Rating of energy performance in residential buildings

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Abstract

One of the tools of EU energy policy is to reduce the energy consumption of buildings. Built-in lighting is one of the four areas with significant potential for energy savings, therefore he received increased attention. Currently, at ever increasing cost of electricity, it is necessary to make arrangements with the lowest power consumption, yet while maintaining light - technical conditions. There is currently no proposed methodology to deal with the evaluation of the energy performance of lighting of residential buildings. The category of residential buildings includes buildings, such as houses and apartment buildings. For these buildings it is awarded the obligation of energy certification only to the energy needs for heating, preparation hot water, ventilation and cooling. The reason for this proposal, to rate the energy efficiency of lighting in residential buildings is to minimize and rationalize energy consumption for lighting, and that have been complied the prescriptive requirements of lighting. For design of such a methodology is necessary to know the facts in lighting of residential buildings. General principle is that, a well-designed lighting and lighting systems know to ensure, in good harmony use of interior space of buildings and regulation of lighting systems, large energy savings. The theme of an article will be processing review of the facts of lighting residential buildings as a contribution to the processing of design methodology and overview of the possibilities for energy savings in these buildings.

Keywords

energy performance, energy savings, lighting, residential buildings, light sources, legislation

1. Introduction

Council of the European Union in 2000 was approved the Action Plan on energy efficiency and the required measures in the construction sector, since it was found that the sector of residential buildings and tertiary sector, whose the major part are the building, which consumes more than 40% of total final energy consumption in the European communities, with a growing trend. The crucial part is the burning non-renewable natural resources, which creating a huge amount of carbon dioxide emissions. In Slovakia, the situation is similar, a crucial source of energy required for residential buildings is the burning of non-renewable natural resources, and the creation of carbon dioxide emissions. While about 10% of the energy falls on the built-in lighting and use of appliances. (Sternová, 2010)

1.1 Energy performance of buildings

The term energy efficiency means the amount of energy required to meet all the energy needs associated with a standardized use of the building, in particular the amount of energy needed for heating and hot water, cooling and ventilation and lighting. Energy performance of buildings is determined by calculation and is expressed in numerical indicators of its energy needs and emissions of carbon dioxide.

The methodology for calculating energy performance may vary on a regional basis. The methodology for calculating the energy performance has generally contain in addition to the impact assessment of thermal characteristics of the building and the impact of heating system and equipment for preparation hot water, including thermal properties of distributions, the impact of air-conditioning, ventilation, **integrated lighting systems**, passive solar systems and solar protection, but also the impact of natural ventilation, the position and orientation of buildings, including outdoor climate. Methodology has to consider the impact of the designed indoor climate. The buildings are in terms of their energy efficiency classified into energy classes, allowing their comparison across categories of buildings. (EN 15193, 2007)

1.2 Legislative framework

European Parliament and Council adopted on 16 December 2002 **Directive 2002/91/EC** about the energy performance of buildings (EPBD for short). Directive about the energy performance of buildings should be implemented into the laws of the Member States of the European Union to 4 January 2006. (Directive 2002/91/EC, 2003) On 19 May 2010

Directive 2010/31/EC was approved by the European Parliament and the Council on the energy performance of buildings (the EPBD II or EPBD Recast) amending Directive 2002/91/EC with the aim of improving the energy performance of buildings. Increased demands on the overall energy savings and CO2 reduction required in the final substantive amendments and therefore of clarity it should be recast. (Directive 2010/31/EC, 2010)

Directive 2002/91/EC on the energy performance of buildings in Slovakia was implemented by law **555/2005 Z. z.** about energy Performance of Buildings with validity from 1.1.2006 and effect from 1.1.2008. The Act defines the conditions and obligations in the process of evaluation of energy performance of buildings and energy certification. (Act No. 555/2005, 2005) Since 1. 1. 2013 is effective law **300/2012 Z. z**., amending and supplementing law 555/2005 Z. z. on the energy performance of buildings and on amendments to some laws, as later amended. (Act No. 300/2012, 2012) To the act came ordinance no. **364/2012 Z. z.** as the implementing regulation. (Ordinance No. 364/2012, 2012)

2. Current status of lighting in residential buildings

Potential for increased energy efficiency lighting is the two limiting factors: current status of lighting and current state of technology, which opposite to the original state offers greater energy efficiency. Therefore, analysis of the facts is necessary precondition for further analyses of technical solutions, selection rationalization measures, determine potential savings for these measures, and finally the cost rationalization optimize energy consumption for lighting.

