

## LED Lighting



### CASE STUDY

Business Type:	Offices
Location:	Richmond
Existing lighting:	Fluorescent, metal halide, halogen
Proposed lighting:	LED
Installed cost:	£27,000
Simple payback period:	1.1 years

### ANNUAL SAVINGS

Electricity:	98,765 kWh
Cost:	£23,874
Carbon:	29.4 tCO <sub>2</sub> e

## WHAT ARE LEDS?

Traditional lighting, such as fluorescent tubes and halogens are inherently wasteful, as a large amount of the electricity they use is given off as heat, instead of light. LEDs (light emitting diodes) are a type of semiconductor which convert electrical energy directly into light, reducing the amount of electricity required to light a space. Reducing the amount of electricity your business consumes helps to save you money, as well as reducing your greenhouse gas emissions.

## WHAT TO KNOW WHEN SWITCHING TO LEDS

- Savings**
  - Lower energy usage leads to lower greenhouse gas emissions and a lower running cost.
  - Specialised lighting controls and LEDs go hand in hand. These include as PIR (passive infrared sensors) and dimmable switches, allowing you to use your lighting in a way which best suits you and your business.
- Longevity**
  - LED lights can offer a lifetime of 50,000 hours, equivalent to around 24 years worth of use in a typical office.
- Quality**
  - The quality of light associated with LEDs is very good, due to their high colour rendering index. This measures how naturally the colours of surroundings appear.
  - LED lights turn on instantly at full brightness, with no delay or flickering.
  - There is a large range of choice for colours and styles of LED lighting, meaning that customers can find a product to best suit their needs.
  - LEDs are more efficient than other forms of lighting, due to their luminous efficacy. This means that they have a higher output of lumens per watt.
- Recycling**
  - LEDs contain no hazardous materials, meaning that they can easily be recycled. Older lighting types can contain mercury, and may require specialist disposal, often with a cost involved.
- Overheating**
  - LEDs are not always the best lighting solution for high temperature environments. Overheating can shorten the lifespan of LEDs.
- Colours**
  - As with many other lighting types, the colour stability of the light from LEDs can vary slightly over their lifetime.



## LIGHTING TYPES

Lighting types and styles have varied a lot over the years, from incandescent bulbs, which had a lifespan of 2,000 hours, through to modern day LEDs, with a lifespan of 25 times that amount. As newer and more efficient lighting styles are brought onto the market, older and less energy efficient means of lighting are being removed from sale, and phased out of circulation. The versatility, efficiency and adaptability of LEDs mean that they are the preferred method of lighting the places we use.

	Lamp Life (hours)	Colour Rendering (Ra)	Colour Temperature (K)	Efficacy (lm/W)
Standard Incandescent	2,000-3,000	100	2,500-3,000	10-20
Tungsten Halogen	2,000	100	3,200	15-24
Tubular Fluorescent	10,000-12,000	>85	2,700-6,500	60-105
High Pressure Sodium	12,000-28,000	25-85	2,000-2,700	25-90
Metal Halide	6,000-20,000	65-93	3,000-4,500	50-100
LED	25,000-50,000+	65-97	2,700-8,000	70-150+



## HOW DO I SWITCH TO LED LIGHTING?

When upgrading to LEDs, there is a choice to be made between retrofitting the LED lamps into existing light fittings, or whether to replace the entire fitting (the luminaire). Each choice has benefits and drawbacks. Several other considerations are also given below.

	Retrofit LED	LED Light Fixture
<b>Pros</b>	<ul style="list-style-type: none"> <li>• Large variety of retrofit products available</li> <li>• Easy to install</li> <li>• Inexpensive</li> </ul>	<ul style="list-style-type: none"> <li>• Optimises the performance of the LED</li> <li>• Little maintenance required</li> <li>• Specifically design lenses, diffusers, heat sinks and driver electronics work to maximise the performance and reliability of the light</li> </ul>
<b>Cons</b>	<ul style="list-style-type: none"> <li>• Maximum lumen strength may be limited to existing fittings</li> <li>• Dependent on the type of retrofit light chosen, the efficacy of the light may be lowered due to ballast offering another point of failure</li> </ul>	<ul style="list-style-type: none"> <li>• Replacing the original fitting means that there is more waste to dispose of overall, which can give higher overall lifecycle emissions</li> <li>• Costly</li> <li>• Installation requires significant work</li> </ul>

### WATTAGE

Wattage should always be considered alongside the luminosity of a light. The wattage of a light is how much energy per second a light requires to light up. LEDs frequently have a lower wattage than traditional lights, but still produce the same level of light.

