Appendix 8.8

Application Guide for Daylight Responsive Lighting Control Systems

This application guide is a publication resulting from IEA SHC Task 21 Subtask B work. It consists of two parts. The first part addresses general design considerations involving electric lighting and shading controls, installation procedures, and the prediction of energy savings and costs. The second part consists of the monitoring procedures used and the results of performance evaluations of lighting controls installed in test rooms. The executive summary for this guide is given below.

Information on how to obtain additional copies of this guide can be obtained from the Internet site at http://www.iea-shc.org or by contacting the IEA SHC Executive Secretary, Pamela Murphy Kunz, Morse Associates Inc., 1808 Corcoran Street, NW, Washington, DC 20009, USA, Telephone: +1/202/483-2393, Fax: +1/202/265-2248, E-mail: pmurphy@MorseAssociatesInc.com.

Executive summary

Daylight responsive control of lighting applies both to the control of the artificial light and dynamic control of the distribution and amount of daylight. Objectives for using daylight responsive controls are energy savings, visual comfort and reduction of cost. It is a prerequisite that windows are used as a light source, not just for a view. Also proper integration of daylight and artificial lighting is important. The eventual savings depend very much on the behaviour of the user.

Finding the right solution

The best approach to arrive at a good solution is to first optimize daylight in terms of levels and distribution in the space. This does not ensure that daylight will supply sufficient light for illuminating the room and the visual task(s) all the time and thus eliminate the need for artificial light. The objective is to design a solution that yields a significant contribution of daylight and provides the greatest user acceptance and satisfaction. Typically a daylight factor of 1-3% to a depth of up to two times the room height from the façade is a suitable goal. Daylight systems will in general not improve the amount of daylight, but are often needed to improve the distribution of the light and avoid glare.

Control of daylight and direct sun is typically manual. If automatic control is used, the criterion used is typically to avoid direct sunlight entering the space and control is often based on illuminance or irradiance of the façade. Few experimental systems have been designed to control interior daylight conditions, direct sun, and other criteria related to visual comfort.

Electric lighting and daylight must be integrated to achieve the goals of energy efficiency and good visual comfort. The layout of the electric lighting must be designed so that suitable zones are created and daylight is supplemented in each zone. The daylight responsive control system of the electric lighting must also be designed to accommodate the specifics of each daylit zone.

There is quite a variety of daylight responsive control systems for artificial lighting on the market. The main objective of this guide is to support the user in selection, installation and maintenance of such a system.

What are the benefits?

Daylight responsive controls systems yield significant electric lighting energy savings at an unaffected visual comfort level. In a number of practical demonstrations, energy and comfort aspects are evaluated. In the conclusions of this book, it is shown that the actual savings from different types of control systems do not differ much: almost all systems save a significant amount of energy. More essential differences between systems are in the user interface and adaptability to user demands.

Once the step is taken to install daylight responsive lighting at a small added cost, other advanced controls may be available. Not only controls for lighting but, in the case of building-wide systems, user-control of automated shading systems may also be made available. Also, when the users are absent (e.g., at night), the controls may be used for climatic control of the building.

What will be the future?

As can be seen in this guide, the developments in electric lighting controls have led to a vast number of satisfactorily performing systems. The actual savings from these systems strongly depend on the use of window shades. Future developments, therefore, will be more in the direction of improved daylight systems that are adjustable, or automatically adjustable to daylight availability. This will increase the benefits of daylight-responsive lighting even further and will also lead to optimized working conditions with respect to visual comfort and the thermal environment. Current developments aim at more distributed logic replacing the centrally-controlled systems. The central computer would then be used predominantly for issuing building wide commands, accepting inputs, and providing facility management data such as diagnostic and monitoring performance.