

LIGHTINGEUROPE position on Lighting System Design Energy Label as policy option in the ENER Lot 37 study on lighting systems.

Executive summary

LightingEurope appreciates the current activities of the European Commission to explore possibilities of setting energy requirements for lighting systems under existing EU regulations. LightingEurope believes that in the ENER Lot37 study on lighting systems **energy labelling lighting system designs** is one of the policy options that shall be considered.

This paper describes the key considerations in energy efficient lighting system design and specifies the outline for energy labelling of lighting system designs for the different project segments. The designed lighting system will ensure effective good quality lighting and the energy labelling of the design will encourage the use of energy efficient lighting systems that will contribute towards ongoing EU energy saving ambitions.

Annex A share further LightingEurope thoughts on how to make energy labelling for indoor lighting system designs work. For outdoor lighting systems design work a similar methodology can be defined based on a different set of EN standards.

LightingEurope Recommendations

The 'lighting system design' shall be regarded as a product and shall contain all information used in the design and information required for the correct installation and operation of the lighting system.

The 'lighting system design' shall be based on criteria for the required illumination for places in the tertiary lighting sector defined in the various EN lighting application standards.

The 'lighting system design' shall include estimation of the energy requirement for lighting and shall indicate by means of labelling the energy efficiency class of the lighting system design.

The 'lighting system design' energy label can be used for all major projects, new or refurbishment, requiring lighting system designs.

Energy labelling of lighting system designs will cover following project segments;

- Office buildings – Business, Communication, Design
- Industry buildings – Manufacture, Warehouse
- Healthcare buildings – Hospitals, Hospice, Residential care
- Retail buildings – Shops, Supermarkets, Wholesales establishments
- Indoor sports facilities and Outdoor sports fields
- Hospitality buildings – Bedded areas, Meeting rooms, Restaurant, Café
- Education buildings – Schools, College, University
- Roads – Traffic routes and conflict areas
- Amenity – Cycle paths, Residential roads, Pedestrian and Amenity areas

Energy Labelling Lighting System Design

The illumination can be provided by daylight, electric light or the combination of the two sources by a well-designed, installed and operated lighting system. Traditionally the required lighting system is designed by the lighting system designer appointed by the client. The lighting system has to fulfil the clients brief, conform to the criteria set by the relevant lighting application standard and meet all legal requirements including the selection of approved products.

In a good lighting system design both ‘light quality’ and ‘energy use’ are considered as equally important elements. A complete list of relevant lighting EN standards is given in Annex B. In lighting system design the latest published versions should be applied.



How are ‘light quality’ and ‘energy use’ linked?

1. Lighting design based on the right EN ‘application’ standards to secure ‘light quality’;
2. Calculate the ‘energy use’ indicator of lighting systems used in the lighting design;
3. Check calculated indicator against benchmark value in the EN ‘energy use’ standard;
4. In case calculated value is too high: review design, add additional controls functionality and/or use more efficient products as relevant.

Based on 'energy use' calculations for the different project segments, it is possible to create a benchmark table (see example Annex A - table 2) where the 'energy use' (in kWh/m²/year) is linked to an Energy Efficiency Class. In this way it will be possible to assign the lighting system energy efficiency class and put an energy label on a lighting system design.

All new lighting project designs can follow a similar systematic design approach in the execution of the client brief. The collation of project information including the client's brief, concept philosophy, selection of lighting criteria, calculation and planning of the lighting system, production of lighting scheme drawings and assigning of the lighting system energy efficiency class for the project will form the portfolio of the lighting system design.

Verification shall be done by inspection and calculations of the project information portfolio of the lighting system design that the designer shall make available.

Annex A

How to make energy labelling for (indoor) lighting system designs work?

Lighting system design is an iterative process in which much information, data and drawings are generated and accumulated. This is the responsibility of the Lighting System Designer who shall carry out or will supervise the execution of all the required tasks.

In general the client defines the project content and provides architectural drawings of the site and facilities. However, for refurbishment projects the information may be dated so the lighting system designer may also have to make site surveys and prepare initial site drawings.

The project may consist of a single element such as an open plan office or may be a building complex having many diverse activity areas such as found in a hospital. In the execution of the lighting system design for the project the lighting designer can deal with each element separately and can sum up the solutions and the energy requirements of the elements of the project.

The project can include indoor and outdoor areas such as a supermarket sales area, stock area, service roads and car park but to have a single energy efficiency classification the project shall be placed into the dominant lighting segment that occupies over 60% of the useful area. Alternatively the projects may be split and placed into indoor and outdoor lighting segment and have two classifications.

Specific requirements lighting system design

1. The lighting system shall be designed by a competent person
2. The lighting system shall conform to the requirements recommended in the relevant EN lighting applications standards (see Annex B) for the lighting segments specified in the Scope
3. The lighting system shall use lighting products conforming to the relevant product standards. However, the designer may explore new techniques and innovative solutions not yet standardised and shall give written justification.
4. The lighting system shall include suitable lighting controls.
5. The designer shall ensure that the concept philosophy and the lighting system design shall embrace best lighting practice and shall be energy efficient in use.
6. In complex projects having multi elements the lighting designer can deal with each element's requirement separately and use the appropriate useful area.

