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LIGHTING
How Efficient
is your Lighting
Scheme?

Keeping a close eye on energy consumption and sustainability is on top of everyone's agenda. Using the latest LED technology is a given but just using the technology without a professionally produced lighting design won't make the scheme efficient (or visually comfortable for that matter).

Sustainability

The energy consumption of a lighting installation can be significantly reduced by the introduction of lighting controls

Over the years, we have been witnessing a shift from lighting controls being a ‘nice to have” and then becoming a subject to value engineer, to a necessity for a scheme to meet compliance with current building regulations. The forward-thinking schemes are now using wireless lighting controls as an integrated part of the intelligent buildings.

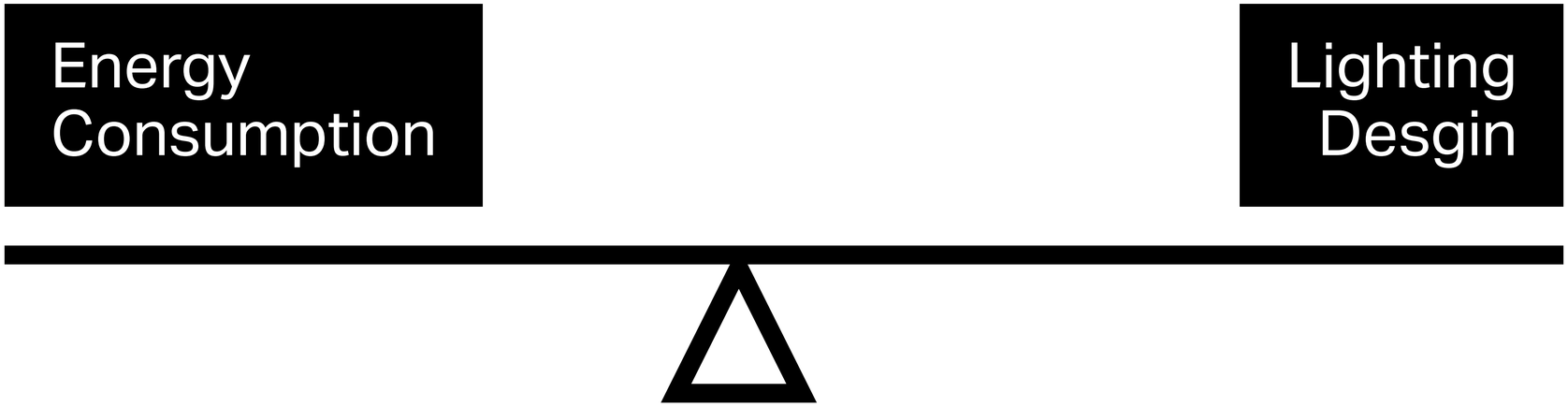
So with a calculator in one hand and a desire to create beautiful spaces, how do we make sure that a lighting scheme focusing on energy consumption doesn’t fall back on the performance and design? And how do we actually ‘label’ a scheme as efficient?

There are several methods of making sure your scheme is performing well in terms of energy efficiency and each practice or client would choose to go down a different route.

LENI

The first one is LENI, a metric for calculating lighting installation energy over time. LENI comes up in every lighting textbook as a prelude to lighting regulations and allows the designer to use less efficient luminaires in some places, balanced by highly efficient luminaires used elsewhere

The Balancing Act



Lighting Energy Numerical Indicator or LENI is the calculation for all aspects of energy consumption by a lighting installation measured in square meter per year. It can be used to calculate the energy consumption for areas, zones, rooms, and even whole buildings. The biggest advantage of using LENI to calculate your energy consumption for your project is the opportunity of being more creative in your choice of luminaires. If a design brief is calling for highly decorative (and most of the time not so efficient luminaires) in some places, the scheme can be still energy efficient by using highly efficient luminaires in other areas.

How to calculate

There are 3 main ways to calculate LENI. First is known as the ‘Quick Method’ This method has fixed parameters taken from the table in the Non-Domestic Building Services Compliance Guide (NBS, 2013; Scottish Government, 2018)

The second method is the ‘Comprehensive Method’ based on the formulae, values and tables found in the BS EN 15193:2017 (BSI,2017a)

The Third Method is the ‘Metered Lighting Load’ This method is only used where LENI is benchmarked for complete installations.

To calculate LENI there are variables that need to be taken into account.

