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Research Article

ENERGY ESTIMATION: A CASE STUDY OF UNIVERSITY

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ABSTRACT

Preliminary Energy estimation analysis is made to assess Gandhi Institute of Technology and Management University to identify not only simple and low cost improvements but also a list of energy conservation measures or energy conservation opportunities to orient the future detailed energy audit.

INTRODUCTION

Energy audits initially became popular in response to the energy crisis of 1973 and later years. Interest in energy audits has recently increased as a result of growing understanding of human impact upon global warming and climate change. Energy audits are also popular due to financial incentives for homeowners Generally, four levels of analysis can be outlined: [1]

- Level 0 – Benchmarking: This first analysis consists in a preliminary Whole Building Energy Use (WBEU) analysis based on the analysis of the historic utility use and costs and the comparison of the performances of the buildings to those of similar buildings [2]
- Level I – Walk-through audit: Preliminary analysis made to assess building energy efficiency to identify not only simple and low- cost improvements but also a list of energy conservation measures (ECMs, or energy conservation opportunities, ECOs) to orient the future detailed audit.[3]
- Level II – Detailed/General energy audit: Based on the results of the pre-audit, this type of energy audit consists in energy use survey in order to provide a comprehensive analysis of the studied installation, a more detailed analysis of the facility, a breakdown of the energy use and a first quantitative evaluation of the ECOs/ECMs selected to correct the defects or improve the existing installation.[4]
- Level III – Investment-Grade audit: Detailed Analysis of Capital-Intensive Modifications focusing on potential costly ECOs requiring rigorous engineering study.

The present case study is done on Level I – Walk- through audit

Energy Estimation

Table I First floor with energy estimation

ROOM NO.	No. of Lights	Light Wattage	No. of Fans	Fan Wattage	Total wattage
J201	10	10*95	10	10*80	1750
J202	10	10*95	10	10*80	1750
J203	10	10*95	10	10*80	1750
J204	24	24*36	10	10*80	1664
J205	10	10*95	10	10*80	1750
J206	10	10*95	10	10*80	1750
J211	27	27*24	0	0	648
J212	7	7*95	8	8*80	1305
J217	1	1*95	2	2*80	255
J218	2	2*95	2	2*90	370
J219	2	2*95	2	2*90	370
J220	2	2*95	2	2*90	370
J221	2	2*95	2	2*90	370
J221T	3	3*43	0	0	129
J222TJ	6	6*36	0	0	216
Director	15	15*(95+36+36)	3	3*80	2745
Corridor	39	39*43	3	3*80	1917
				TOTAL	19109

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First floor energy estimation given in Table 1

Floor energy estimation

Table II Third floor with energy estimation

ROOM NO.	No. of Lights	Light Wattage	No. of Fans	Fan Wattage	Total wattage
J401	7	7*95=665	10	10*80=800	1465
J402	9	9*95=855	10	10*80=800	1665
J403	9	9*95=855	10	10*80=800	1665
J404	9	9*95=855	10	10*80=800	1665
J405	9	9*95=855	10	10*80=800	1665
J406	9	9*95=855	10	10*80=800	1665
J411	13	13*95=1235	10	10*80=800	2035
J412	5	5*95=475	5	5*80=400	875
J413	5	5*95=475	4	4*80=320	795
J415	1	1*43=43	1	1*80=80	123
J416	1	1*43=43	1	1*80=80	123
J417	6	6*95=570	12	12*80=960	1530
J417T	6	6*36=216	0	0	216
J418T	18	18*36=648	0	0	648
J419	2	2*43=86	1	1*80=80	166
J420	2	2*43=86	1	1*80=80	166
J421A	12	12*95=1140	8	8*80=640	1780
J421B	12	12*95=1140	8	8*80=640	1780
J422A	12	12*95=1140	8	8*80=640	1780
J422B	12	12*95=1140	8	8*80=640	1780
CORRIDOR	53	53*43=2279	0	0	2279
				TOTAL	25866

Floor energy estimation

Table III Fourth floor with energy estimation

ROOM NO.	No. of Lights	Light Wattage	No. of Fans	Fan Wattage	Total wattage
J501	9	9*95=855	10	10*80=800	1655
J502	9	9*95=855	10	10*80=800	1655
J503	9	9*95=855	10	10*80=800	1655
J504	9	9*95=855	10	10*80=800	1655
J505	9	9*95=855	10	10*80=800	1655
J506	8	8*95=760	10	10*80=800	1560
J517T	10	10*36=360	0	0	360
A4	1	1*43=43	1	1*80	123
A18	1	1*43=43	1	1*80	123
J512	11	11*95=1045	10	10*80=800	1845
J520A	10	10*95=950	10	10*80=800	1750
J520B	11	11*95=1045	12	12*80=960	2005
J521A	10	10*95=950	10	10*80=800	1750
J513	1	1*43=43	0	0	43
J516	16	16*43=688	10	10*80=800	1488
J521B	12	12*95=1140	10	10*80=800	1940
J522	12	12*43=516	4	4*80=320	836
J516T	6	6*36=216	0	0	216
A5	1	1*95=95	1	1*80	175
CORRIDOR	31	31*43=1333	0	0	1333
				TOTAL	23822

Floor energy estimation

Energy Conservation Measure At Corridors

As shown in Figure 1 and Table V it can be seen that only one bulb glows when the main switch S is on. Similarly we can use the modified circuit in figure1 to accommodate say 36 tube lights and 33 two way switches in between S1 and S2 so that only one tube glows at a given instant of time as given in figure 2. Layout diagram for the first circuit in fig.1 is given in fig 3.

