LIGHTING AUDIT - THE NEED AND AFTERMATH

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1. INTRODUCTION

Lighting is the most visible form of energy consumption. It accounts for 17 % of total energy consumed in India. In commercial and industrial buildings as much as 30 % of the electricity bill is due to lighting. Because of advances in lighting technologies, a number of energy efficient lighting products are now available along with better understanding of the lighting needs. Since the country's energy generation is not able to match the demand, conservation of energy appears to be the only solution to reduce this gap.

2. DETERMINING THE NEED

Before any step is taken to work towards conservation of lighting energy, it should first be ascertained whether such an activity should at all be undertaken. The following questionnaire should help in determining the need for lighting audit.

a) Has the function of buildings remained the same since they were constructed ?

b) Have you developed a lighting schedule for indoor and outdoor lighting ?

c) Have you converted from incandescent lighting to fluorescent ?

d) Have you converted from standard fluorescent to more energy efficient compact fluorescent lamps ?

e) Have you converted from conventional magnetic to energy efficient electronic ballasts ?

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f) Do you use metal halide, high pressure sodium, or low pressure sodium lamps for outdoor lighting ?

g) Do you have controls in your lighting system to provide increased flexibility and energy savings ?

h) Has the lighting system been modified to accommodate rearrangement of desks and workstations ?

i) Have employees been exposed to awareness programmes regarding energy conservation in lighting?

j) Was the building lighting system designed with energy efficiency in mind ?

k) Have you investigated rebate programs, if any offered by your local utility or the government ?

IF ANSWER TO ANY OF THE ABOVE QUESTIONS IS A "NO", THEN YOUR ESTABLISHMENT NEEDS A LIGHTING AUDIT.

3. THE OPTIONS FOR ENERGY CONSERVATION

Energy conservation in lighting does not mean switching "OFF" the lights. Energy conservation should be synonymous with energy efficiency, which, in the lighting scenario, means use of energy efficient light sources. Some such light sources are briefly described below :

i) ENERGY-SAVING FLUORESCENT LAMPS

It involves replacing standard fluorescent lamps with energy-saving fluorescent lamps in the existing luminaires. When used with existing standard ballasts, these energy saving fluorescent lamps would use around 10 % less power than the standard fluorescent lamp it replaces. Since most commercial and industrial organisations have many fluorescent luminaires in use for many hours every day, this could add up to a substantial reduction in lighting costs. The reduced wattage also results in a corresponding reduction in heat generated by the lamps. This often translates into a reduced load on

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the air conditioning system. Though the light output of an energy-saving fluorescent lamp is a little less (6 to 10%) than the standard lamp being replaced, this is seldom a problem. If the luminaires, lenses and reflectors are cleaned at the time of replacement, there is usually an initial increase in the illumination level.

ii) COMPACT FLUORESCENT LAMPS

Compact fluorescent lamps are used for replacement of incandescent lamps. Compact fluorescent lamps use up to 80% less electrical energy than the incandescent lamps they replace, resulting in substantial cost savings. They also produce less heat. These are available with integral ballast, and with separate ballast. Compact fluorescent lamps are most economical in applications where lighting is needed constantly or for long periods of time, such as corridor or security lighting. Since they have a rated life of 10,000 hours or more, compared with 1,000 hours for incandescent lamps, maintenance requirements are reduced dramatically - particularly where luminaires are difficult to reach and burnt-out lamps are time-consuming to replace.

iii) ENERGY-EFFICIENT BALLASTS

These can broadly be of two types. One is the energy-efficient core/coil ballast, which uses copper wire and cores of higher quality steel. These changes result in lower resistance losses, reduced heat generation, improved electrical performance and higher efficiency. The second is the electronic ballast, which uses solid-state technology to perform the ballast functions. These convert standard 50 Hz AC input to high frequencies (20 to 40 kHz). This enables the lamp to operate more efficiently, with excellent regulation and control. Other advantages of the electronic ballasts are quick start, low voltage start, flicker free operation, low ballast loss, improved

power factor, higher luminous efficacy, low temperature rise, higher lamp life, lower weight-easier installation, no separate starter, repair/servicing facility.

iv) HIGH INTENSITY DISCHARGE (HID) LAMPS

HID lamps are among the most efficient light sources available. These lamps produce light by passing an electric current through a special atmosphere containing vaporized metals or metallic compounds. Like all discharge lamps, the starting and operating power levels are controlled by ballast. HID lamps are most economical in applications where they operate for extended periods. Their long life makes them ideal for use in locations where replacement is difficult.

