllers	Replace with new controllers or new fittings	This action alone will not save energy but will raise the illuminance and improve performance. If new fittings with high frequency (HF) control gear are installed further savings are possible
Old style reflector fittings with discoloured reflectors	Replace with modern, more efficient reflector fittings	Modern HF, high quality reflector fittings use more efficient reflector materials. This allows a reduction in the number of lamps saving 30 - 50%

The above tips provide an indication of possible savings - you are advised to seek expert advice.

2002 Building Regulations

Any new lighting schemes over 100m² now need to meet new building regulations. Contact your Local Authority planning department, or your electrical contractor for further details.

Summary

Energy efficient lighting will aid productivity, improve the working environment and keep operating costs down. It should be kept in mind however, that controls that seem to dictate the users of a space are often considered by the users as more hindrance than help and this is where a balance must be achieved with any lighting control system.

Further Action Energy support

- This factsheet is only a summary of principal measures. More detailed information and sector specific publications are available from the Action Energy helpline, **0800 58 57 94**, or on the website at www.actionenergy.org.uk

Action Energy is a programme run by Carbon Trust and funded by the Department for Environment, Food and Rural Affairs, the Scottish Executive, Invest Northern Ireland and the National Assembly for Wales. It is designed to help businesses and public sector organisations cut their energy costs through the provision of free, professional advice and assistance. Action Energy is an integral part of the Government's climate change programme, aimed at meeting the UK's carbon reduction obligations under the Kyoto Protocol.

