

Human Centric Lighting

Introduction

The human body has a 24-hour cycle which synchronises our bodily functions, this cycle is known as the Circadian Rhythm. The Circadian Rhythm is regulated by the light we are exposed to, so light not only has visual benefits it also affects our biological and emotional functions which includes alertness, sleep, and digestion all which affect health, wellbeing, and productivity.

Light can help us function better

Humans have lived outdoors for thousands of years. We have naturally evolved to respond to natural daylight that provides the right amount of light, at the right time and spectral content to keep our circadian rhythm synchronised.



Ideally, we should all spend more time outdoors to boost our health and wellbeing with natural daylight. Unfortunately, the reality is that we live more than 90% of our time indoors, of which around a third (33%) of that is in the workplace. During an average sunny day, people are exposed to light levels of 100,000 lux, or 10,000 lux on a cloudy day. But spend a day in the office and this is reduced to 500 lux, or just 300 lux whilst attending school. Indoors, most of us do not receive the right amount of daylight that our bodies require to feel healthy and happy.

Why does the light matter?

The central pacemaker of our biological clock and circadian rhythms is in our suprachiasmatic nuclei (SCN) in the hypothalamus, which is in our brain just behind the eyes. The SCN has around 20,000 neurons which are divided into light and non-light sensitive parts. The non-light sensitive part drives our circadian rhythms without external input, but the light-sensitive neurons which receive signals from our eyes, adjust our internal clock to consider the changing seasons and daylight changes. These signals alter our levels of melatonin, core body temperature and effect our bodily processes such as heart rate, blood pressure, and the release of hormones such as cortisol and insulin, all which effects our sleep and wake cycle.

What type of light?

A discovery in the early part of the 21st century found that the human eye has ganglion cells in the retina that are light sensitive with a peak sensitivity around 480nm which is the cyan part of the spectrum; any electric light which activates these cells to control our SCN is known as biological active light or circadian light. The amount of circadian light is expressed as the melanopic daylight efficacy ratio (melanopic DER), and so this ratio can be used to determine how well each light source supports the occupants' biorhythms. It is now commonly known

that in the morning people need a high melanopic DER lighting level to trigger us to wake up, also having continued exposure during the day helps us to keep us alert. In the evenings, the opposite is true, later in the day our bodies need to start to adjust and regulate ready for sleep, this is achieved by having light that has a low melanopic DER so that our circadian rhythm can adjust, which then ensures we have good deep sleep which is important for long term health.

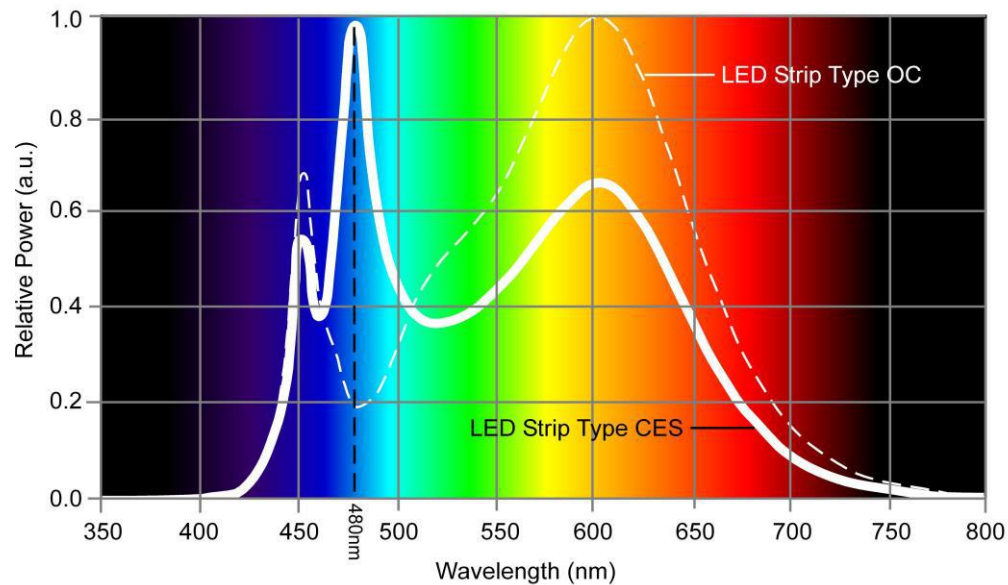


Can we improve indoor lighting to improve our health and wellbeing?

As we strive to become carbon neutral to limit global warming it means that it will not be possible to replicate the 10,000 to 100,000 lux that people experience outdoors given this would be inefficient. To achieve a balance between efficiency and biological active light we need to use LED's that use spectral tuning to achieve 500lux with less energy but to also provide cyan enhanced spectrum to activate the ganglion cells and positively effect occupant's circadian rhythms. Frenger can achieve this using the latest Philips Fortimo LED strip type Cyan Enhanced Static (CES) which provides a neutral white colour temperature ideal for office and applications.



The following spectral graph shows a comparison between a standard LED Strip type OC and the Human Centric Lighting solution type CES:



The LED type CES provides a peak cyan at 480nm to coincide with the human ganglion cell sensitivity to help achieve the highest MDER possible at a comfortable light quality; the key features and benefits are:

- High Melanopic DER (MDER) ≥ 0.86 possible at 500lx
- Colour: 4200K
- CRI > 80
- R9 > 50
- High efficiency: 161 lm/W
- Excellent colour consistency of 3 SDCM
- Long Lifetime Solution: >70,000 hours
- Activation close to natural daylight spectrum.
- Conforms to office standards such as LEED and BREEAM.
- Helps to attain at least 4 WELL points for lighting.

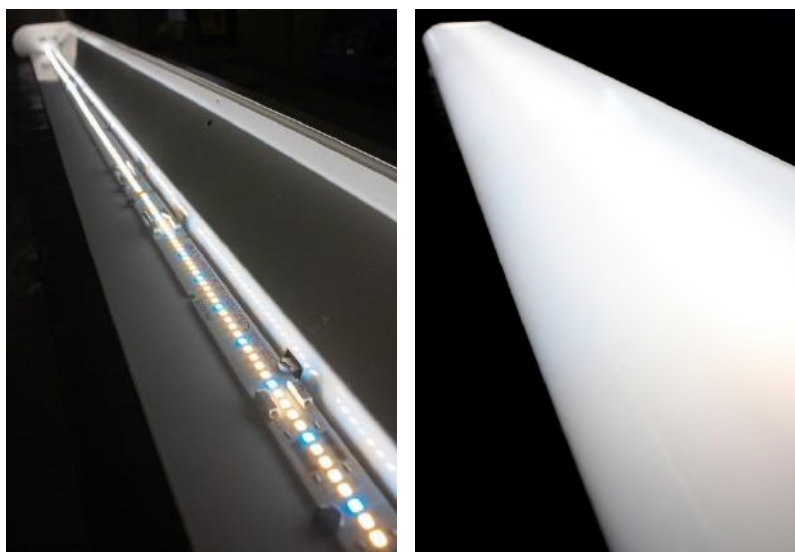


Image: Frenger Extruded Polycarbonate MSCB Lighting Solution with Cyan Enhanced Static lighting