7. The designer shall ensure that the Power demand for the lighting system is minimised but shall make adequate allowance to provide for flexibility in the use of the lighting for different task or activity areas by the designed and installed lighting control functions
8. The designer shall calculate the Power demand (P_j in W/m^2) for lighting and the standby energy requirements for battery charging of the emergency lighting (W_{pe}) and for lighting controls (W_{pc}) for the useful area of the project element or project
9. The designer shall calculate the values of the dependency factors F_c , F_o and F_D . Note the F_o value for outdoor lighting projects shall be based on the lighting usage which is aligned to the traffic flow rate control, see also EN 13201-5 Road lighting standard
10. The designer shall make energy use calculations for the useful area of the elements and shall sum up the area weighted energy requirement of the project elements to provide the Lighting Energy Numeric Indicator (LENI) value for indoor projects expressed in $kWh/m^2/yr$.
11. The designer shall list all assumptions and provide list of identifiers and information on the concept philosophy, product data and maintenance factor used in the lighting system design process for the project
12. The designer shall estimate and declare the lighting system design energy efficiency class of the project
13. The designer shall provide lighting scheme drawings and instructions for installation of the lighting solution for the project
14. The designer shall provide the maintenance schedule and operating instructions for the lighting system to ensure the installation is maintained and operated within design conditions through life
15. The designer shall collate all necessary and relevant information regarding the lighting solutions and produce a project information portfolio
16. The portfolio shall be the lighting system design and shall contain all the information specified in items 1 to 15 above.

Specific requirements energy labelling lighting system designs (indoor)

1. The LENI label value for the Lighting System Design Energy Label for the project shall be estimated by the designer making use of the procedures recommended in the relevant CEN Lighting application standard listed in Annex B.
2. The LENI label value of the project shall be calculated using the LENI label formula shown in the next section.
3. In the LENI label formula the values for W_{pe} , W_{pc} , P_j , F_C , F_0 and F_D shall be those obtained during lighting system design steps 8 and 9 in the “Specific requirements section”.
4. In the LENI label formula the values for t_N and t_D shall be taken from table 1 in the next section for the relevant lighting segment.
5. The calculated LENI label value (if needed the summed area weighted LENI label values of the elements) shall be used to obtain the lighting system design Energy Efficiency Class for the project.
6. The LENI label value of the project shall be compared to the LENI value given in the relevant lighting segment benchmark LENI table 2.
7. The Lighting System Design Energy Efficiency Class shall be the letter whose LENI value is equal or just higher than the LENI label value.
8. The Energy Efficiency Class for the lighting system design shall be declared with the lighting system design by the lighting system designer and shall form part of the Project Information.
9. If parts of the lighting system are used for emergency purposes the requirements for safety have priority against energy consumption.

Example of energy labelling of a lighting system design based on LENI (indoor)

LENI – is the Lighting Energy Numeric Indicator of the total annual energy required for the lighting system of the project per unit area kWh/m²/y

$$\text{LENI} = \{F_C \times (P_j/1000) \times F_O [(t_D \times F_D) + t_N] + W_{pe} + W_{pc}\} \text{ [kWh/m}^2\text{/year]}$$

W_{pe} – is the total annual energy used for charging the integrated batteries in case the emergency lighting function is included in the general lighting luminaire per unit area kWh/m²/y

W_{pc} – is the total annual energy used for standby control of the lighting control system including luminaires per unit area kWh/m²/y

t_D – is the annual daylight time usage h

t_N – is the annual non-daylight time usage h

P_j – is the total installed luminaire power demand for illumination per unit area W/m²

F_C – is the constant illuminance factor

F_O – is the occupancy dependency factor

F_D – is the daylight dependency factor

Table 1 Lighting System Design Energy Label - Typical operating hours

Time	Office	Industry	Healthcare	Retail	Sports	Hospitality	Education	Roads	Amenity
t_D	2250	2500	3000	3000	2000	3000	1800	365	365
t_N	250	1500	2000	2000	2000	2000	200	3650	3650

Table 2 Lighting System Design Energy Label - Energy Efficiency Class LENI (kWh/m²/year)

EE Class	Office	Industry	Healthcare	Retail	Sports	Hospitality	Education	Roads	Amenity
A	00	00	00	00	00	00	00	00	00
B	00	00	00	00	00	00	00	00	00
C	00	00	00	00	00	00	00	00	00
D	00	00	00	00	00	00	00	00	00
E	00	00	00	00	00	00	00	00	00
F	00	00	00	00	00	00	00	00	00
G	00	00	00	00	00	00	00	00	00

NOTE: Values to be calculated in order to generate limits for the segments.

Annex B

European Lighting Application Standards (CEN)

Note – for lighting system design use the latest published version of the standard

EN 12665	Basic terms for specifying lighting requirements
EN 12193	Sports lighting
EN 12464-1	Lighting of work places. Indoor work places
EN 12464-2	Lighting of work places. Outdoor work places
EN 15193-1	Energy performance of buildings – Energy requirements for lighting – Part 1: Specifications
CEN/TR 15193-2	Energy performance of buildings – Energy requirements for lighting – Part 2: Explanation and justification
EN 13201-2	Road lighting – Part 2: Lighting criteria for road lighting
EN 13201-5	Road lighting – Part 5: Energy performance requirements for road lighting.