- Daytime Energy (Ed)
- Night-time Energy (En)
- Parasitic Energy (also known as Standby Energy) (Ep)
- Total Power consumed by Luminaires in the space. (Pi)
- Occupancy Factor (Fo)
- Daylight Factor (Fd)
- Constant Illumination Factor (Fc)
- Total hours of operation during the night time. (Tn)
- Total hours of operation during the daytime. (Td)

Step 1

$$Ed = \frac{Pi \times Fo \times Fd \times Fc \times Td}{1000}$$

Step 2

$$Ed = \frac{Pi \times Fo \times Fc \times Tn}{1000}$$

Step 3

Ed = Parasitic load - Sum of stanby energy associated with Ed and En

Step 4

$$LENI = \frac{Ed + En + Ep}{A}$$

Parasitic Energy

Allowance of 0.3 W/needed to be made for the energy used by the control system and that luminaires require a little power even while dimmed down. If the whole lighting system is switched off when the room is not in use, then power loss only applied during house of use. Total power in Watts consumed by the luminaires in the space

Occupancy Factor

If there are no automatic controls Occupancy Factor has a value of 1, if the luminaires are automatically turned off after 20 minutes of room being empty Occupancy Factor is 0.8.

Daylight Factor

If there is no daylight dimming then the daylight factor is 1. Areas within 6m of windows or where the roof is 10% or more translucent or have roof lights the daylight factor is 0.8

Constant Illumination Factor

Lighting systems that have a control aspect have a Constant Illumination Factor of 0.9. Systems that do not have a control have a Control Illumination Factor of 1

Although LENI has been around for over a decade, the uptake of it has been slow perhaps due to the complexity of calculations and accurate prediction of building usage. The more recognised measures are BREEAM and SKA

SKA

The SKA Rating was created by RICS (Royal Institute of Chartered Surveyors) and was introduced to help buildings meet energy efficiency criteria. It looks at many M&E Services, but from a lighting perspective, it considers lighting in the following ways:

Reduce lighting energy use

The SKA Rating document requires the annual lighting electricity use to be less than or equal to:

	Naturally vented circular office	Naturally vented open plan office	Air conditioned office	Air conditioned prestige office
kWh/m/year	14	22	27	29

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You should design to these principles, but the document is very clear that this can only be assessed in a real installation, rather than theoretically. This means that you can only achieve these ratings 12 months after practical completion. The rationale behind this element is ‘to encourage the occupant to reduce energy consumption. The targets are set based on good practice benchmarks.’ (RICS, 2013)

Install energy-efficient lighting

The criteria for this section is that the lighting load in the general office area should be less than 11W/m2. Unlike the reduced energy usage section, this can be calculated at the theoretical stage and confirmed from the as-built drawings.

Lighting controllability

Lighting controls play a huge role in the sustainability of an installation. One report by the LIA in 2017 found you could save up to 75% of your lighting electricity usage by installing a control system alongside your lighting. The SKA Rating requires that lights are automatically controlled by PIRs (presence detectors) and daylight sensors where appropriate. Furthermore, each lighting control zone should be no larger than 8 workstations. Each zone would have its own independent PIR and daylight sensors. You should also provide a manual override of automatic control to allow for occupant control of the environment.

The idea behind this stems from the CIBSE Guidelines for office lighting – office lighting should be simply and easily controlled to minimise energy usage. All of the SKA ratings are aimed solely at reducing energy consumption, and therefore a building's carbon emissions.

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BREAM

The Building Research Establishment (BRE) developed an internationally recognised method of construction for sustainable buildings, called the ‘Building Research Establishment Environmental Assessment Method’, or BREEAM. It covers a range of stages including procurement, operation, design and construction and looks at how we can achieve functions like carbon reduction, design resilience, adaptation to climate change & biodiversity protection in all of these areas. The more of the functions of BREEAM that you achieve, the more BREEAM ‘credits’ you receive and the total number of credits at the end of a project determines your BREEAM rating.

Lighting is covered in the following topics:

- External lighting
- Visual comfort
- Reduction of night time light pollution

Specifying more efficient luminaires that use less electricity to operate also assists with the BREEAM requirements for reduced energy usage as well as reduced carbon emissions – whilst internal lighting isn't specifically mentioned (or have a target), a lighting scheme that is more energy-efficient can lead to more BREEAM credits.

13-20 Settles Street, London
February 10, 2021

The Forge, Surrey
June 24, 2021

External Lighting

The external lighting section of BREEAM considers how we can use energy-efficient luminaires combined with control systems to reduce energy consumption on the project. It has requirements for luminous efficacy (how many lumens are outputted per circuit watt of electricity used) as well as a requirement for automated controls to ensure the lights are only used when required (e.g. daylight sensors and presence detectors).

Visual Comfort

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Visual comfort

The visual comfort section of BREEAM considers how daylight and electric light are designed and used, alongside lighting controls to satisfy the visual performance/illuminance requirements, whilst still being comfortable for the building users. This includes, lighting control zoning, appropriate illumination both internally and externally, the view out of the building and control of solar glare.

Reduction of night time light pollution

This section is focused on the distribution of external lighting – ensuring that it is only used where required, as well as minimising upwards light. This is to ensure light pollution is reduced, there is no or little nuisance lighting with neighbours and energy consumption is also minimised.

