



Electrical Energy Audit of Sanjeevan Knowledge City

Piyush Dattatray Pawar, Vipul Suryakant Chougule

Abstract : *In this paper, a sincere attempt has been made to conduct the Energy Audit at Sanjeevan Knowledge City, to estimate the Energy consumed in a day, week and month. Identification of areas of energy wastage and estimation of energy saving potential in the whole campus has been made by detailed energy Audit. Also, detailed analysis of data collected is done by suggesting cost-effective measures to improve the efficiency of energy use. Estimation of implementation costs for each recommended action has been made. The results & vital information generated through these activities are documented. The Energy Auditing is the index of the consumption which normalizes the situation of Energy crisis by providing the conservation schemes.*

Keywords: *Energy audit, Energy Consumption, Energy management, Estimation, energy conservation*

1.Introduction

An energy audit is a study of a plant or facility to determine how and where energy is used and to identify methods for energy savings. There is now a universal recognition of the fact that new technologies and much greater use of some that already exist provide the most hopeful prospects for the future.

This energy audit of the Sanjeevan Knowledge City has been carried out and reported in this paper. We have compiled a list of possible actions to conserve and efficiently utilize our scarce resources and identified their savings potential. The next step would be to prioritize their implementation. I look forward with optimism that the institute authorities, staff and students shall ensure the maximum execution of the recommendations and the success of this work.

Sanjeevan Knowledge City is one of the pioneer private Educational Institute in Panhala, Kolhapur and was established in the year 1994. At present the trust is running School, Jr. College and Engineering College. Before planning this project the various papers related to the Energy Audit available in the IEEE archives were studied. Most of the papers are related to such studies made in different industries like, mechanical and heavy engineering.

In the paper the whole detailed analysis of all the equipments present in the institute has been done. In this process all equipments ratings places of maintenance and unsafety conditions have been identified. Thus the electrical energy audit allows us to understand and reduce the energy consumption which not only saves money but also helps us to reduce carbon foot prints globally.

A) Problem Formulation

The total sanctioned maximum demand of Institution is 240 KVA. But Actual Demand of Institution ranges between 110-155 KVA. The Institute Electricity bill from Jan 2018 to Dec 2018 is analyzed which is 1,08,94,666 Rs and its unit consumption 6,94,296 units is observed. This has been done to understand energy consumption in every particular month and factors leading to its variations.

The institute is very conservative and has adopted renewable energy sources including Solar, Wind and Hybrid plant. In order to achieve the required savings in power the different steps need to be taken. The details of all the components and factors involved need to examine.



B) Objective of this Project:

The main objective is to investigate the energy consumption of full campus by energy auditing. This energy audit assumes significance due to the fact that the Sanjeevan Knowledge City electricity bill had crossed Rs. 1 Cr. during 2018 financial year.

It was aimed at obtaining a detailed data about the various end use energy consumption activities and identifying, enumerating and evaluating the possible energy savings opportunities. The target is to achieve savings in the electrical energy consumption to the extent of 20% to 60%. The audit was also aimed at to learn or to get a feel of the practical problems and difficulties in carrying out energy audits.

1. Methodology

A) Data Collection – In preliminary data collection phase, exhaustive data collection was made using different methods such as observation, interviewing key persons, and measurements. Following steps were taken for data collection:

1. Visited each classroom, department, laboratories, library, canteen, auditorium and other entities of the School, Jr.College, Engg. College in institution.
2. Information about the general electrical appliances was collected by observation and interviewing.
3. Obtained Single Line diagram and Electricity distribution.
4. Collection of Electricity bill from the in-charge personnel.
5. The power consumption of appliances was measured using digital multimeter and in some cases while in other cases, rated power was used.
6. Information collected on non-operational energy systems
6. The details of usage of the appliances were collected by interviewing key persons e.g. Electrician, caretaker, etc.

B) Data Analysis - Detailed analysis of data collected was done. Energy consumption per month in kWh is calculated based on each section which were divided into different blocks according to the RMU's. The analysis of data is done in following way:

1. Power Flow diagram
2. Evaluation of collected data RMU wise analysis, building wise analysis and location wise analysis.
3. Reasons for the Variance between connected load and actual consumption was evaluated.
4. The database prepared was further studied and the results have been graphically represented.

