LENI Part EN 151 93

The coming standard EN 15193, Energy performance of Buildings Energy requirements for lighting, describes an harmonised calculation method for how energy usage for interior lighting is to be calculated within different buildings. The lighting's energy efficiency in the building shall be rated by an index expressed in kWh/m2, year (LENI*). The LENI-number is to be presented for the entire building and can be used to compare the energy consumed for lighting.

The comparison can be made between different buildings with the same function, but of a different size and design.
The standard will give example values of the LENI number for a number of common building types. These can be used as the basis for national recommendations.

New regulations 17A to 17E of the UK Part L Building Regulation implement Articles 3 and 4 of the Energy Performance of Buildings Directive and state that the Secretary of State shall approve a methodology of calculation of the energy performance of buildings.

Initially this is being achieved for nondomestic buildings with the Simplified Building Energy Methd (SBEM) and for dwellings by a revision of the Standard Application Procedure (SAP) rating system.

The LENI rating has been written into the UK SBEM software by the Building Research Establishment (BRE).

The UK calculation methodology relies on the use of a notional building. This is a building with the same geometry and activity data as the actual building but built with systems in accordance with Part L2 standards. The methodology then requires that two calculations are performed: one on the actual building and one on the notional equivalent. For Part L compliance, the actual building has to perform better than the notional building by a specified percentage improvement.

The indicator for the energy efficiency of the lighting
The energy consumption for lighting must be declared with an index (Lighting Energy Numeric Indicator, LENI) and is expressed in kWh/m2, year.

The calculation of the LENI number for the building is done using the formula:

LENIcalculated = Wtotal / A (kWh/m2, year)

LENI is calculated on the lighting for the entire building. At the same time the lighting shall conform to current standards and recommendations for indoor lighting (EN 12464-1).

Wtotal is the total annual energy usage for lighting

A is the building's total interior area (m2).

The area is calculated inside the outside walls excluding non-used cellar areas and unlit rooms.

The LENI number can be calculated in two different ways, a quick and a comprehensive.

The quick method is used to give an estimate of the building's annual energy usage. The method can be used for just a number of common building types. The standard includes tables where the annual standard data for different types of buildings can be read to aid calculation according to the quick method.

These are offices, buildings for tuition, hospitals, hotel, restaurants, sports centres, department stores and retail shops and manufacturing industries.

The quick method also includes a standard value for the parasitic energy ($W_{parasitic}$) which is stated as 6 kWh /m^2 and year and which should be used when applicable.

It is distributed over 1 kWh /m^2 and year for charging emergency lighting and 5 kWh /m^2 and year for standby energy for the ballast.

$$LENI = W_{light} + W_{parasitic}/A \text{ kWh/m}^2\text{, year}$$

The comprehensive method is based on actual values for each room. Unlike the quick method, the comprehensive method can be used for all types of buildings even at different geographical positions. As the comprehensive method is based on actual values it gives a lower LENI number than a calculation with the quick method.

The comprehensive method can be used for all types of buildings irrespective of geographical location. Using the comprehensive method you can calculate for a selected period (not only the whole year) under the condition that you can get an estimation of the presence and availability of daylight. In the examples on the coming pages we have used the comprehensive method

$$LENI = W_{light} + W_{parasitic}/A \text{ kWh/m}^2\text{, time*}$$

* Using the comprehensive method you can calculate on an annual, monthly or time basis.

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To calculate energy usage for lighting (W_{total})

The total energy consumed for lighting is calculated according to the formula and is stated kWh/year:

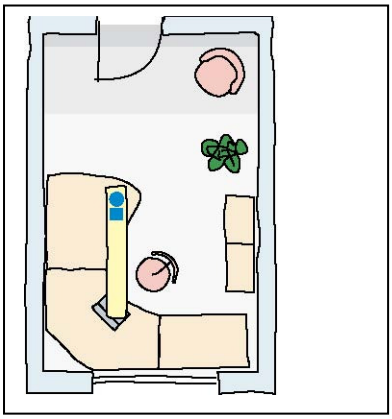
$$W_{total} = W_{light} + W_{parasitic}$$

W_{light} is the estimated energy consumption to power thelighting in the building during a given period. All light sources and ballasts included.

$W_{parasitic}$ is the estimated energy used when the lighting is extinguished. That is to say, the energy used by the ballast in standby mode or for charging emergency luminaires.

Example - cellular office 2.4 x 4 m

Lighting planning In accordance with the European standard for lighting indoor workplaces EN 12464-1 and the UK lighting guide LG7.



A cellular office where we have used a position oriented lighting system with a T5-luminaire where the lighting is oriented according to the workplace. Control is integrated in the luminaire.

During the entire usage time which is normally 20 years for a lighting installation, light control represents a saving of in total 1690 kWh compared with the same room with manual On/Off control during the same period.