Verdict

It is clear that there are many different metrics and targets for the sustainability performance of a building. Ultimately, the targets that are set are down to the client preference – do they want to achieve certain certification, or simply have a reduced carbon footprint and a more sustainable building. These schemes have been developed to help us all understand what a sustainable building looks like and what we can do to reduce our carbon footprint. Lighting can be responsible for up to 40% of your buildings electricity usage (LIA, 2017) and so changes to the lighting specification can have quite an impact on the overall carbon emissions of a building.

Our commitment to the environment

When moving to our new HQ in Bristol, we wanted to practice what we preach. During the refurbishment stage, all surplus timber has been donated to the Bristol Wood Recycling project. On top of installing new dimmable LED lightign fitted out with sensors, we also invested in solar energy. Our solar panels enable us to produce up to 30kW/h. When the Bristish weather fails to cooperate, our energy will be supplied by a renewable energy supplier, Ecotricity.


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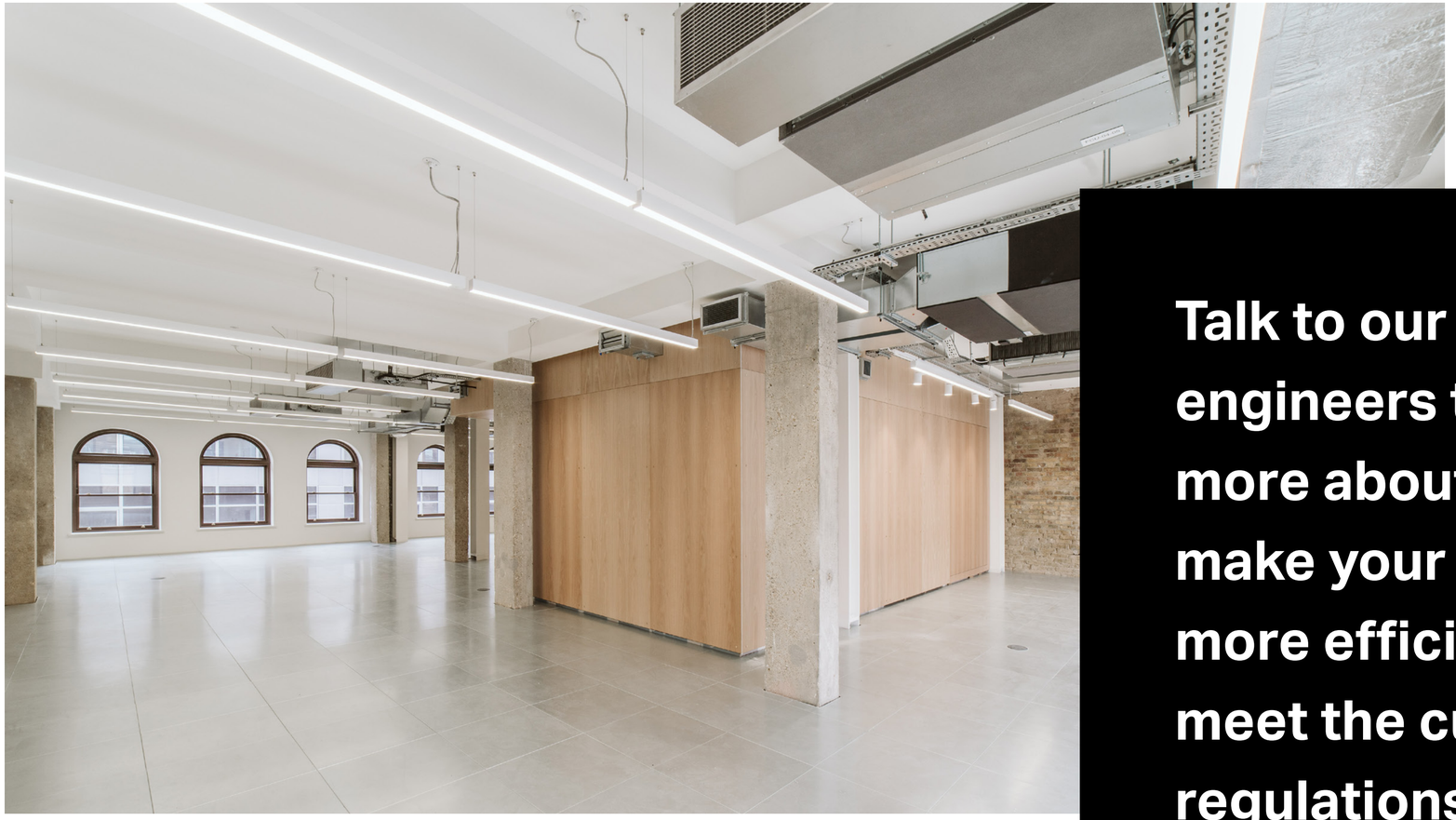
See what else we have done to become a more sustainable business



Talk to our light engineers to learn more about how to make your project more efficient and meet the current regulations