To finding out the current status of lighting in residential buildings were made measurements of illumination, recording of age lighting systems, control type and the type of used light sources. Studied sample consisted of 25 apartments, but the topic will continue to work and the sample will expand.

2.1 Light sources

Despite the fact that cost-effective solutions to energy-efficient light sources for households are already on the market some time available, due to lower acquisition cost of incandescent bulbs over other light sources, these light sources have not yet been sufficiently exploited. However, it may be assumed that the proportion of efficient light sources will grow.

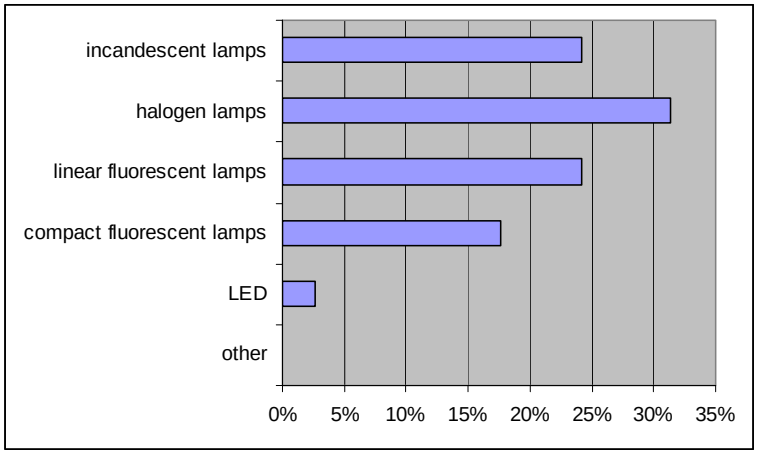

Fig. 1 Light sources used in residential buildings

2.2 Age of lighting system

The majority of investigated lighting systems reached a high age, more than 10 years. The operation of such a lighting system is inefficient and substantially increases the cost of operation and maintenance.

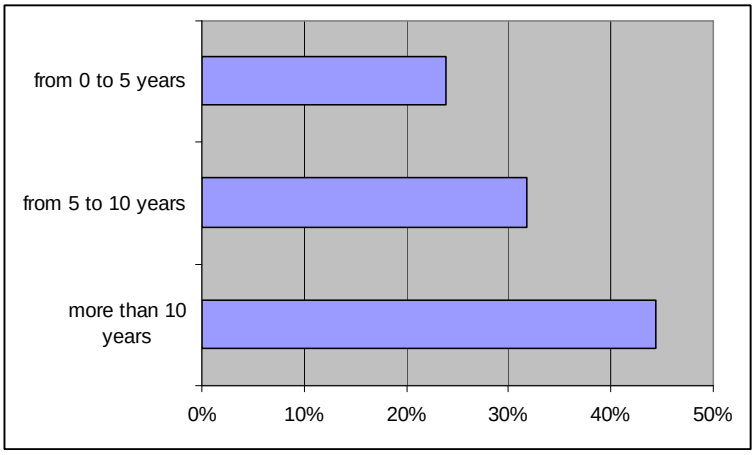

Fig. 2 Age of lighting system in residential buildings

2.3 Lighting management system

In the standards EN 15193 are defined nine possibilities for lighting control. They are shown in the following table. (EN 15193, 2007)

R1	Manual: two-state switch ON / OFF without sensors
R2	Manual: two-state switch ON / OFF with function of time off (stairs)
R3	Motion sensor: auto ON + dimming
R4	Motion sensor: auto ON + auto OFF
R5	Motion sensor: manual ON + dimming
R6	Motion sensor: manual ON + auto OFF
R7	Motion sensor: manual ON + dimming on the constant illuminance
R8	Photocell: switching or dimming depending on daylight
R9	Central lighting control

