IJEE 0973-7383 Volume-9 • Number-2 June -Dec 2017 pp. 41-44 available online at www.csjournals.com

Power Management Strategy for Academic Block of BRCM-CET to Reduce Energy Cost Using Energy Audit

Mr. Sandeep Jakhar, Dr. Vivek Kumar, Mr. Vikrant Verma, Mr. Naveen Yadav
Department of Electrical & Electronics Engineering, BRCM-CET, Bahal
sjakhar1989@gmail.com, kvivek@brcm.edu.in, vvikrant@brcm.edu.in, naveen_yadav35@yahoo.com

Abstract: This paper/ audit report is aimed at managing energy consumption in academic block of BRCM-CET; Bahal as there is a huge scope of energy conservation in this block. It is a concerted attempt in achieving improved energy performances by replacing the conventional luminaries and fans installed in academic building with energy efficient luminaries and fans. The audit was conducted and suitable strategies of adjusting and optimizing energy were suggested so as to reduce energy requirements and hence the total cost spent with payback period.
Keywords: Energy Audit, Energy Conservation, Payback Period, Load.

Introduction

Energy crisis is one of major problem in exiting world where demand of energy is increasing rapidly. Energy is prime focus due to rapid growth and development of technology. Proper utilization of Energy is one of the major aspects of any developing country. Today the need of energy has increased greatly in order to meet the demand of ever-increasing consumption of it. This energy crisis problem will be solved through Energy conservation and use of energy efficient equipment.

Audit Phase

BRCMCET is a premier engineering institute in Haryana since its inception in the year 1999 in Bahal, Distt. Bhiwani, Haryana. The academic building of BRCM CET consists of five different blocks department wise and these blocks are EEE/ECE Block, ME Block, CSE Block, CE Block and each block of academic building has three floors. The academic building consist of total 53 labs, 37 lecture halls, 18 office rooms, 17 wash rooms, 1 central library as well as 4 seminar halls and each block consists of a large corridors.

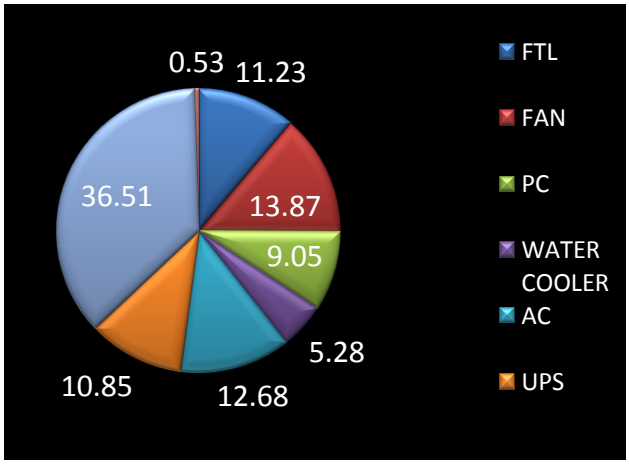

Figure-1 Total Connected Load

The average monthly power consumption units of academic block for the year 2016-17 are 77432 kWh and average monthly electricity bill is Rs. 48395/-. There is a huge scope of energy conservation in this block. The CSE block of

academic building of BRCMCET consists of three floors. The ground floor has 1 lab, 1 lecture rooms, 5 office rooms, 2 wash rooms and 1 seminar hall. This block consists of a large corridor. There is a huge scope of energy conservation in this block.

Parameters Considered

The most prominent parameter considered here in this work is the overall wattage and lumens/ watt possessed by the installed luminaries and overall wattage of fans installed. Second parameter considered here is the cost of replacement of high-wattage equipment by some low-wattage equipments available and the time-of-return of the invested cost.

Sr. No.	Area	Total Rooms	Total FTLs	Fans
1	Lecture Rooms	37	325	318
2	Laboratory	53	230	226
3	Galleries	9	72	2
4	Bathrooms	17	34	30
5	Staff Rooms	8	55	48

Table-1: Potential Areas in Academic Block

Lumens/ Watts			
Lumens	FTL	CFL	LED
220	3.96	6	4
400	7.2	9	6
700	12.6	12	10
900	16.2	15	13
1300	23.4	20	18
2000	36	25	20

Table-2: Lumens/ Watt Values for Luminaries

Total no. of FTLs installed in academic block is 797 and total no. of fans installed in academic block is 656.

	April 2016	May 2016	Jun 2016	July 2016	Aug 2016	Sep 2016	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	March 2017	April 2017
Civil	102	32	50	28	28	103	109	40	26				
CSC	61	146	139	68	68	439	201	6	207	7	7	53	636
ME	5939	8760	8290	7204	7204	6043	4439	2153	2204	2655	2311	2778	5451
EEE/ECE	1233	1362	1433	956	956	1473	1067	344					
Total	7335	10300	9912	8256	8256	8058	5816	2543	2437	2662	2318	2831	6087
Total One KWH	77432												
One year bill	77432*7 = Rs. 542024												
One month average	77432/12 = 6452 Kwh												
One month bill	6452*7 = 45164												

Table-3: Total Load for Year 2016-17

The given table shows the total load of the academic block that includes FTLs, Fans, Exhaust Fans, PCs, Coolers, etc. The maximum energy consumption by FTLs and Fans can be conserved in the academic block. So, in this work the study was undertaken for the replacement of FTLs and Fans in the academic building.

