Relation between the lighting and environment

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The daylighting and the artificial lighting is a part of environment. The lighting plays an important role in life of everyone of us. We know that it is not possible fully replace daylighting by artificial lighting. The amount of daylight is important mainly in areas with permanent stay of people and it influences the choice of parameters and functions of system of artificial lighting.

That`s why I focus on the relations between daylighting and artificial lighting in my report. Owing to these relations I evaluate influences causing an optimal using of artificial lighting. Finally, I state here the influence of using of lighting sources in lighting on environment and ecological aspects used for the production and the liquidation of light sources.

1. Relation between daylight and artificial lighting

Lighting system is functionally finished set of illuminative objects, which makes in illuminated place luminous area depending on characters, state and situation of these illuminative objects and on luminous characters of illuminated place and apparatus inside of it as well.

Lighting systems can be separated in following three types of systems according primary sources of light and functional extent which were used:

a) system of daylight
b) system of artificial lighting
c) system of mixed lighting

The main requirement of inner area from technical aspect is visual comfort. The visual comfort is defined as a pleasant psychophysiological state of organism caused by luminous area which is needed for efficient making of work, for relaxing and which respects hygienic requirements.

ad a)

The daylight with its physiological and psychological influence is the most important for the whole hygienic appreciation of lighting.

If we speak about daylight of inner area we think not only lighting by natural sunny light or the sky light penetrating directly to rooms through illuminative hole, but also natural light reflected froms outer and inner obstructions. Daylight is changing during a day and a year. The lateral light makes special presentations of cubic objects, distribution of brightness in rooms and required visual contact with outdoor area. At the same time the daylight can cause a glare by sun or sky and can unfavorably influence heat comfort. The basic parameter of daylight is a factor of daylight determined by norm.

ad b)

Systems of artificial lighting ensure conditions for visual activity while the lack of daylight in areas with insignificant daylight and in areas without windows. The main lighting specified for the main visual activity can be separated into three types according the way of assurance and situation of illuminance in the area:

- the whole lighting
- graded lighting
- combined lighting

The illuminance of working place, the uniformity of lighting and the level of glare and presentation of colours is observed for the artificial lighting.

ad c)

The mixed lighting is made by daylight of inner areas and completive artificial lighting. Its importance is in the assurance of needed lighting in rooms or their functionally deliminated parts, where daylight is not sufficient.

Daylight and the artificial lighting are in a near relation. The favorable psychosomatic effect is an important preference of daylight. Lighting holes provide us the daylight. The size of lighting holes is influenced by required norms for the level of daily illuminance and technical luminous effectivity of lighting system, for relative effectivity of lighting holes and used filler. The wiev through lateral lighting holes makes a contact of persons with exterior, it takes out claustrophobia feelings and it enable relaxation of sight. Wastes of heat depend on the construction of lighting holes (kind and multiplicity of glaring, the slant, possibilities of screening and perspective functions) and their sizes. The downsizing of lighting holes causes the extension of period of using the artificial lighting, so savings of energy with lower heat wastes is accompany by more frequented using of the artificial lighting. It is necessary to find that size of lighting holes which will make the sum of energy for supporting of heat wastes and electrical energy the least.

For complex appreciation of lighting is necessary count with next wastes and gains:

- electrical energy for the artificial lighting
- heat wastes
- energy for ventilation of heat stress through holes in summer
- gain of heat from sun radiation in winter
- gain of heat from systems of the artificial light
- usage of energy related with increasing of hygienic requirements
- different invest costs depending of variety of lighting systems
- costs for servicing of systems of daylight and the artificial light as well

The sight is ill-conditioned because of long artificial lighting. Areas without daylight have to higher requirements of hygienic norms, it means enough of ventilation, enough of artificial lighting and next microclimatic parameters. If we use buildings, we have to take care of cleanness of lighting holes, take care of luminaries to renew the painting of inner surfaces. And we can not forget to care about screening apparatus (shutter, blind).

2. Factors which affect the optimal using of artificial lighting

Consequential using of daylight

Through a convenient choice of lighting holes in peripheral or roof mantle of the building are achieved considerable savings of energy (due to the shortened time of artificial lighting). Larger lighting holes assure enough daylight, however, we must also consider a possible warmth loss especially in winter.

Using sources of light with big specific output η (lm/W)

Specific output of a source of light is given by the following relation:

$\eta = \frac{\Phi}{P}$ [lm/W], where Φ … is specified luminous flux of source,

P… is energy input of source.

