International Journal of Enhanced Research in Science Technology & Engineering, ISSN: 2319-7463
Vol. 3 Issue 10, October-2014, pp: (47-49), Impact Factor: 1.252, Available online at: www.erpublications.com

Energy Conservation Opportunities and Measures in Lighting of a Building

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Abstract: Lighting Load of a building consumes large amount of energy and also the cause of peak load in night hours. By proper management of electrical lighting load, management of peak load and reduction in electrical demand and billing cost is achievable. In this paper cost effective energy saving techniques with economical benefits are mentioned with energy conservation opportunities in lighting. Lighting load need detailed analysis and proper management since human comfort and work or output quality linked with it. Heat generated from lighting load also cause hike in electrical billing cost due to space cooling. Since electrical lighting load offers many energy efficiency opportunities in any building with ease of implementing energy saving measures with very low implementing cost

Keywords: Energy conservation, Energy efficient lighting.

Introduction

A building has different light level requirement in different areas which depends upon usage of area and type of work with taking care of personnel's comfort. In operation theatre there is a need of lots of light with low glare and excellent color rendering, In hotels & restaurant low light levels is pleasant and sufficient, In offices there is a requirement of lighting level and quality that reinforces a feeling of importance and success during audiovisual presentations outlets and shops require lighting level to make their merchandise sparkle so that it draws the attention of customers. An office worker needs modest ambient lighting level, good task lighting on work surface, and minimal glare to effectively read and work on computers. Thus the quality of light in majority of situations is as important as the quantity of light. Lighting Quality also affects on the visual comfort and health of the occupants. Proper lighting quality is able to improve productivity. The right quality and quantity of light can be provided efficiently (with less energy) by using the right technology and its effective integration with daylight. In each area there are different sets of available energy conservation opportunities and cost effective technically feasible energy conservation measures available which should be properly analyzed and implement.

Energy conservation Opportunities in Lighting

Energy Efficient Lighting Proper design of electrical lighting enhance visual performance and comfort by maintaining adequate and appropriate illumination while controlling reflection and glare.[1]Whenever any lighting source is compared the parameter should be Output lumens and not the input watts since Watts refers to the amount of energy used, not the amount of light and lumen refers to amount of output light.[1]

1. Installation of Energy-Efficient Fluorescent Lamps T-5 or T-8 in place of Conventional T-12 Fluorescent Lamps

In places where uniform lighting level is required fluorescent lamps are used for lighting .All fluorescent lamps are not energy efficient and cost effective. Fluorescent lamps are classified as T12, T-8, and T-5 having different life, energy efficiency, regulated power, and light color. Their names come from the size of their diameter per eighth inch. For example, a T-12 lamp is 12/8 inch in diameter (or 1 1/2 inch); a T-8 lamp is 8/8 inch in diameter (or 1 inch); a T-5 lamp is 5/8 inch in diameter. [1]

The most cost effective fluorescent lamp is T-8 lamp, since it's cost is about Rs50 and are 30% to 40% more efficient than standard T-12 fluorescent lamps & can be used directly in place of T-12 fluorescent lamp while T-5 requires different holder and ballast.

Therefore the recommended style of fluorescent lighting is a T-8. Although T-5 lamps are the most energy efficient and also tend to transmit the best color; but their cost is high.

Fluorescent lamp requires ballast. Ballast is an electrical device used in fluorescent lamps to regulate starting and operating characteristics of the lamp. Ballast available in markets are electromagnetic and electronic. Electronic high frequency ballasts are now standard for most fluorescent lights since electronic ballast are more energy efficient than electromagnetic ballast.