Total corridor tube light wattage =1917+2279+1333 +1677=7206 watts

Total corridor wattage with energy conservation=43*4=172 watts

Power saved= 7206-172=7034 watts
Ratio of energy saved=97.6%

Table IV Fifth floor with energy estimation

ROOM NO.	No. of Lights	Light Wattage	No. of Fans	Fan Wattage	Total wattage
J601	9	9*95=855	10	10*80=800	1655
J602	9	9*95=855	10	10*80=800	1655
J603	9	9*95=855	10	10*80=800	1655
J604	9	9*95=855	10	10*80=800	1655
J605	9	9*95=855	10	10*80=800	1655
J606	9	9*95=855	10	10*80=800	1655
J612	5	5*95=475	12	12*80=960	1435
J613	1	1*43=43	0	0	43
J614	1	1*43=43	1	1*80=80	123
J615	1	1*43=43	1	1*80=80	123
J616	15	15*43=645	12	12*80=960	1605
J616T	6	6*36=216	0	0	316
J617T	10	10*36=360	0	0	360
J618	1	1*43=43	1	1*80=80	123
J619	1	1*43=43	0	0	43
J620A	7	7*95=665	8	8*80=640	1285
J620B	8	8*95=760	8	8*80=640	1400
J621A	10	10*95=950	10	10*80=800	1750
J621B	8	8*95=760	8	8*80=640	1400
J622A	10	10*95=950	10	10*80=800	1750
J622B	8	8*95=760	8	8*80=640	1400
CORRIDOR	39	39*43=1677	0	0	1677
				TOTAL	24763

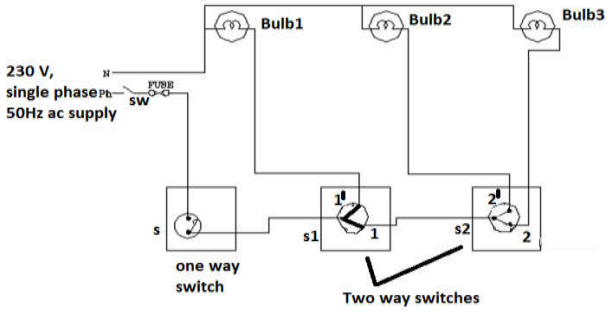

Figure1: Corridor with three bulbs

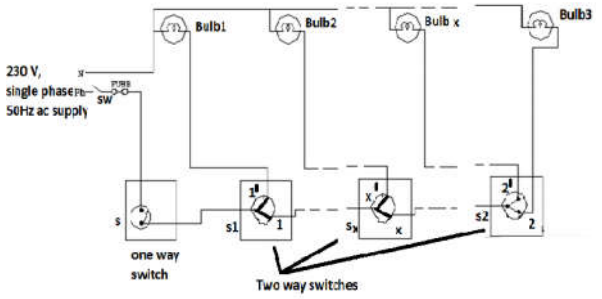

Figure 2: Corridor with n number of bulbs where x=n-3

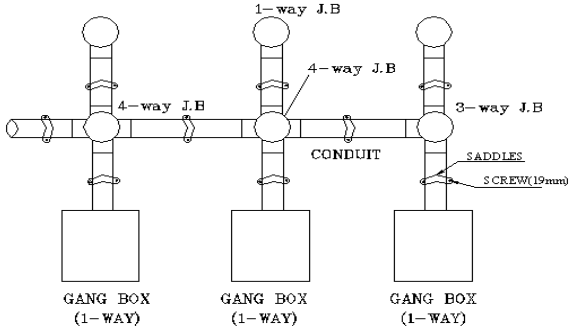

Figure 3: Layout diagram for circuit1

Table V. switching results of corridor with three bulbs

S	S1	S2	Bulb1	Bulb2	Bulb3
off	1/1'	2/2'	Not glows	Not glows	Not glows
on	1'	2/2'	glows	Not glows	Not glows
on	1	2'	Not glows	glows	Not glows
on	1	2	Not glows	Not glows	Glows

Observations of Energy Conservation

Switch off lights and fans if they are not in use. During winter and rainy seasons as we have good temperature fans need not turn on and during summer doors of class rooms can be opened in order to get good illumination from sun. Number of lights fixed in corridor is more as we need not require those many lights because we stay in college only from morning to evening so the number of lights can be reduced. The same thing we observed in staffrooms.

Illumination levels and improvements

In each class there are 18 tube lights placed in front, middle and on either sides of the classroom but there are no tube lights at backside where the illumination at last benches is low compared with the front and middle benches.

The illumination for a reading room is 250lux. On our observation we found the illumination level is equal to practical value at first benches and less at middle benches but at last benches it was quite less.

On either sides of the classroom the total number of tube lights are 12 in one class and in other classroom the number of tube lights are 8 but we observed the illumination at first bench in both classes is same. So we can place the 4 tube lights at backside to get better illumination rather than at front.

CONCLUSION

Energy estimation is done for GITAM University Hyderabad campus. A list of energy conservation measures is identified.

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