Energy Audit Report

Report Submitted by

Mr. Rajagopala R (Head)
Mr. Rajendra C.J
Mr. Praveen M.G
Mrs. Roopa S

Guidelines for the Study

1. Determining the energy Consumption in the Campus
2. Estimating the scope for saving
3. Identifying the most likely (and easiest areas) for attention
4. Identifying the immediate (especially no-cost / low-cost) improvements / savings

1. Determining the energy Consumption in the Campus

A detailed survey of the entire load was undertaken by the members of the Energy Audit Report Committee starting from the canteen, Administrative block, workshop and Machines lab, High voltage and Relay lab, Generator room, MC Block, Hut and ATM block, CRC block, Transportation and PE department, Boys Hostel, Mess and Polytechnic block and submersible pumps.

The load survey was conducted in every class room, staff chambers, all the laboratories and workshops and every load – category wise was noted and the total load of the campus was estimated. The detailed survey and the consolidated connected loads are herewith enclosed. The total connected load works out to be **851.0663 KW**

2. Estimating the scope for saving

In an educational institution, especially in the chambers of the staff room, class rooms and laboratories, the quality of illumination is very important. It was decided not to replace any fluorescent tubes, where quality of illumination is very important. The amount of illumination required on the work place is around 800 LUX and therefore, this is taken as base for replacing the existing fluorescent tubes, CFL tubes and incandescent lamps by LED bulbs only in places where quality of illumination is not very important such as corridors, canteen, workshops etc. From the survey already made about the entire connected load, it was identified to replace the fluorescent tubes, CFL tubes and incandescent bulbs and their total wattage is as follows.

a) Fluorescent tubes	– 9.626 KW
b) CFL tubes	– 11.2 KW
c) Incandescent bulbs	– 5.92 KW
Total	**– 26.746 KW**

The comparison list of the wattage of the bulbs, their life span are listed in Annexure II and this information is used for making the comparisons of various lamps assuming that, 9W LED bulb provides about 800 LUX of illumination, whereas we need 60W of incandescent bulb, 40W of fluorescent tube and 13W of CFL tube for providing the same illumination. As shown in Annexure II, the total wattage of LED bulbs required to replace 26.746 KW of other bulbs is 8.545 KW.

Cost of Replacement

For comparing the cost of replacements, the cost per watt of each type of bulb is calculated as follows. For calculating cost / watt, it is assumed that, each of the different types of bulbs cost as under:

Type of Lamp	Cost / Piece	Cost / Watt
a) Incandescent Lamp (60W)	Rs 20/-	Rs 0.333/-
b) Fluorescent Tube (36W)	Rs 150/-	Rs 4.16/-
c) CFL Tube (13W)	Rs 200/-	Rs 15.38/-
d) LED Bulb (9W)	Rs 300/-	Rs 33.33/-

The cost of replacement of F.L, CFL and Incandescent bulb is calculated as follows,

a) Incandescent tubes	– 5920	X 0.333	= Rs 1971.00
b) FL tubes	– 9626	X 4.16	= Rs 40,044.00
c) CFL tubes	– 11,200	X 15.38	= Rs 1,72,256.00
		Total	**= Rs 2,14,271.36**

The Cost of new investment on LED bulbs is, 8545 X 35.33 = **Rs 3,08,960.00**

Life Comparison of Bulbs

The life span of various bulbs are:

a) Bulbs - 1,200 Hours
b) F.L - 5,000 Hours
c) CFL - 8,000 Hours
d) LED - 50,000 Hours

The equivalence of bulbs on life comparison is as follows:-

1 LED Bulb = 10 FL tubes
= 6 CFL tubes
= 40 Bulbs

The cost of FL, CFL and bulbs to replace of LED bulbs is calculated as follows,

a) Bulbs	– 1971X40	= Rs 78,840.00
b) FL tubes	– 40,044X10	= Rs 4,00,440.00
c) CFL Tubes	– 1,72,256X6	= Rs 10,33,536.00
	Total	**= Rs 15,12,816.00**

The ratio of the cost of other bulbs to LED bulbs is

$$\frac{15,12,816}{3,08,960} = 5$$

Therefore, an LED bulb is 5 times more economical than other bulbs replaced.

Period of recovery of Investment

It is assumed that on an average, each bulb works for about 6 hours per day and average cost per KWH is Rs 6.00. The monthly charges by using CFL, FL and bulbs is calculated as follows.

KW * hours/month * cost per unit = 26.746 X 6 X 30 X 6

= Rs 28,886.00

The monthly charges by using LED bulbs is 8.545X6X30X6 **= Rs 9,228.60**

Monthly Savings:	28,886.00
	9,228.00
	Rs 19,658.00

To save the entire investment on LED bulbs, the time required is,

$$\frac{3,08,960}{19,658} = \textbf{15.72 Months}$$

In about one year three months, the entire cost of investment can be recovered.

Note: In the above recovery period, the life span of LED bulb against other bulbs is not taken in to account. If that factor is also taken in to account, the recovery period is as follows.

$$\text{Recovery Period} = \frac{15.72}{5} = \textbf{3.144 Months}$$

3. Captive energy charges and KPTCL charges

The monthly energy charges of the institute from BESCOM is taken for the month of June 2017 and compared with the energy charges of captive power generated by the separate generator and compared. They are as follows,

a) BESCOM Charges : **Rs 9.65 / Unit**
b) Captive Power Charges : **Rs 20.81 / Unit**

The details of comparison are enclosed.

4. Suggestions

- Details of loads like fans, lights etc with their ratings should be displayed at the entrance of classrooms, staff rooms, labs etc of all the blocks in entire campus to create awareness among students and staffs.
- Even though the entire campus buildings are highly ventilated, many windows stoppers are not in proper condition. This makes usage of fans and lights. Sorting out above problems, utilization of natural resources can be made by saving power consumption.
- Energy saving messages like,

  "Switch off the lights and fans before leaving the place"
  "1 unit saved = 2 units generated"
  "Save power for future generation"

  Should be displayed near switch boards of all class rooms, labs, hostel rooms etc. in the campus to create awareness among students and staff on avoiding power wastage.
- Sensors detecting presence of people can be implemented for automatically turning on/off loads like fans, lights etc.
- Corridor tube lights and CFLs can be replaced by LED bulbs of lower wattage in MC, CRC and Admin (2^{nd} and 3^{rd} Floor) to save power consumption.
- To achieve generation autonomy, it is advisable to install rooftop solar system, with net metering.
- As observed sanction power is 250KVA it is possible to implement 250KWP solar plant.
- Life span of RTS system is 15-20 Years, payback period is 5-7 Years beyond this it will be free energy for whole campus. Advantage of net metering is, excess power generated will be automatically supplied grid.
- Billing is done based on generated power utilization in campus and power supplied to grid.
- In future, it will be made mandatory for educational institutions to install roof top solar plants. It is the right time for this option.
- Detailed analysis can be done with experts/suppliers to get a clear picture of month wise average generation for the whole year, cost of installation and payback period.

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