# Energy saving potentials in lighting

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## Scope of EN 15193 "Energy performance of buildings – Energy requirements for lighting"

The European Standard EN 15193 was elaborated in Working Group 9 of CEN/TC 169 "Light + Lighting" in 2007 to complete the set of all European Commission mandated standards for the Energy Performance of Buildings Directive 2010/31/EU. This European standard was devised to establish conventions and procedures for the estimation of energy requirements of lighting in buildings, and to give a methodology for a numeric indicator of energy performance of buildings. It also provides guidance on the establishment of notional limits for lighting energy derived from reference schemes.

Having the correct lighting standard in buildings is of paramount importance and the convention and procedures assume that the designed and installed lighting scheme conforms to good lighting practices. For new installations the design will be to EN 12464-1, Light and Lighting – Lighting of work Places – Part 1: Indoor work places. The standard also gives advice on techniques for separate metering of the energy used for lighting that will give regular feedback on the effectiveness of the lighting controls. The methodology of energy estimation not only provides values for the numeric indicator but also provides input for the heating and cooling load impacts on the combined total energy performance of building indicator.

EN 15193 can be applied to existing buildings and for the design of new or renovated buildings. It also provides a benchmarking system for different building types, making it possible to rank and order the calculated or measured lighting energy demands. Several alternative routes for determining the energy use are presented in EN15193.

The general understanding is that this CEN standard provides a framework outlining general aspects, but still leaving room for national variations and refinements using more detailed sub-models and methods. In this standard, the buildings are classified in the following categories: offices, education buildings, hospitals, hotels, restaurants, sports facilities, retail services and manufacturing.

## Transposition of EN 15193 in EU Member States

As described in [1] the development of the standard EN 15193 can be regarded as a significant step forward concerning the implementation of energy efficient lighting concepts. It offers a useful umbrella framework of different methods and ways to determine lighting energy needs. Nevertheless, the feedback from a European inquiry process within the CENSE-project on acceptance and applicability of the standard in the EU Member States suggests that further improvements should be considered within the next review phase of the standard. Editorial and structural clarifications should be tackled as well as some technical aspects, which have not yet been addressed sufficiently.

The CENSE project was initiated by the European Commission to improve acceptance and use of the EPBD CEN standards, which were developed

to analyse the energy performance of buildings, including lighting, according to the Energy Performance of Buildings Directive.

### Improvement potentials

In the recommendations of the above mentioned CENSE Report it is proposed to cover e.g. the following aspects in the revision of EN 15193:

- Review of the standard's structure and editing of the equations
- A clear structure, which separates common procedures and national choices
- A common structure of all revised EPBD CEN-standards
- The current layout of the standard with numerous stand-alone equations and many detailed information in the Annexes requires a lot of cross checks in the document when applying the methodology. Especially the editing of equations is crucial. They should be fully spelled out, using common symbols, terms and definitions and be followed by a list of variables used. Input/output-links between equations should also be provided.
- A more distinguished scheme for daylight-responsive controls of artificial lighting.
- Additional representative climatic data, especially for climates of the Northern latitudes.
- For most of these aspects, corresponding methods have evolved within the last years. They can be directly included into the standard's Annex with moderate efforts.
- Control and revision of the benchmark values. Research results and practical experiences show differences in the benchmark values given. These differences should be discussed and eventually be adapted.

### Link of the EPBD with EcoDesign Framework Directives and Regulations

The EuP Directive 2005/32/EC of 6 July 2005 establishing a framework for the setting of ecodesign requirements for **energy-using** products and amending Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC **(Ballast Directive)** have been replaced by the ErP Directive 2009/125/EC of 21 Oct. 2009 establishing a framework for the setting of ecodesign requirements for **energy-related** products.

Under the EcoDesign Framework Directive so called implementing measures have been elaborated with EU Regulations 244 and 245/2009 for the lighting sector. Another Regulation for directional light sources and domestic luminaires is in the drafting process of the European Commission. The working document will be discussed in a Consultation Forum meeting early 2011.

### EU Regulation 244/2009 for non directional household lamps

Commission Regulation (EC) No 244/2009 of 18 March 2009 is implementing Directive 2005/32/EC with regard to ecodesign requirements for non-directional household lamps. Commission Regulation (EC) No 859/2009 of 18 Sept. 2009 is amending Regulation (EC) No 244/2009 as regards the ecodesign requirements on ultraviolet radiation of non-directional household lamps.

According the latest figures published by the European Commission, the annual saving potential for the products falling under this Regulation is 37 TWh/year in the year 2020.

CELMA

*Federation of National Manufacturers Association for Luminaires and Electrotechnical Components for Luminaires in the European Union*

EUROPEAN LAMP COMPANIES FEDERATION

## EU Regulation 245/2009 for tertiary sector lighting

Commission Regulation of 18 March 2009 (EC) No. 245/2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps, and repealing Directive 2000/55/EC of the European Parliament and of the Council. Commission Regulation of (EC) No. 347/2010 is amending Commission Regulation (EC) No. 245/2009 as regards the ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps.