### LUMINOSITY AND ILLUMINANCE

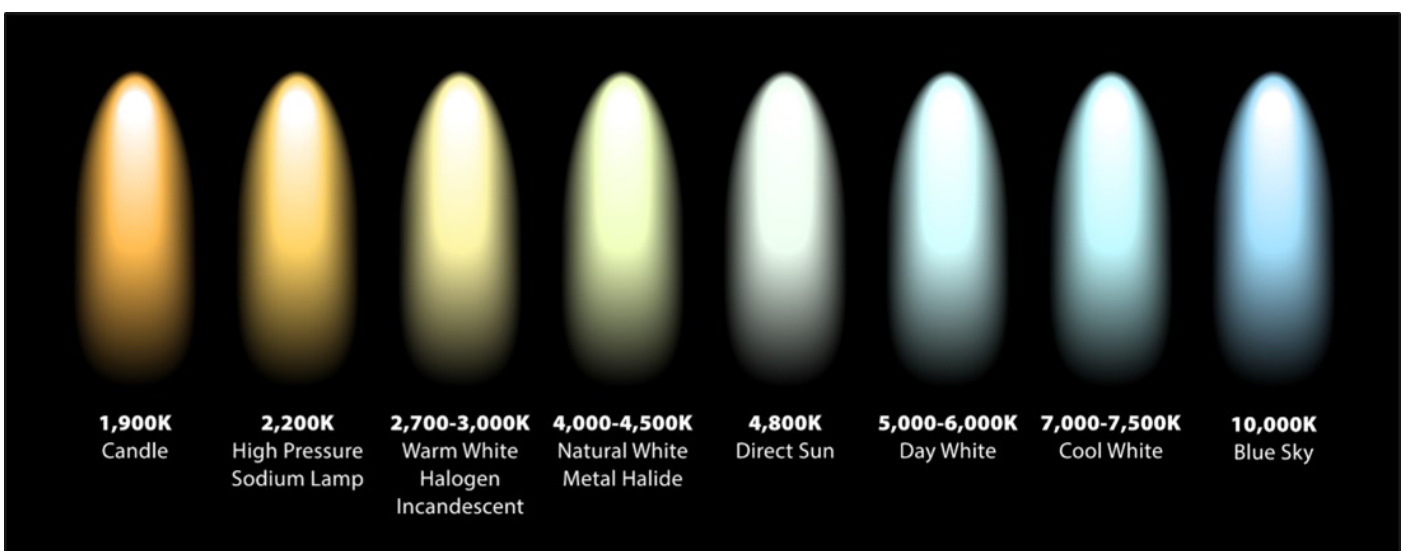
Different areas of a business may require different forms and quantity of lighting, depending on what the area is used for. Luminosity is the amount of light which the LED gives out, and is measured in lumens. It is important to ensure that any lighting upgrade will provide the required amount of light for the area. Before upgrading your lights, you should consider what activities will be carried out at the working surface, and the amount of light they will require. This is called the illuminance. Recommended illuminance levels for several tasks are listed below. When upgrading to LEDs, the same level of illuminance can often be achieved with a reduced number of light fittings, due to their high luminous output. This can further reduce the electricity demand of your site.

### FLICKER

Some poorer quality LEDs can emit flicker, which leads to headaches. If the flicker is at a particular frequency and there are moving machinery parts, this can cause a stroboscopic effect which can make the parts appear stationary, or as if they are moving slowly. This can lead to serious workplace accidents, and must be considered before any LED lighting upgrade.

Illuminance (lux)	Activity	Area
100	Casual seeing	Corridors, stairways, lifts, changing rooms and storage spaces
150	Visual tasks are occasionally performed	Loading bays, warehouses, switch rooms
200	Continuously occupied	Entrance halls, waiting rooms, dining rooms and pulp plants
300	Easy/moderate visual tasks	Offices, libraries, classrooms, lecture theatres, sports halls
500	Moderate/difficult visual tasks	Offices, kitchens, retail
750	Difficult visual tasks	Laboratories, drawing offices, supermarkets, mechanical workshops
1,000	Very difficult visual tasks	Electronic assembly, paintwork, operation theatres
1,500	Extremely difficult visual tasks	Detailed mechanical works, fine work and inspection, precision assembly

