iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** XII **Month of publication:** December 2020

DOI: https://doi.org/10.22214/ijraset.2020.32680

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue XII Dec 2020- Available at www.ijraset.com

Energy Audit of SMSMP ITR Campus, Akluj

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Abstract: ***All electrical load or data collections for energy audit was carried out by the department of electrical engineering for last five years from year 2015-2020. This audit is done to identify energy consumption of last five years as well as to identify wastage of electricity and to reduce this by applying various energy consumption methods. In this audit ,Detailed analysis and survey of all electrical loads was done and studied and it was found that if we are used some equipment ,appliances and instruments in smart and effective ways it may help us to reduce consumption. Data collection consisted loads of all academic areas, laboratories, faculty cabins, libraries, corridor, interior lightening, exterior lightening, water pumps, coolers and cost of all these goes in too many lakhs every year. Also it is necessary to find out ratings of college building for clean and green campus as per energy audit norms .So from this analysis we are calculating ratings of college building from last five years which can be in-house outhouse activity in future perspective.***

Keywords: Specific Energy Consumption, Power Factor, Energy performance index, Energy audit.

I. INTRODUCTION

An energy audit is an inspection, survey and analysis of energy flow for energy conservation in college building, industries and commercial, process to reduce the amount of energy input into the system without negatively affecting the output. Energy audit is a testing and analysis of how the institute, industry or another organizations use energy. According to national energy conservation laws and regulations for energy, consumption investigation and energy audit management. An energy audit consist of a detailed examination and study about of a how facility, equipment's and area uses energy, what the facility pays for that energy, and a finally, a recommended program for changes in energy consuming.[1] Energy auditing is survey of the energy consumption processing related with of institute or organization. Purpose of energy auditing is to recommend steps to be taken by management for improving the energy efficiency, reduce energy cost and saving the money on the energy bills. [2] And calculating star rating of the building by using energy performance index.

SMSMPITR engineering college Akluj is established in 2011 and it is AICTE approved and one of the best engineering college from the rural area of Solapur district. College has 18 acres green and clean area including huge infrastructure. College building which has five degree engineering departments and two diploma engineering departments as well as administrative office Girls hostel building , Boys hostel building and Staff quarters. As on the date, total students strength of the institute is about 750 with total faculty plus staff strength of about 70 and over an area of about 18 acre. The institute annual load demanded for college building is 173997 KWA and annual electricity bill keeps up around 10,24,590 lakh.. Making the institute energy efficient will not only related with reduction in electricity expenses but also helps us to remind our moral responsibilities of not wasting this precious resource which may be used by people of the country in need. And it is very important to analyse the star rating of institute for keeping its own reputation.

The objective of energy audit to find out total energy consumed by institute and analysing which area and which department consumed more and finding out reason behind that Also main purpose of this is to find out star rating of energy audit for energy efficient building.[3]

II. METHODOLOGY

Energy audit methodology consists of data collection and analysis.

A. Data Collection

The data collection includes institute and departments as well as premises. The detailed information about all appliances was collected with their rating which already mentioned. Some other useful information and all records available with respective departments, laboratory etc. Some approximations were taken while there was lack of information or sometimes loads was neglected considering very small fraction of total load. SMSMP Institute of Technology & Research uses energy in the following forms:

1) Electricity from Sugar Factory (Co-GEN)
2) High Speed Diesel (HSD)

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Major data collection points are various departments of institute which is mentioned in below table

TABLE I
Data collection of various departments of institute

Sr no	Department	Number of Appliances
1	Department of Civil engineering	259
2	Department of computer science engineering	393
3	Department of Electrical Engineering	443
4	Department of electronics and telecommunication	401
5	Department of mechanical engineering	261
6	Office	36
7	Canteen	38
8	Staff quarters	192
9	Boys and girls hostel	1050
10	Digital library	76
11	Premises	480
12	Workshop	152

All Data is collected from various departments of institute campus in terms of number of appliances, number of instruments used for every department for particular hour and from that total energy consumption is calculated. Following appliances are used in various sector of department for various time periods .Based on actual working period and KVA rating of instrument ,total energy consumption is calculated.

a) Computers
b) Lighting
c) Air-Conditioning
d) Fans
e) Other Lab Equipment

B. Data Analysis

1) Total Energy Consumption: Total energy consumption of institute is calculated by using collected data from various department which includes number of appliances and total working hours of individual appliances and KVA rating of that appliances. Based on how many hours instrument or appliances is worked its KVA rating is varied from month to month and tear to year . From Collected data from various departments and rating of every appliances and instruments KVA rating is calculated from formula

$$\text{KVA rating} = \frac{\text{Voltage rating} \times \text{current rating}}{1000}$$