According the latest figures published by the European Commission, the annual saving potential for the products falling under this Regulation is **38 TWh/year in the year 2020.**

## Energy saving potentials in lighting

A lot has been done to regulate the energy efficiency of individual products like lamps and ballasts.

For luminaires, energy-efficiency regulations are fairly pointless as the energy use of a luminaire is determined by the lighting design and the way the product is deployed in the application. When these products are put into existing schemes, they can deliver some 15% improvement in energy efficiency. All too often, however, they are put into service in poorly designed and operated lighting installations, resulting in bad lighting conditions and wasted energy. When lighting schemes are properly designed, the improved effectiveness of the lighting – in terms of both quality and quantity – can reduce energy usage by up to 55%.

To fully realize this savings potential, it is vital to introduce at EU level a Lighting System Legislation that focuses on **energy saving with lighting systems put into service** (both new and refurbished lighting schemes).

The majority of existing stock of the tertiary lighting sector in the EU Member States consists of lighting installations based on outdated, inefficient technologies quite often older than 25 years! Assuming that users are able to overcome investment hurdles to finance refurbishment, tapping into refurbishment of existing stock to more efficient lamp and ballast technologies, in combination with controls, opens up a huge energy saving potential.

### Proposal of the European Lighting Industry (CELMA/ELC) for a Lighting System Legislation

CELMA and ELC propose that the European Commission is developing a Lighting System Legislation (LSL) for putting into service luminaires. The LSL defines requirements for design, installation, operation and maintenance, specifies the methodology for control and approval of lighting systems, to new design schemes, to refurbishment design schemes, to auditing existing installations.

The LSL explores the additional energy saving potential by applying a system approach based on existing European lighting design standards.

With European Commission **Working Document on possible measures targeting the energy efficiency of lighting in the tertiary sector**, published by the Directorate General for Energy on 5 July 2010, the European Commission asked the EU Member States to give their comments on the CELMA/ELC proposal as described in Option B.

They also described an alternative Option A which is rejected by CELMA/ELC as it covers only the optical efficiency of a luminaire.

In **Option B: Addressing Lighting at the System Level (Beyond Eco-design)** the European Commission explains that Ecodesign addresses individual products at the time of design by the manufacturers. It is not possible to determine how the product is going to be installed in the particular application where it is going to be used. For some product groups, such as lighting in the tertiary sector, the use-phase energy efficiency is to a large extent determined by the design of the entire system in the context of each particular installation. For example, even with very efficient lamps / ballasts / luminaires, if the system design is bad and too many of them are installed in a room with no intelligent controls, the total energy consumption of the system will be still higher than that of less efficient products operated in a properly installed system dimmed according to daylight or presence in the room. Therefore there is potential in improving the energy efficiency of both the individual products and that of the systems in which they are used. According to the lighting industry, in addition to the 15% energy savings that will be achieved by the existing ecodesign measure on lighting products in the tertiary sector, a further 40% savings could be achieved via legislation on lighting systems (a total of 55% of savings). Such legislation would leave it to the lighting designers to address the needs of each particular system, choosing the proper combination of products and controls to achieve the energy efficiency requirement.

**Estimated yearly saving potential compared to Business as usual, in case of full implementation by Member States: 80 to 90 TWh for the whole tertiary sector.**

In this working document the European Commission is mentioning that at EU-level instruments are already in place which partly addresses the efficiency of tertiary sector lighting beyond Ecodesign. For indoor lighting the **Energy Performance of Buildings Directive (2010/31/EU)** encourages Member States to adopt requirements on lighting systems. Lighting systems need to be taken into account in the methodologies developed to measure the overall energy efficiency of a building (see Annex I of the Directive). Article 5 request the Commission to develop through delegated acts a "Comparative methodology to identify cost-optimal levels of energy performance requirements for buildings and building elements" (Annex III), where provisions to calculate cost-optimal levels for the energy efficiency of lighting systems could also be included, requiring the use of existing CEN standards in the calculation. According to Article 5, Member States have to use this methodology to calculate cost-optimal levels against which their own minimum requirements will have to be checked (if they exist for lighting). If the latter are substantially less efficient than cost-optimal levels, the difference should be motivated in reporting towards the Commission, and the gap reduced to the extent possible.

**Option A: Ecodesign Requirements and Energy Labelling for Tertiary Sector Luminaires** described in the document is rejected by CELMA/ELC as it sets some simple product information requirements by regulating the optical efficiency of luminaires. Energy labelling based on optical efficiency for tertiary luminaires leads to wrong conclusions as tertiary sector luminaires are a highly complex product group due to an extreme variety of applications and specific situations in which they need to function.

**Estimated yearly saving potential of saving 15-20% in optical efficiency compared to Business as Usual: 30 to 45 TWh.**

### Reference

1. CENSE Report on the Application of CEN Standard EN 15193 by Anna Staudt, Jan de Boer and Hans Erhorn from Fraunhofer Institute for Building Physics (FhG-IBP), Germany (CENSE_WP3.3_N02 January 21, 2010)