W_{total} with traditional manual On/Off control is calculated to 140 kWh/year, a saving of 60 % is attained in the example by using control.

Average illuminance in operation ≥ 500 lux on the working plane and ≥ 300 lux within the immediate surroundings.
Lighting solution A cellular office with a workplace oriented pendant, equipped with 2 x35 W T5 lamps.
LOR 74.9 % Circuit watts 77 W.
Part L 2 luminaire-lumens/ circuit watt calculation 75.5 (incorporating L2B control factor).
Control system Daylight/Constant light control. Absence control.

Energy usage
W_{light} 47 kWh/year
$W_{parasitic}$ 9 kWh/year
W_{total} 56 kWh/year
$LENI_{sub\text{-}area}$ 5.8*

**The LENI number is normally an indicator for the whole building's energy efficiency. The value has been broken down to a sub-area for comparison between different sub-areas.*

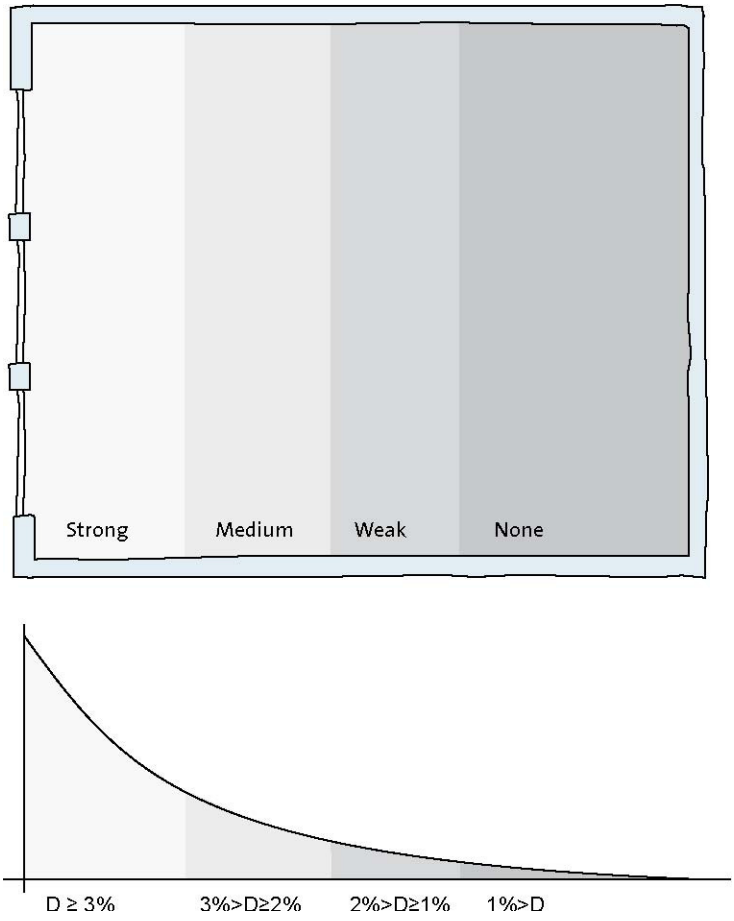
Availability of daylight

In the examples on the previous pages the availability of daylight is shown as in the illustration to the right. This EN calculation for daylight uses strong, medium and weak whereas the UK SBEM software incorporates a continuous spectrum of daylight.

The availability of daylight divides the room into different zones. The different zones describe a specific daylight interval. The zones are divided by daylight factor: Strong, Medium, Weak or None.

Luminaires located in the stronger zone can utilize a larger devaluation of the utilization time, which reduces the total power consumption. The daylight factor is obtained by making a light measurement of indoor illuminance and expressing the measurement result as a relation to the outdoor illuminance at the same time.

The formula becomes D(%) = E indoors x 100 / E outdoors.



Daylight factor (D)
Example of the zone division within an area with incident lighting.

Control

In the examples on the previous pages the different types of control are shown by symbols. An explanation to the different types of control we have used is given to the right.

The cellular office below has both daylight/constant light and absence control.

Daylight control/Constant light control
Daylight sensor: A light sensor that adapts the lighting output to the amount of daylight (natural light).
Constant light sensor: A light sensor that adapts/corrects the lighting output to the operating value according to /following the retention factor.

Presence control
Presence control switches the lighting on and off automatically. After the last presence detection with max. 15 minutes delay the lighting is automatically turned off.

Absence control
Absence control prevents the lighting from automatically switching on, on detection.
Manually switching of the lighting is required. After the last presence detection with max. 15 minutes delay the lighting is automatically switched off.

Presence dimming
Presence dimming switches the lighting automatically on detection. Light dims to a low level, maximum 20 % of the operating value. With a short delay after the last presence detection, for example, from 2 min. – max. 15 min, the
light is automatically dimmed to the lower level.