

TECHNIQUES FOR ELECTRIC ENERGY AUDITING IN EDUCATION SYSTEM

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ABSTRACT

Present education system is concentrating in imparting the quality education to the student community with the help of various electric and electronic equipments like computer, Internet facility, audio visual classrooms, video conferencing facility, LCD Projectors, wi-fi facility etc. In this regard the uses of the various electric and electronic equipments in the teaching field should be optimized and students should be trained in optimal utilization of the same. Continuous use of the above mentioned equipments in the education system need the routine auditing activity to keep the facilities in good condition. The routine auditing activity helps in optimal usage of the equipments, diagnosis of the electrical leakage and maintenance of the equipments. This routine auditing activity helps in minimum usage of the power, avoiding the unnecessary waste. The result of the routine auditing and optimal utilization improves the performance of the devices. The life span of the devices will be improved due to this regular auditing activity which results in reduction of the maintenance cost for the institution. This paper contains the techniques suggested for auditing activity in an education system taking Srinivas Institute of Management Studies as an example. The paper contains the study on the electricity distribution system in the education institutions, the various electrical and electronic devices used in the institutions with the individual power consumption, and need for auditing. The paper contains the charts showing the consumption of electricity with respect to time at Srinivas Institute of Management Studies. This paper also contains some suggestions to be implemented where green technology can also be used where ever possible and the methods to minimize the wastage in the system.

Key words: energy auditing, auditing activities, green technology

Introduction:

The college education system is giving more and more importance to the modern teaching methodology using all sorts of technical innovations. The new innovations in teaching include use of audio video facility, smart classes, animated video displays, conference classes, practical oriented teaching etc. This system needs different types of electric and electronic equipments to be installed in the class rooms of the college to impart teaching in the system. This set up requires complicated electrical system as different devices require different type of wiring system. This network should provide the energy for heavy equipments like Air Conditioner, Computers in the lab, Electric oven, Deep Freezer, Audio Video facility, Elevators etc and light equipments like TV, CCTV camera, Fans, Lights, LCD/LED projectors etc. [Al Thuman et al, 2003] The electric wiring system becomes complicated to provide the service to these equipments. Some of the equipments like Elevator, Computer Lab, Electric Oven etc require the three phase wiring and the others like light electric equipments require a single phase wiring system. The computer labs require backup power facility like UPS system. The entire network needs to have a generator backup facility with the proper change over system. So the complicated wiring system requires an electrical duct which can systematically channelize the wiring system to the appropriate load with the help of safety measures like Trippers, fuses and earthing facility to protect the entire electrical system from short circuit or any other electrical hazards which lead to the fire and other serious damages. The complicated electrical networking system leads to the following problems like, [Ray A Jones, 2011]

- Loss of electrical energy due to several switches, gears, trippers.
- Loss of energy due to the connectors
- Aging of the connectors cause the extra loss in the form of heat
- Influence of lizards or rats cause the extra loss in energy which may even lead to short circuit.

Due to these major problems it is very important to have a routine auditing of all the electrical equipments, power consumption, power distribution through which we get to know the performance condition of the equipments, the electrical network, and the condition of the various electrical devices. This auditing activity shows the power wastage in the entire network and through this activity it is possible to trace out the point of electrical leakage and the cause for the leakage. This results in replacement of the faulty devices and minimizes the leakage. This auditing activity helps in keeping the entire system in good condition so that the electrical wastage is minimized and usage is optimized. The life span of the electrical devices will be improved. The chance of electrical short circuit is nullified due to this regular electrical auditing activity.