TABLE III
Total KVA rating of various departments of institute

Sr no	Department	Total KVA rating
1	Department of Civil engineering	25925
2	Department of computer science engineering	45170
3	Department of Electrical Engineering	14656
4	Department of electronics and telecommunication	1028
5	Department of mechanical engineering	54844
6	Office	4247
7	Canteen	8092
8	Staff quarters	33067
9	Boys and girls hostel	183565
10	Digital library	4822
11	Premises	5838
12	Workshop	8013

After calculating KWA rating of instruments total energy consumption per year in hour is calculated from formula given below
KWH = Calculation of power (watt) per hour × 1000

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Total energy consumption of whole institute is calculated for last five years .Year wise equipment rating, its use and working condition, weather condition, all considered. Year wise total energy consumption in KWh and P.F is mentioned in table I

TABLE IIIII
Total energy consumption of last five years

Sr. No.	Year	kWh	PF
1.	2015-16	170765	0.98
2	2016-17	185932	0.97
3	2017-18	177555	0.99
4	2018-19	172833	0.99
5	2019-20	162901	0.980

The Power Factor to reduce the utility power bill. Most utility bills are influenced by KVAR usage. A good Power Factor provides a better voltage. Reducing the pressure on electrical distribution network. Reducing cable heating, cable over loading and cable losses. Reducing over loadings of control gears and switch gears etc. Whenever the average power factor over a billing cycle or a month, whichever is lower, of a High Tension consumer is below 90%, Penal charges shall be levied to the consumer at the rate of 2 % (two %) of the amount of monthly energy bill (excluding of Demand Charges, FOCA, Electricity Duty and Regulatory Liability Charge etc.) For power factor of 0.98, the effective incentive will amount to 5% (five percent) reduction in the energy bill and for unity power factor; the effective incentive will amount to 7% (seven percent) reduction in the energy bill.

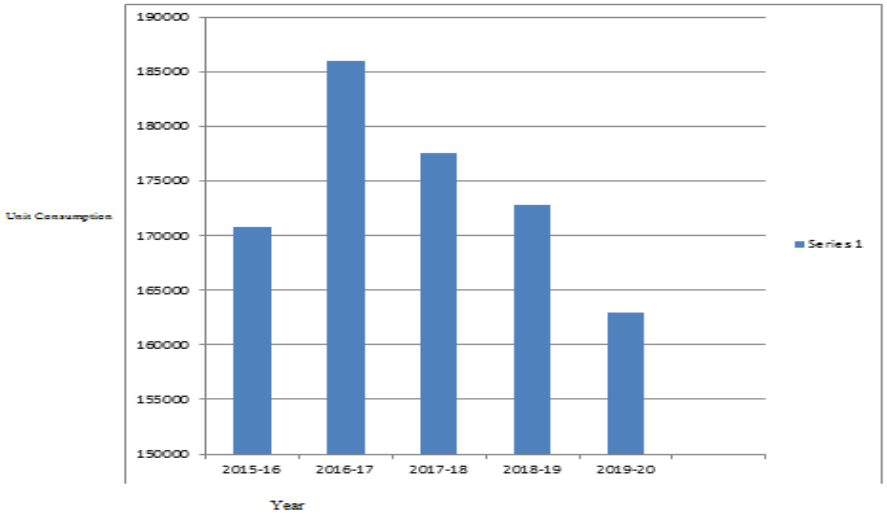

Fig. 1 Year wise unit consumption graph.

2) *Specific Energy Consumption (SEC):* Specific Energy Consumption (SEC) is defined as energy usage per Square meter of area. It is calculated total electrical kWh/total area of the campus. By calculating SEC, we can crudely target the factors of energy efficiency or inefficiency. SEC for last Year was calculated and is as shown in the table and chart below.