Tab. 1 Type control for the individual room / area

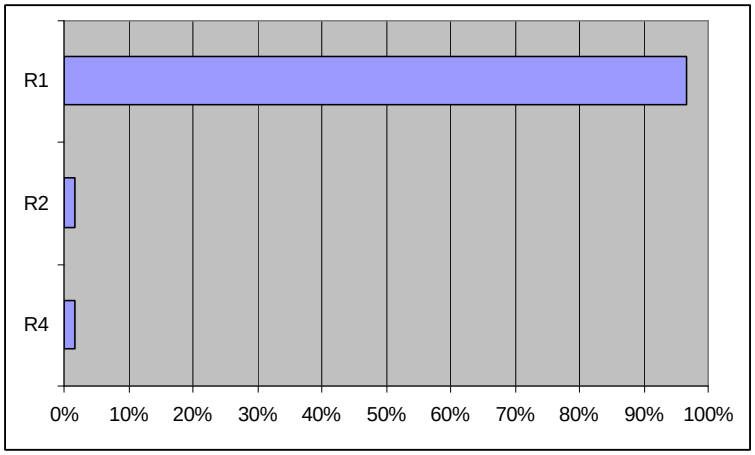

Fig. 3 Type control used in residential buildings

In most areas it used simple management of type R1 - manual: two-state switch ON / OFF without sensors. Automatic control is represented in the minimal, usually only in the corridors.

2.4 Measured illumination

In Slovakia is valid norm STN 36 0452 - Artificial lighting of residential buildings, which I used for this evaluation. (STN 36 0452, 1986) Measured illumination values were compared with the requirements of the standard and evaluated.

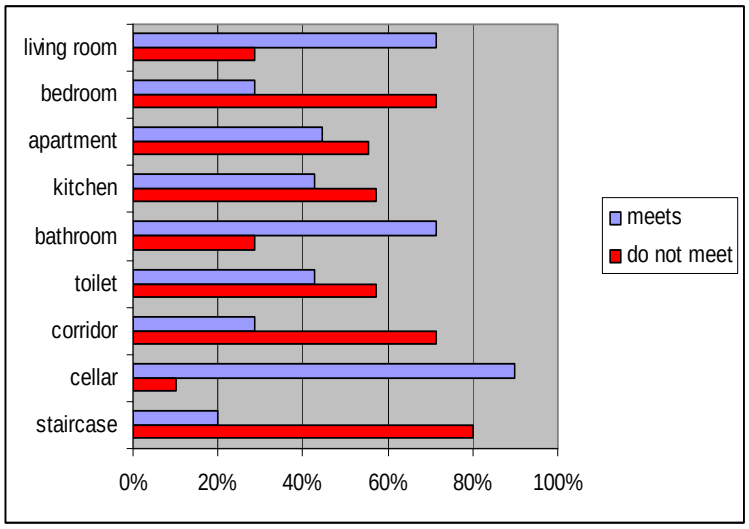

Fig. 4 Show that the requirements of standards are met for individual rooms

3. Opportunities for energy saving

Generally applies principle that a well-designed lighting fixtures and lighting systems know ensure significant energy savings at good interplay use of interior building lighting systems and control significant energy savings. Energy efficiency of the entire lighting system while determining the energy efficiency of lamps, lighting efficiency and effectiveness of the lighting system.

Minimization and rationalization of energy consumption for lighting must be:

• consistent with the need the same time ensuring appropriate levels of lighting and other qualitative and quantitative indicators light

• to meet the hygiene requirements of visual work

• to be created simultaneously with adequate lighting ergonomic space for creative and productive work for passive or active recreation respectively. other activities by purpose and destination of the building space

Rationalization of lighting in buildings includes the following options:

• use light sources with high output - lamps, induction lamps, LED ...

• use of modern and for the intended purpose appropriate lamps with high efficiency

• individual dimming of lighting - based on photocells or motion sensors in rooms or parts thereof. Individual dimming is not only a tool for energy savings, but also brings the possibility of moody lights, increase comfort of lighting, illumination adjustment and distribution of brightness with individual requirements and similar.

• use of light sources with appropriate intensity – for example orientation lights in the hallways do not require such intensity as lighting in the reading room or office

• suitable timing, auto power off, power-off outside time use

• computerization of lighting - use electronic ballasts with low energy consumption, control systems, control DMX

• use of natural light as far as possible

• use of light guides - their use can save a considerable amount of energy for lighting. Although Slovakia is not yet a lot of installations with light guides (these systems are expensive), their contribution is not negligible and the interest in these systems begins to grow also in our country.

• implementation of an energy audit of lighting systems

4. Conclusion

The issue of energy certification of buildings is still being developed. Energy certification, which began to implement in all EU countries and also in some other countries, is a completely new approach and it is not possible launches of its implementation. Methodology and legislative conditions will therefore require the development, modification and improvement. Based on the analysis of the facts lighting in residential buildings, this post is to contribute to the improvement of the methodology of energy certification of buildings introducing new requirements and procedures, especially for the category of residential buildings.

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