The producers try to improve the lighting technical parameters (including specific output) by using new materials, luminescent materials of higher quality, etc. and by developing and producing new sources (for example shining diodes).

The choice of luminaire considering their efficiency η_S and distibution of luminance $I_{C\gamma}$

Efficiency of luminaire is given by the following relation:

$\eta_S = \frac{\Phi_{sv}}{\Phi_{zdr}} < 1$, where Φ_{sv} … is luminous flux of luminaire,

Φ_{zdr} … is the sum of all luminous fluxes of all sources in the luminaire.

The producers of lights try to increase its value by using new constructions, new materials and by adjusting their surface.

Distribution luminance of luminaire in space is given by the so called curves of luminance in the cutting plane through the fotometric surface of luminance. Each curves of luminance is derived by measurements on special apparatus (goniophotometer) and they are mentioned in documentation by the producers of luminaires or light sources. Using direct or indirect lighting influences the energetic demanding of artificial lighting.

Project and maintenance of lighting systems

A lighting technician should choose the optimal using of artificial lighting and not dimension the lighting system in his project. In a project are first of all chosen the possible sources of light based on the parameters of lighting. Next, the economic factors (specific output, price) are considered. It is necessary to get the technical data for the selected kind of source light. Then the lighting system is calculated. There are several calculation programs available for their purpose. If there are done several versions of the project of the light system at once, the economic analysis enables us to choose the most suitable version.

Once the lighting system is put into service, the environment will have a negative impact on its character when in use and the system will also naturally get old. Because of that will change also its basic parameters, such as level lighting and its uniformity. Therefore, we must consider the maintenance when projecting a lighting system.

An inconvenient plan of maintenance of the lighting system for example inadequately prolonged time intervals can came overlarge in a draft plan of a lighting system

Regulation of lighting systems

The following ways of regulation of lighting systems are recommended to reach the optima using of artificial light:

- according to daylight – the option of using a sensor of the lighting intensity
- according to the used space – a movement sensor can be used for present of people – sensor of movement
- according to the performed eyesight activity – if the level of eyesight activity declines, it is advisable to decrease the amount of light and thus decrease energy input of the artificial lighting system

Colour adjustments of surfaces

Factors of light reflection from inner surfaces (ceilings, walls, floors) and the interior equipment have a considerable effect on the amount of the reflected part of illuminance. Particularly with indirect lighting is necessary to use the lightest reflection surfaces possible, in order to assure a high level of the reflected part of illuminance and to decrease energy input of the lighting system of artificial light.

3. Environment and the lighting

Ecologic of lighting relate with the economy of lighting. Economy of lighting means that we get the required quality and quantity with the lowest usage of energy and costs, we make conditions for all kinds of activities and the sight relaxing. The efficient use of light means that we project the lighting owing to the function of illuminated areas. If we change the function of area, we will change the way of lighting.

Owing to the progress in lighting technology there are still new kinds of light sources with longer use, with lower energetic usage, better colour of light and also less toxicants. In spite of lower content of mercury in discharge lamps, this lamps are still dangerous for the environment.

The unuseful products of lighting technology become just the waste. Bulbs belongs to the groups of "the other waste" category (O) and all discharge lamps to category dangerous waste (N). The danger of waste is appreciated according dangerous character which the waste has or can have.

Mercury and next toxicant are spread in light sources only if they are broken. Unuseful bulbs and discharge lamps become a part of communal waste, they go into the communal tip. Owing to the quantity of such as kind of the waste in communal tip it necessary to limit it and

unuseful discharge lamps and fluorescent lamps pass on firms which ensure use and disposal of it.

More ecological light sources has bigger specific output η (lm/W), which cause decrease of usage of energy and it more environmental friendly.

Producer of light sources make an effort to improve their products, they change technological processes of production, they use new materials.

For example:

- removal Cd (cadmium) from luminophore
- decrease of mercury in fluorescent lamps – 3 mg – 120 mg
- decrease of lead in glass
- tarnishing of bulb lamps by electrostatic spreading
- soldering is replaced by welding

Storing of dangerous light sources is forbidden, so their liquidation is necessary to ensure by proffesional organization. The contract partner of importers and producers of lighting technology called EKOVUK is focus on waste with mercury. This firm organizes reverse taking of waste respecting the appropriate notice.

To sum up, owing to words mentioned before, it is evident that we can do much for more ecological lighting. We should have helped with the preservation and the improvement of our environment.

Literature

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