Table IVV
Yearly Specific Energy Consumption (SEC)

Sr.No	Academic Year	SEC
1	2015-16	10.85
2	2016-17	11.81
3	2017-18	11.28
4	2018-19	10.98
5	2019-20	10.35

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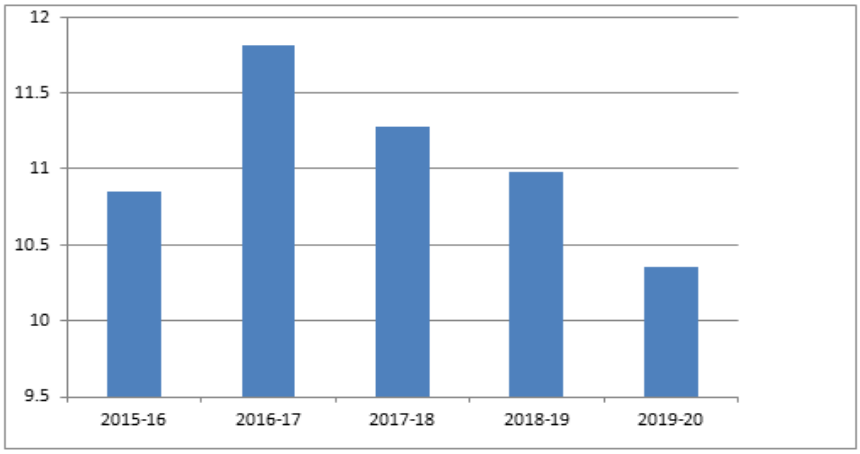

Fig. 2 Year wise specific energy consumption graph.

3) *Monthly Electricity Cost:* Standard rate of MSEB for LT Public services others (>20 - ≤ 50 kW)consumer is 9.24 Rs /unit[10] .Total cost of energy consumption per month is calculated as per standard charges of MSEB.

TABLE V
Monthly electricity cost for last five years

Sr. No	Academic Year	Average Cost Of Energy/Month
1	2015-16	85,382/Month
2	2016-17	92,966/Month
3	2017-18	88,777/Month
4	2018-19	86,416/Month
5	2019-20	81,450/Month

The Monthly average cost of energy is around for last Five year is: 86998/Month.

III.BUILDING ENERGY STAR RATING

The Star Rating Program for buildings would create a demand in the market for energy efficient buildings based on actual performance of the building in terms of specific energy usage. This programme would rate office buildings on a 1-5 Star scale with 5 Star labeled buildings being the most efficient. Five categories of buildings - office buildings, hotels, hospitals, retail malls, and IT Parks in five climate zones in the country have been identified for this programme. Initially, the programme targets the following 3 climatic zones for air-conditioned and non- air-conditioned office buildings:

A. Warm and Humid
B. Composite
C. Hot and Dry

For star rating of office buildings, a standardized format is developed for collection of actual energy consumption: data required includes building's built up area, conditioned and non-conditioned area, type of building, hours of operation of the building in a day, climatic zone in which building is located, and other related information of the facility.
Energy Performance Index (EPI) in kWh / sqm/ year will be considered for rating the building. The table indicating the EPI with the corresponding Star Label under the customize climate zones is given below. EPI shall be kWh/sqm/year in terms of purchased & generated electricity divided by built up area in sqm. However the total electricity would not include electricity generated from on-site renewable sources such as solar photovoltaic etc. Climate zone of institute is under composite.

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TABLE VI
Table for Building Energy Star Rating Programme Less than 50 % air conditioned built up area
Climatic Zone- Composite

EPI(Kwh/sqm/year)	Star Label
80-70	1 Star
70-60	2 Star
60-50	3 Star
50-40	4 Star
Below 40	5 Star

SMSMPITR College Building Star Rating
EPI shall be kWh/sqm/year in terms of purchased & generated electricity divided by built up area in sqm.
EPI=Total Energy Purchased/Built up area in Sqm

TABLE VII
Table for EPI of last five years

Sr.No	Academic Year	EPI
1	2015-16	10.85
2	2016-17	11.81
3	2017-18	11.28
4	2018-19	10.98
5	2019-20	10.35

TABLE VIII
Table for EPI of last five years

College Building EPI(Kwh/sqm/year)	Star Label
Below 40 (11.05)	5 Star

IV. GENERAL RECOMMENDATIONS

A. Lighting System

1) It is found that LED,FTL, CFLs is need to be install in the premises of institute .
2) It is recommended that some tube lights in this area be switched off when sufficient daylight is available.
3) Presently there are no reflectors installed for tube lights.

B. General Recommendations

1) All Class Rooms and labs to have Display Messages regarding optimum use of electrical appliances in the room like, lights, fans, computers and projectors.
2) Most of the time, all the tube lights in a class room are kept ON, even though, there is sufficient light level near the window opening. In such cases, the light row near the window may be kept OFF.
3) All projectors to be kept OFF or in idle mode if there will be no presentation slides.
4) All computers to have power saving settings to turn off monitors and hard discs, say after 10 minutes/30 minutes.
5) The comfort air conditioning temperature to be set between 24˚C to 26˚C.
6) Lights in toilet area may be kept OFF during day time.

