

Achieving energy savings in lighting

The primary objective of any lighting – indoor or outdoor – is to provide the necessary lighting effect for the lowest installed load that is the highest illumination at the lowest power consumption... But how? Learnings from the Maharashtra Energy Development Agency (MEDA)

Energy Savings Tips from MEDA

Essentials and Savings

In everybody's life, lighting comes as an essential need after cooking. If habits are well organized and lumen levels studied, then a substantial amount of savings in lighting can be achieved.

Electrical Lights

Dwellings with completely closed surroundings without any natural light consume higher lighting energy, for example, in IT industries an artificial environment is created through energy. While designing any house, ensure sufficient openings to enable natural lighting.

Use of Colors

The colors on walls and ceilings inside the house should be of light shades.

Reflectives and Placement of Lighting Gadget

Placing suitable reflectives as well as decorative items near windows can provide savings up to 40 percent. Lighting in the office should be oriented to fall over the table and not on the back of the seats.

Lighting Zone and Task Lights

Distribute the home and work place into different lighting zones. The light should be enough not to strain the eyes while performing any activity such as reading, writing, studying, stitching, knitting. The recommended lighting levels for various places are prescribed by various standards, national and international bodies. In this article, MEDA's recommendations are given. See Table 1.

Table 1: Expected from home energy conservation

Place	Lumens / m ²
Sitting	50
Reading room	300
Bathroom	100
Entrance	200
Kitchen	200
Office	150
Godown/Garage	50

People of different ages require different amounts of lighting. The Lumens per square meter give an idea about the amount of light needed for different ages.

- Light as Task: Plan your lighting level depending on the activity to be performed. Knitting or reading needs high lumens while talking or watching TV needs less.
- Zero Watt Concept: The 'Zero' bulb used in bedrooms at night consumes 15 Watts per hour. Keep it ON only if it is absolutely necessary.
- Cleaning of Lights and Fittings (Blockage of light 20-30% due to dust and reduction in life of lighting gadget): Regularly clean the surfaces of lamps and tube-lights. The accumulated dust blocks the light output by as much as 20-30 percent. The dust also absorbs the heat and adds this heat to the fixture, thus reducing the life of the lamp.
- Tube vs Bulb: Wherever the usage of lighting is constant, tube lights must be used instead of incandescent bulbs. The lumen output of a 40 W tube and a 100 W bulb is the same.

Thus, about 60 percent of energy can be saved. The bulb has a light efficiency of 6-8 percent. The balance electricity consumed is wasted on generating unwanted heat.

Generate Free Power – Save Energy, Reduce Electricity Bills

Lighting

Lighting accounts for about 18 percent of electricity consumed in the country. The majority of the lamps and fixtures used are incandescent light bulbs or general lighting system (GLS), with low efficiency.

Inefficient GLS

90-95 percent of electricity consumed by GLS is wasted as heat and only 5-10 percent gets converted into visible light. (This leads to heating up of rooms and the need for cooling in a hot country like India, which means using fans, etc).

Energy-efficient Lights

Energy-efficient lamps such as fluorescent tube-lights (FTLs) and compact fluorescent lamps (CFLs) consume much less energy, offer the same light, and are cool to touch.

CFLs vs GLS (Incandescent)

A 60 W bulb, replaced with a 15 W CFL gives the same light, and offers the following savings (see Table 2, pg 16). The higher cost of CFL is paid back within 6-7 months

Table 2: Savings from using CFLs in place of incandescent bulbs

Parameter	60 W Bulb	15 W CFL	Savings
Cost in Rs	10	150	-
Wattage (W)	60	15	45
Life (hours)	1,000	8,000	-
Annual Consumption (Units)	108	27	81@
Annual running cost @ Rs. 4.5 per unit	486	121	365#
Total cost over 4 yrs (CFL life) in Rs	1,944	484	1,460

Note

1. Approximately rate/price/costs have been taken for comparison
2. @ 6 hours per day usage in the 300 days
3. #domestic tariff varies from 145 paisa to 550 paisa per unit based on consumption
4. Non-domestic tariff varies from 395 to 600 paisa per unit

Say NO to GLS bulbs and replace the existing ones by CFLs in bathrooms, toilets, lobbies, corridors, etc, and where they may not be used for reading purposes.