A Study on Electric system and the power consumption:

The various possible electrical and electronic equipments used in any educational institution are given in table 1. All the educational institutions have similar type of equipments, power distribution having separate network of heavy electrical equipments like computers in computer labs and offices, kitchens in the case of hotel management colleges, Air conditions etc. with three phase wiring system having switch gears, ELCB power trippers for the protection, UPS power backup and a single phase wiring system for lights, fans, audio visual aids, LCD/LED TVs, CCTV cameras, Projectors etc. This single phase wiring system also is protected using ELCB trippers. The entire electrical network is protected from high voltage surge or lightning or short circuit by a proper earthing system.[Ray A Jones et al, 2006]

Table 1: Standard power consumption of individual item used in the college per hour [Tushar K et al, 2011]

Sl. No	Particular	Power consumption per hour
1.	Air Conditioner	1.5 KW
2.	Computer	300 W
3.	Network Printer/Xerox Machine	500 W
4.	Inkjet Printer	50 W
5.	Dot Matrix Printer	50 W
6.	Tube Light	40 W
7.	Fan	50 W
8	LCD Projectors	500 W
9	Water Cooler	200 W
10	Lift	5KW
11	Spot light (CFL)	25 W

Need for electric auditing:

The electric system having wired networking, safety devices and the ultimate load like lights, fans, pump, projectors, audio video equipments deviate from their performance due to several reasons like aging of devices, aging of wires used, humidity etc. The deviation results in loss of electric energy in the form of heat. It is possible to avoid this loss through the routine auditing system which helps in identifying the performance of the whole electric system. It is possible to identify any leakage in the system through auditing. The leakage if any observed will be rectified. This regular auditing activity keeps all the electrical and electronic devices last for a long time. This system avoids the electrical short circuits. Thus the electrical energy in an educational institution is optimally used with minimum wastage. [Tushar K et al, 2011]

Electrical auditing in Srinivas Institute of Management Studies:

Srinivas Institute of Management Studies is a well known college in the heart of the city imparting value based education to the needy students. This college is spread in 3 floors with the total area of 5926 sq. mtrs. In order to impart the value based education the college has several electric and electronic devices which are continuously used for teaching and other administrative activities. The table 1 shows the list of the electric and electronic devices used in the college with the individual power consumption per hour. Assuming that the working hours per day is 6 hours. The consumption of power by various items per day is given in the table 2 [Steven H Voldman, 2013]

Table 2: Daily power consumption of different rooms in the college

Sl. No	Room Particulars	Tube lights	Fans	Computers	Air Conditioners	LCD Projectors	Printers	Total power /day in KW
1	Director's chamber	2	2	1	1(sparingly used)	-	1	5
2	Office	4	4	6			2	24
3	Staff rooms	30	40					18
4	Class rooms (15)	75	130			15		84
5	Auditorium	24	24		10	1		69.84
6	Library	34	34	4				25.5

7	Computer Lab	45	45	210			5	425
8	Ladies Room	8	6					3.7
9	Staff toilet	9	3					1
10	Gents Toilet	6	2					0.5

Total daily usage of the power - 656.54 KW or units appr.

From the table 2 it is very clear that in a day the maximum power consumption is observed in the computer lab with 425 units per day for 6 hours of usage. The table suggests the separate auditing for the computer lab in order to minimise the power consumption and power loss without any compromise with the quality of the service.

The diagrammatic representation of the daily power consumption is given in the figure 1.

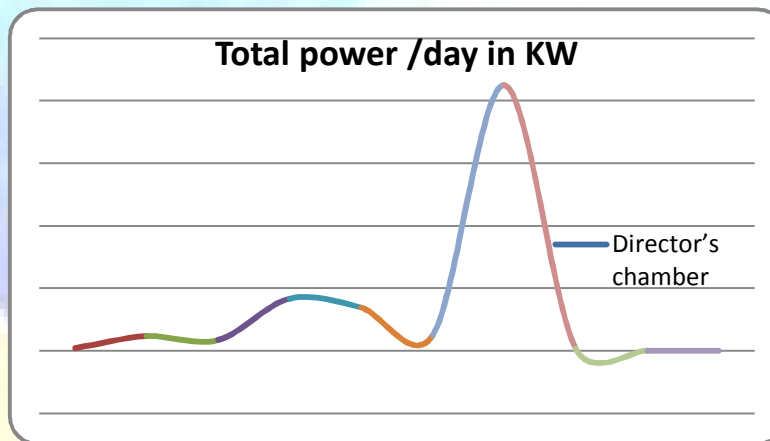


Figure 1: Chart representing the consolidated power consumption per day by different rooms in the college