2. Replace Incandescent Lighting with Compact Fluorescent Lamps in Dwelling Units

When there is a need of lighting within a 50°-60° angle or in a small area with more luminous intensity CFL is the best available option for both energy saving and cost reduction. Incandescent light bulbs use three to four times more energy than fluorescent lamps. Replacement of incandescent bulbs with fluorescent lamps will save 75 percent of the electricity. Fluorescent lamps has longer life than incandescent bulbs, thus saves replacement and maintenance costs. Recent advances in technology have brought improvements to CFLs in terms of light quality and appearance. CFLs now come in a large variety of shapes, sizes and watts.

Although the initial cost of CFLs is high relative to incandescent lamps, the energy savings and more operating hrs make CFLs a cost effective energy conservation measure for many applications. CFLs are not compatible with dimming switches, unless used with a special dimming ballast. [3]

3. Installation Of Sensors To Turn Lights On & Off

Lighting fixtures should be turn off when not in use automatically to avoid wastage of light with the help of sensors and automatic control. Occupancy can be detected by sensors within the area being scanned and turn on or off lighting fixtures automatically accordingly. This helps in reducing wastage of energy because of careless use and avoiding lighting of areas when not in use thus helps in achieving energy saving. [1]

Infrared sensors react to changes in heat, as created by a moving person. [1]

Ultrasonic sensors transmit sound above the range of human hearing and monitor the time it takes for the sound waves to return. A break in the pattern caused by any motion in the area triggers the control. Ultrasonic sensors can see around obstructions and are best for areas requiring 360-degree coverage. [1]

Photo sensor monitor daylight intensity and availability and controls lighting fixtures and dimmers to operate when needed. Photo sensors detect the quantity of light and send a signal to a main controller to adjust the lighting. Photo sensors are commonly used with outdoor lighting to automatically turn lights on at dusk and off at dawn. It is a very cost-effective control and energy saving device. This helps to lower energy costs by proper control of lighting fixtures. Photo controls are designed to eliminate these unnecessary hours of operation and the resulting energy waste by monitoring natural light levels and switching on lights only when natural light levels fall below a predetermined level. Photo controls can be installed on individual lamps or grouped together to control multiple lamps. [2]

Day lighting

When properly designed and effectively integrated with the electric lighting system, day lighting can offer significant energy savings by offsetting a portion of the electric lighting load. Related benefits include a reduction in cooling required, higher student learning retention, and improved comfort. Strategies to get the most of day lighting include light shelves, skylights, clerestory windows, and related controls that optimize daylight using occupancy and photocell sensors. [3]

4. Exterior Lighting

HPS and metal halide lighting is twice as efficient as mercury vapor lighting, four times more efficient than halogen, and eight times more efficient than incandescent lighting. [2] Where mercury vapor, incandescent, or halogen exterior lighting fixtures illuminate exterior areas such as grounds or parking lots, substantial savings can be realized by converting these fixtures to high pressure sodium (HPS) or metal halide lighting. In addition, the color quality of both types of lighting is much better than that of mercury vapor lamps. In some cases, such as porch lights, compact fluorescent lamps may be the most appropriate replacement for incandescent lighting. [4]

Low pressure sodium lamps are not recommended because all colors appear yellow or gray under these lamps. [4]

Conclusions

The energy conservation measures helps in saving energy and cutting cost in electricity cost of any building. These cost effective measures are use of Compact Fluorescent Lamps in Dwelling Units in place of Incandescent Lighting. In Common Areas use of Fluorescent Lighting in place of Incandescent Lighting. Use of Energy- Saving florescent lamps with Electronic Ballasts in Common Areas. Install Lighting Controls in Common Areas. Install Photo-Controls for Exterior Lighting. Adjust lighting levels with dimmer to match needs at different times of the day by using day lighting. Use natural light whenever possible. Ensure windows are clean and encourage staff to open blinds before thinking of switching on lights. Turn off non-essential lights, signs and billboards inside and outside the building. Scale back to half lighting or reduce lights on a dimmer where possible. Turn off the lights when leaving the office/building for the day by using master switch. Ensure after-hours security and cleaning staff are briefed on the importance of turning unnecessary lighting off.

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