FTLs T-12 vs T-5

The majority of FTL fittings currently used are T-12, the popular 40 W 'fat' (38 mm dia) tubes, fitted with cooper or aluminum ballast (choke). More recently these have given way to highly efficient T-5, the 28 W 'ultra slim' (16 mm dia) tubes fitted with electronic chokes. The life of a T-5 is about 18,000 hours, compared to 4,000 to 5,000 hours of a T-12. See Table 3.

Table 3: Savings from replacing a T-12 tube-light with T-5

Parameter	T-12 TI 40 W Regular	T-5 TI 28 W Ultra-Slim	Savings
Cost in Rs	45	500	-
System Wattage (Watts)	55	31	24
(Tube + Choke)	(40+15)	(28+3)	(12+12)
Light output (lumen)	2,450	2,900	450 gain
Annual consumption in Units	99	56	43 @
Annual running Costs in Rs	455	252	193
Total cost over 8 yrs (T-5 life) Rs	3560	2,016	1,544

Note:

1. The approximate rate/ price/ costs have been taken for comparison
2. @at 6 hours per day usage in 300 days
3. The higher costs of T-5 of Rs 450 has payback of about two years

Lighting Tips – use Efficient Lighting Systems

- **Switch to CFLs.** The normal incandescent bulbs are not energy-efficient. CFLs use about 25 percent of the energy used by an incandescent bulb and can last 10 times as long. They often fit in the same fixtures and are available in most building and lighting supply stores.
- **Switch off unnecessary lighting.** Get into the habit of switching off the light every time you leave a room for more than a few minutes. For CFLs, turn them off only if you will be away for more than 15 minutes. This prolongs the life of the fixtures.
- **Avoid idle running of any light/equipment.**
- **Use outdoor motion detectors and timers.** Instead of leaving outdoor lights on all night while you sleep, let these handy devices turn them on only when they detect motion. Of course, that means they will come on for passing cars, waving flags and swaying branches, so position them carefully.
With motion detectors, use the lowest wattage incandescent bulb that will do the job.
If security is a concern, leave a low-wattage porch light on all night. For maximum security, use a high-pressure sodium bulb on a timer or light sensor. Set the time to come on at bedtime and go off at dawn. High – pressure sodium bulbs perform best when they are on for long periods of time.
- **Use low-wattage bulbs where applicable.** Unless you frequently read in your closets and hallways, bright lights really are not necessary in these areas. Switch to low-wattage bulbs and save some energy.
- **Clean light bulbs and increase light and life.** Dirty, greasy, smoky light bulbs can reduce light output by as much as 10-20 percent. Clean your light bulbs regularly. (Make sure they are cool before touching them.) You will avoid the tendency of switching to a stronger bulb, which will use more energy.
- **Remove unnecessary lighting and position correctly.** Especially in track and recessed lighting use only the number of bulbs needed to light an area. Three bulbs can usually do the same job as four if they are positioned accurately.
- **Use natural light/resources: use light from windows.** Natural light is more efficient than electric, not to mention free. When you are not frolicking in your pajamas, leave the curtains open.
- **Paint and decorate in light colors.** Dark colors absorb light. Light colors reflect light. The lighter the colors you use, the less artificial lighting is required to illuminate the area.
- **Use timers when vacation.** Not only will it save energy when lights are on timers, but burglars and prowlers too will have no idea that you are in the Bahamas basking in the sun. Set your timer to turn lights on and off at different times on different days. Your home looks more lived in this way.
- **Install dimmers.** In areas where dimmed lighting makes sense, such as the dining room and bedroom, dimmers save an equal percentage of energy as they are dimmed (dimmed 15 % reduces energy consumption up to 15%).
- **Check your lamp shades.** Many shades are decorative but absorb light or reflect in the wrong direction. You may want to consider switching to a more efficient shade in a lighter color.
- **Use task lighting.** Light up areas where you are working; switch off or dim lights in the other areas.

Efficiency at work place – use efficient equipments

- **Switch to energy-efficient CFLS.** They use about 25 percent less energy and can last ten times longer, saving energy and replacement labor.
- **Saving through occupancy sensors.** In rooms that are not occupied constantly, such as conference rooms, lunchrooms and bathrooms, occupancy sensors will automatically turn lights

on when people enter the room and off after they leave. Lighting accounts for 40 percent of energy used in office buildings.

