

LENI – what it means and what it does

EN 15193, which is the standard relating to the Energy Performance of Buildings energy requirements for lighting, describes a harmonised method of calculation for how to determine energy usage for lighting inside different buildings. Called the Lighting Energy Numeric Indicator (LENI), this is the methodology used to provide a far more effective and flexible approach to building regulations – such as Part L. Voltimum explains LENI here, with the help of the calculation methodology by Thorn Lighting:

LENI is a big step forward for the lighting industry because it promotes the intuitive use of controls and best practice in the use of lighting to minimise energy consumption. This new calculation methodology also reflects much more accurately how a space will be used and lit, based on kWh/m²/year.

The methodology uses a 'notional building' that has the same size and shape, and activities, as the real building, but with systems according to Part L2 of the Building Regulations. In effect, this means that two calculations have to be made – the first on the real building; the second on the notional building.

The result is a LENI number, which is for the entire building concerned, and which can be used to compare the energy consumed for lighting. A very useful feature is that comparisons can be made between different buildings having the same or similar functions, but of different design and size.

Note that to comply with Part L, the real building has to perform better than the notional building – and this is specified.

The overall result is that this standard provides sample LENI number values for various common building types, and these can be used as the basis for national recommendations – hence the importance of LENI in relation to Part L of the Building Regulations, for example.

How does this work in terms of Part L?

Part L of the Building Regulations contains Articles 3 and 4 of the Energy Performance of Buildings Directive (EPBD), which are implemented by regulations 17A to 17E. It concerns the methodology of calculating the energy performance of buildings, which is achieved for dwellings by a revision of the Standard Application Procedure (SAP) rating system.

For non-domestic buildings, it is different, and the Simplified Building Energy Method (SBEM) is used instead. It is here that the LENI rating comes into play, as it has been written into the UK SBEM software by the Building Research Establishment (BRE).

'Notional buildings'

The idea of a 'notional building' is an important part of the the UK calculation methodology, but what is it?

It is a building having the same geometry and activity data as the real building, but with systems in accordance with Part L2 standards. Following this, two calculations are performed, one on the actual building and one on the notional equivalent. Note that for Part L compliance, the actual building has to perform better than the notional building by a specified percentage improvement.

When the calculation has been completed, the result – the energy consumption for lighting – is expressed as an index, which is the Lighting Energy Numeric Indicator, or LENI, as kWh/m², year.

The calculation

The calculation of the LENI number for the building is carried out using the formula (by courtesy Thorn Lighting):

The total installed charging power for emergency lighting (P_{em}) – installation input charging power, in watts, of all emergency lighting luminaires in an area.

$$P_{em} = \sum_i P_{ei}$$

Where P_{ei} is the emergency lighting charging power in watts.

Total installed control circuit parasitic power (P_{pc}) – installation input power, in watts, of all control systems within luminaires in an area when the lamps are not operating.

$$P_{pc} = \sum_i P_{ci}$$

where P_{ci} is the parasitic power consumed by the controls when the lamps are off, in watts.

Total installed lighting power (P_n) – installation power in watts of all luminaires in an area.

$$P_n = \sum_i P_i$$

where P_i is the luminaire power in watts. In existing buildings where measured luminaire circuit power is not available an estimation can be made:

1.2 x lamp rating x number of lamps in the luminaire = luminaire power.

Daylight operating hours (t_D) – installation operating hours when daylight is present. Units: hours.

Non-daylight operating hours (t_N) – installation operating hours where daylight is not present. Units: hours.

Annual operating time (t_O) – the annual number of hours with the lamps operating (i.e. turned on)

$$t_O = t_D + t_N$$

where t_D and t_N are defined above.

Standard year time (t_y) – the time taken for one standard year to pass, taken as 8,760 hours.

Emergency lighting charge time (t_e) – the operating hours during which the emergency lighting batteries are being charged. Units: hours.

Constant illuminance factor (FC) – this is a factor relating to the usage of the total installed power when constant illuminance control is in operation in the area. When constant illuminance control is not in operation, this has the value of 1. Units: none.

$FC = (1+MF) / 2$ where MF is the maintenance factor for the scheme.

Occupancy dependency factor (FO) – this is a factor relating the usage of the total installed lighting power when occupancy control is in operation in the area. When occupancy control is not in operation this has the value of 1. Units: none.

Daylight dependency factor (FD) – this is a factor relating the usage of the total installed lighting power to daylight availability in the area. When daylight control is not in operation this has the value of 1. Units: none

The LENI formula is:

$$LENI = \frac{W}{A}$$

where:

W is the total energy used for lighting a room or zone in kWh/ year and

A is the total useful floor area of the building in m².

W is composed of two components

$$W = W_L + W_P \quad [\text{kWh/year}]$$

where:

W_L is the annual lighting energy required to provide illumination so that the building may be used. W_P is the annual parasitic energy required to provide charging energy for emergency lighting systems and standby energy for lighting control systems.

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W_L may be calculated using the formula:

$$W_L = \sum \{ (P_n \times F_C) \times [(t_D \times F_O \times F_D) + (t_N \times F_O)] \} / 1000$$

where the individual terms are defined above.

W_P may be calculated using the formula

$$W_P = \sum \{ \{ P_{PC} \times [t_y - (t_D + t_N)] \} + (P_{em} \times t_e) \} / 1000$$

where the individual terms are defined above.