There are four types of HID lamps. Metal halide, high-pressure sodium, low-pressure sodium and mercury vapour.

Metal halide lamps (MH) give best colour rendition amongst the HID lamps.

High-pressure sodium lamps (HPSV) are even more energy-efficient than metal halide but have comparatively poor colour rendition. A mixture of light from MH & HPSV lamps gives colour temperature close to that of incandescent lighting.

Low-pressure sodium lamps (LPSV) are the most efficient light source available. However, these lamps generate a monochromatic yellow-orange light, giving rise to poor colour rendition. LPSV lighting is largely used for security lighting, warehouse, parking lots and street lighting.

Mercury vapour lamps (MV) were the first successful HID lamps and has a useful life the same as metal halide and high-pressure sodium lamps. However, being least energy efficient of the HID lamps, their application is being taken over by the other HID lamps

v) EXIT LIGHT CONVERSION

Conversions of incandescent lamps in illuminated exit signs can offer energy savings. Exit signs can be converted by installing compact fluorescent retrofit kits or by replacing the existing sign with a new one using compact fluorescent lamps. Exit signs must be illuminated 24 hours a day, 365 days a year, and many commercial and industrial buildings and hotels have numerous signs installed. As a result, the total energy and cost savings from exit light conversion could become substantial.

iv) REFLECTORS FOR FLUORESCENT LUMINAIRES

Specially designed reflectors manufactured from aluminium with a reflective silver coating or chemically polished aluminium have reflectance values of 90 to 95% (compared with reflectance values of 80 to 86% for white-painted surfaces). Such reflectors could be used with the existing fluorescent luminaires to increase luminous efficiencies. These will reflect more light downward on the area to be illuminated. Properly applied, this permits the number of fluorescent lamps and ballasts to be reduced, saving energy, lowering lighting costs and also lowering cooling costs.

4. CONTROLS FOR ENERGY SAVING

Controls can be effectively used for energy saving. Two types of controls are available, lighting controls and day-lighting controls.

Lighting controls is possible through switching controls, time clocks and photocells. Switches can be installed and used to turn off lights in a particular location when the area is unoccupied or illuminated by daylight. Time clocks can save energy and reduce operating costs by automatically shutting off lighting and other electrical equipment when not needed at pre-set times. Photocell can be used to switch interior or exterior lighting on and off, depending on the amount of daylight present.

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Day-lighting controls save energy and reduce operating costs by automatically regulating the operation of indoor electric lighting in conjunction with the amount of daylight present. Two types of control devices can be used in day-lighting systems, switching controls and dimming controls. Both types include a sensing device to measure the amount of daylight.

5. OTHER METHODS

Certain simple activities and decisions can also save lighting energy. These are :

i) Maintenance of the lighting system in good order through periodic cleaning

ii) Have light friendly interior decor by using light coloured paints for walls and ceiling and light coloured curtains

iii) Use light source with luminaire only

iv) Use correcting capacitor for improving power factor

6. CONVERSION TABLES

FOR INDOOR USE

Presently being used	Switch over to
GLS Lamp, 100W	TL, 40W/36W
GLS Lamp, 100/60/40W	CFL, 9/11/13W
TL, 40W	TLD, 36W
TLD, 36W	TLD, 36W with Tri-phosphor coating

FOR OUTDOOR USE

Presently being used	Switch over to
GLS Lamp, 200/500W	HPSV, 70W
HPMV, 400W	HPSV, 250W
HPMV, 1000W	HPSV, 400W
GLS Lamp, 1000W	Halogen, 1000W