- **Best of lights. Remove excess lights.** Many older office and warehouse buildings have more lighting than needed. In many areas, half the light may be sufficient to light the area. When removing excess fluorescent tubes, remember to disconnect the ballasts that serve them.
- **Separate switch for different applications:** Install separate switches for smaller areas. Often in large buildings, dozens of lights are controlled by a single switch, and not all of them need to be on. These lights can be rewired into smaller groups of lights on independent switches. This way only those that are needed can be turned on.
- **Use thermostat controls: Keep the heating and cooling to a minimum.** Heating and cooling for half of the total energy use in office buildings. If you have individual thermostat controls, keep the heat set at 65° F (18 °C) and the air-conditioning at 76 °F (24 °C). A programmable thermostat can set back the temperature at night.
- **Shut computer off at night.** A single computer can use over 100 W of power, and most desks have one. Same with printers. When replacing computers, purchase the new energy-efficient types that use up to 90 percent less energy.
- **Use computers equipped with Auto Power Off**
- **Fax and copy only when really necessary.** Sometimes we take advantage of these common luxuries, but there was a day when we did not have them. If you must make copies, make all you need in one batch, then turn the machine off if you know it will not be needed again soon.
- **Keep heating vents unobstructed and air flow across the room.** In offices, this includes furniture placed over floor vents. In warehouse, this could be boxes piled in front of vents. Especially in warehouse buildings where one vent supplies a large area, be sure nothing obstructs the airflow. The air should be able to move across the entire room.
- **Open freight doors only when needed.** When trucks are being loaded or unloaded, leave the doors open. As soon as the job is done, close the doors to conserve energy.
- **Use rotating doors.** If there is a choice in your building, use rotating doors instead of standard hinged or sliding doors. They allow less heat to escape.
- **Take the stairs and have exercise.** Instead of the elevator take the stairs. You will save energy and get little exercise to boot.
- **Replace burned – out motors with energy-efficient models.** The energy to operate a motor each year can cost more than five times more than the cost of motor.
- Standardize the equipments/motors to the extent possible
- **Influence of heat on air conditioner:**
 - Lesser load on compressor – saving increases from 33 to 36 percent
 - Studies show for every 1 W saved, load reduction on air-conditioner is equal to 0.05 W
 - Savings in air-conditioned area 49 percent (approx)

Appeal for Conservation based on savings and Environment Protection

On an average, it is estimated that a family of four consumes about 200 units electricity per month. Saving one unit per day requires as small an effort as a) not using lights during the day; (b) switching off lights when leaving the rooms; (c) good housekeeping methods; and (d) attitudinal change toward energy conservation.

Saving of Rs 9 Crore Units per Month (Rs 41 Crore)

If every household can save just one unit per day, about 30 lakh middleclass residential consumers in the state of Andhra Pradesh may save 9 crore units (90 MU) per month, working out to a saving of Rs. 40.50 crore per month at the rate of Rs 4.5 per unit.

The power shortage and the heavy investments at the rate of Rs 6 crore per MW of additional capacity can be avoided.

Result of Saving One Unit per Day

- Resources savings of 45,000 tons of coal per month or
 - 5.40 lakhs tons of coal per year, and
 - About 7.35 lakh tons of CO₂ emissions per year. All from one unit saving day per household.
- A change in attitude and positive approach to energy conservation will change the situation from “Can you do it?” to “you can do it”. The fastest growing source of energy is “efficiency”.

Conclusion

The normal prescribed herein are useful for benchmarking. The targets can be fixed in these areas and monitored. This will reduce lighting energy drastically. Using the latest lighting system/equipment will accrue adequate savings.

References

1. Publications of the Bureau of Energy Efficiency
2. Publications of the Energy Conservation Mission (ECM) – Institutions of Engineers (I) Hyderabad
3. Publications of the Petroleum Conservation Research Association (PCRA)
4. Publications of the Maharashtra Energy Development Agency (MEDA)
5. Newspapers – Times of India, 27 November 2004.
6. ECM website www.save-today_survive-tomorrow.com

Courtesy: R.A. Sharma, Managing Director and Lead Assessor, Master Consultancy & Productivity Pvt. Ltd., Secunderabad, Andhra Pradesh
Tel: 27810214, 27815288
Fax: 040-27810214
Email: masteriso2k@yahoo.com,
masteriso2k@sify.com,
rasmcppl@rediffmail.com
Website: www.shriramamgroup.tk

Reference Book:

The Bulletin on Energy Efficiency
Vol. 6 Issue 4-6