V. CONCLUSIONS

The analysis calculation of electrical energy conservation of SMSMP ITR campus. According to the last five years of examination, energy consumption from every department and various campus sector is varies month to month and year to year. As energy consumption is varying cost of electricity also varies. The optimum electricity load is 11Kwh to maintain 5 star rating. It also suggests significance of condition of environment and other factors to correlate each other which will affect energy efficiency.

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VI. ACKNOWLEDGMENT

The energy audit is completed under the guidance honourable Dr Yadav I.N. ,Principal ,SMSMP ITR campus Akluj. The assistance received from Director, Dean, Head of all departments, Warden of hostels, and Faculty of department of electrical engineering of SMSMP ITR sincerely appreciated.

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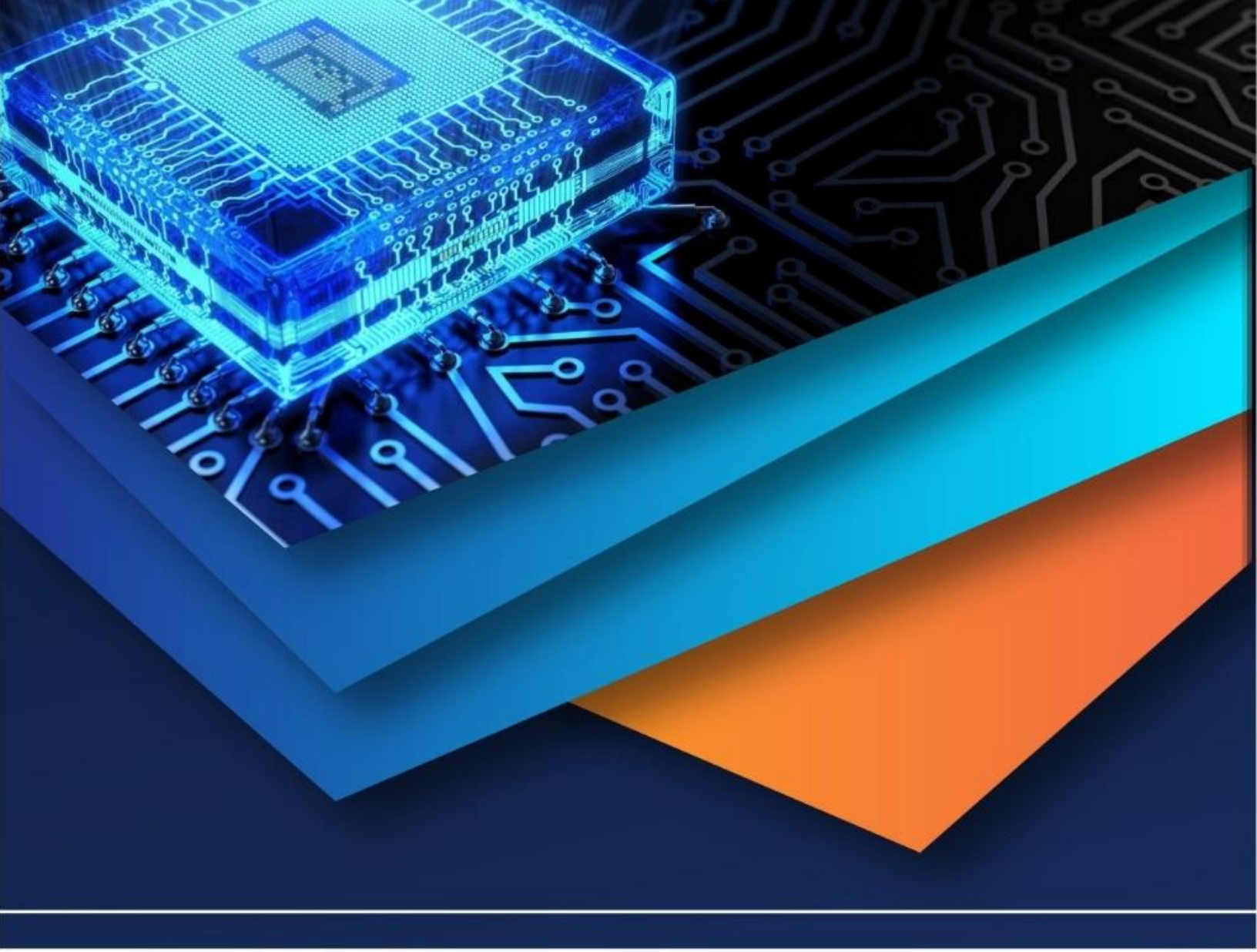

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