The consumption of the electricity for the years 2011, 2012 and 2013 are listed below :

Table 3: Power consumption for the four years (unit wise) [S. Shivanagarraju, et all, 2010]

Sl. No	Year	Total Power Consumption in units	Electricity Charges in Rs.
1	2011	177491	9,40,699
2	2012	187490	10,04,187
3	2013	168550	8,93,314
4	2014	158950	7,87,514

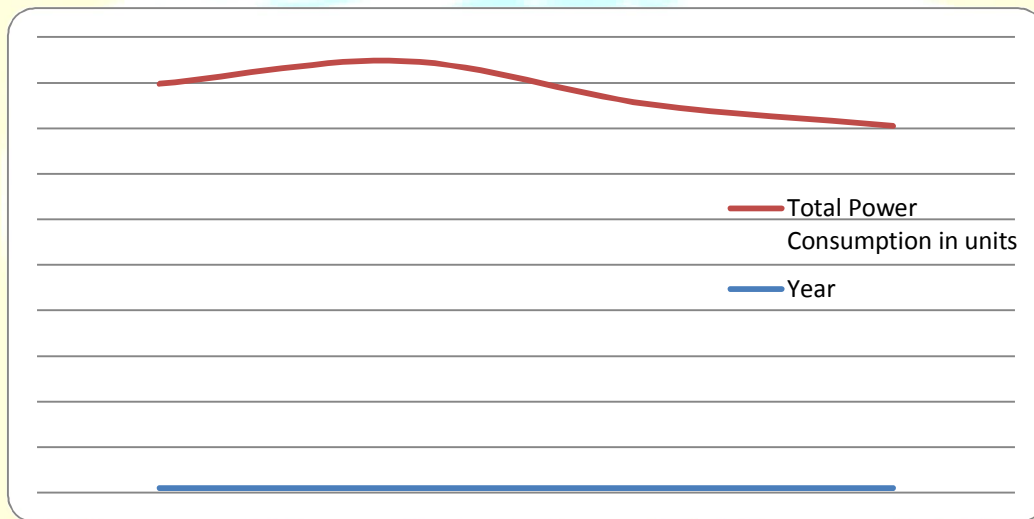


Figure 2: Chart representing power consumption for the four years

Inference:

In the audit for 2011 and 2012, the electricity consumption and cost increased but due to the institutional effort, both consumption and cost could be reduced even though there is an increase in the strength of students. This is because the internal auditing committee had taken a lot of measures in stopping the power wastages observed by

- Constant supervision to switch off lights and fans when not in use.

- Gradual replacement of CRT monitors in the computer lab by LED monitors. [E. Scott Dunlop, 2015]
- Window screens which were obstruction to natural light were replaced so that dependents on electrical lighting are reduced.
- Replacement of incandescent bulbs with tube light & CFL lights which consume less energy
- Suggestion is given to the institution to replace all the bulbs with LED bulbs which consume energy which is equal to the 1/4th of the consumption of energy for CFLs.
- Looking into the geographical structure of the building suggestion is given to the institution to install solar panel to generate energy for the lights and fans in the college. [Carol J Buck 2013]

The effect of the auditing is observed in the reduced consumption of electricity in the subsequent years 2013 and 2014. It is possible to still decrease the consumption by switching over to the LED bulbs in the place of CFL bulbs.

Conclusion:

The electrical auditing activity at Srinivas Institute of Management Studies is done in the year 2011, 2012, 2013 and 2014. The chart shows the decrease in the power consumption during 2013 and 2014. This is mainly because the suggestions given by the auditing activity is implemented step by step. The detailed suggestions are already given in the inference. Further the college building has enough space to install solar power system which will be added with the commercial system to make use of renewable energy system and decrease the conventional supply of the electricity from commercial sectors. The auditing activity is suggested to continue every year to use the electrical energy efficiently. The energy consumption meter is suggested to install in various places like the starting point where the wiring network is starting from the conventional suppliers, every floor, computer labs, etc to identify the proper distribution without any loss.

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