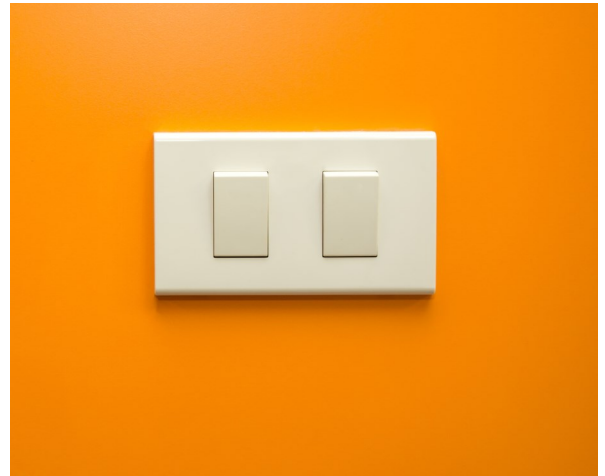
Different activities require different levels of lighting, and this can present an opportunity for energy saving. The building you occupy may be over or underlit, and therefore could require fewer or more luminaires than currently installed. Ensuring that an appropriate level of lighting is achieved can also benefit staff, by reducing headaches and eye strain.



## TYPES OF LIGHTING CONTROLS

Lighting controls are important to consider when installing LEDs. Leaving lights on when they are not necessary can reduce the efficacy of the light, increase bills and creates unnecessary greenhouse gas emissions. Although LED lights require less energy to run than other lighting types, energy waste should be avoided wherever possible.

There are several options available when choosing lighting controls, with different controls best suiting different fittings. Options can include:



### MOVEMENT SENSORS/OCCUPANCY CONTROL

Motion sensors are a commonly used lighting control that come in two main types; presence and absence detection. Presence detection senses movement in the room, and turns the lights on and off accordingly. Absence detection needs to be turned on manually, but the sensor turns light off when it detects no movement and the space is empty. Motion sensor controls are highly appropriate for areas with intermittent use, such as hallways and toilets.

### TIME CONTROLS

Time controls can be scheduled to switch on lighting at specific times of the day or week. This is particularly useful for outside lighting, to ensure that lights only come on when required.

### LIGHT SENSORS

Light sensors monitor the brightness of a space from natural daylight, and dim or turn off the lighting when appropriate levels of illuminance are achieved. The sensor can be mounted in a ceiling or a wall.



Dawn/dusk light sensor



Infrared motion sensor

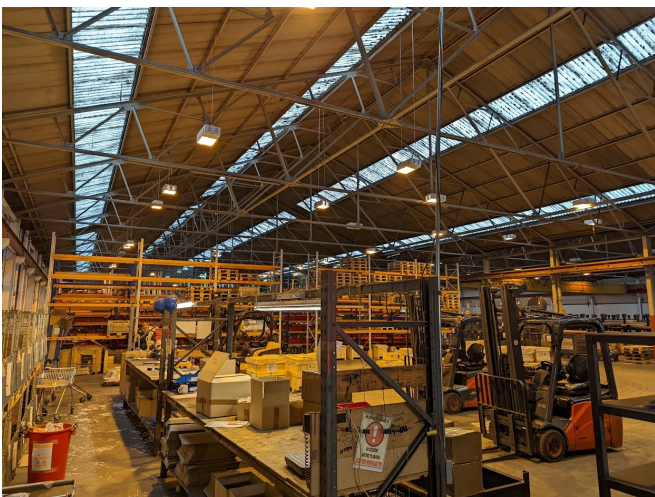


Electronic time control

## SELECTING CONTROLS

Many companies now share their building with other companies. If a room is occupied by a single occupant, it is common to give them responsibility over the lighting control. If a room is used by several occupants, and is a share space, control over lighting becomes harder, because different occupants have different requirements. The table below gives some examples of appropriate controls.

Type of Space	Examples	Appropriate Controls
<b>Owned</b>	Cellular office, consulting room, small workshop	Wall switch and movement sensor with absence detection.
<b>Shared</b>	Open plan offices, factory production areas	Wall switch and movement sensors, both localised and combined
<b>Temporarily owned</b>	Meeting room, hot desking	Wall switch and movement sensors with absence detection
<b>Occasionally visited</b>	Toilet, storerooms	Motion sensors
<b>Un-owned</b>	Corridor, stairs	Remote manual or automatic movement sensors
<b>Managed</b>	Hotel lounge, museum galleries, foyer, terminals	Remote manual and automatic operation, with time scheduling



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