Analysis of Collected Data

(i) Analysis of FTL Replacement

The difference between FTL and CFL in energy consumption = (30042.72 kwh-16783.4 kWh) = 13259.32 kWh
Cost difference between FTL and CFL = (150213.6-83917) = Rs. 66296.6/-
The difference between FTL and LED in energy consumption = (30042.72 kwh-15021.36 kWh) = 28540.36 kWh
Cost difference between FTL and LED = (150213.6-75106.8) = Rs 75106.8/-
The difference between CFL and LED in energy consumption = (16783.4 kwh-15021.36 kWh) = 1762.4 kWh
Cost difference between CFL and LED = (83917-75106.8) = Rs 8810.2/-

(ii) Analysis of Ceiling Fan Replacement

The difference between 60W ceiling fan and 40W ceiling fan in energy consumption = (45607.2-30404.8) = 15202.4 kWh
Cost difference between 60W ceiling fan and 40W ceiling fan = (228036-152024) = Rs 76012/-

Audit Results

Yearly energy consumption of lighting = (P x T x N/1000) kWh
P = Power rating of lamp in Watts
T = Time in hours per day lamp is in use
N = Number of lamps in use

Per year energy consumption of 36W fluorescent tube light, E1 = 30042.72 kWh
Per year energy consumption of 20W CFLs, E2 = 16783.4 kWh
Per year energy consumption of 18W LED, E3 = 15021.36 kWh
Per year energy consumption of 15W CFLs, E4 = 12517.8 kWh
Per year energy consumption of 6W LED, E5 = 5007.12 kWh

Per year energy savings by 20W CFLs = E1 - E2 = 30042.72-16783.4 = 13259.32 kWh
Per year energy savings by 18W LED = E1 - E3 = 30042.72-15021.36 =15021.36 kWh
Per year energy savings by 15W CFLs = E1 – E4 = 30042.72-12517.8 = 17524.92 kWh
Per year energy savings by 6W LED = E1 – E5 = 30042.72-5007.12 =25035.36 kWh

Yearly energy cost savings = (Yearly energy savings) *(energy cost)
Yearly energy cost 36W fluorescent tube light = 30042.72 *7=Rs.210299.04
Yearly energy cost savings by 20W CFLs = 13259.32 *7=Rs.92815.24
Yearly energy cost savings by 18W LED = 15021.36 *7=Rs.105149.52
Yearly energy cost savings by 15W CFLs = 17524.92 *7=Rs.122674.44
Yearly energy cost savings by 6W LED = 25035.36 *7=Rs.175247

Implementation cost for CFLs = (Total number of equipment) * (Unit cost CFL)
Implementation cost for 20W CFLs = 797*130 = Rs.103610
Implementation cost for 18W LED = 797*100 = Rs.79700

Payback period for Instillation = (Implementation cost) ÷ (Monthly energy cost saving)
Payback period for CFLs = 103610/92815.24 = 1.11 years
Payback period for 18W LED = 79700/105149.52 = 0.75 years

Thus, the payback period for each recommendation is roughly 1.5 years, following which the savings in energy cost appear as profit for after the installation. The results show the practical possibility as well as the viability of the replacements if implemented in a proper manner.

Conclusion

In this paper we have considered the academic sector for evaluation of energy audit and energy conservation of engineering college of BRCM-CET, Bahal. Key issues pertaining to the implementation of Energy Conservation proposal and methodology have been discussed in detail. Based on the exhaustive literature survey for energy conservation and audit data the study was carried out keeping in mind the present energy scenario and future conditions.

References

[1] Arabinda Sharma, Happy kumar "Seasonal Variation on Electricity Consumption of Academic Building –A Case Study"18-19 March 2017.
[2] Arabinda Sharma, Priyaijt Dash "Energy Ratings of an Academic Building" 18-19 March 2017.
[3] Mr. Mandar S. Isasare, Prof. Swapnil A. Zadey "A Case Study: Energy Audit at AVBRB, Sawangi (M), Wardha." 2016.
[4] Farong Kou, Long Chen, Dongdong Zhang "Energy Management Strategy for Active Suspension with Linear Motor" 2016 IEEE.
[5] Takshashila Bhandari,A.G.Thosar, M.R.Bachawad, Pankaj Bhakre "Energy Audit: A Case Study Of An Academic Building" Volume-4, Issue-11, Nov.-2016.
[6] Swapnil Zadey,Srushti Chafle and A.S Lilhahre "Analysis of Various Parameters by Energy Audit" April 6-8, 2016, India.
[7] R. Hari Baskar1, Hitu Mittal2, Mahesh S Narkhede3, Dr. S.Chatterji4 " Energy Audit –A case study" Volume 4, Special Issue 1, February 2014.