This helped to identify the areas with maximum energy saving potential.

C) Recommendation – On the basis of results of data analysis and observations, some steps for reducing power consumption were taken. The recommended measures will not affect the present working conditions and at the same time substantial energy savings will arise. Following steps are recommended

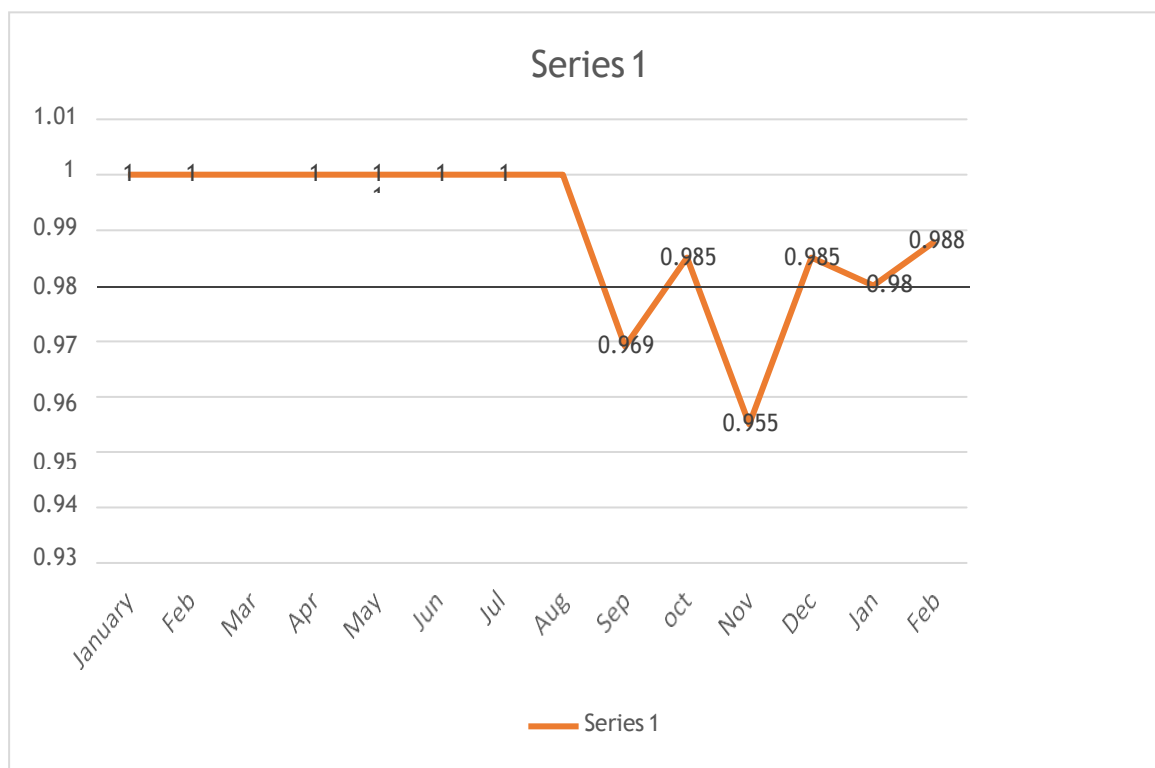
1. Change in operation time for swimming pool filter, RO plant, chakki atta machines and all the other possible equipments from day to night after 9 p.m. to 6 a.m. as this time zone has minimum tariff.
2. To maintain the power factor unity as the distortion in power factor either lagging or leading causes penalty.
3. To start net metering for solar and hybrid plant.
4. To maintain a record of all the parameters at the power house.
5. Need of preventive maintenance to reduce the breakdown maintenance.
6. To clean the solar plates to gain maximum efficiency.

Some other recommendations were also made which are based on lighting intensity, computer usage, fans and motion sensors.

2. Sanjeevan Knowledge City Energy Scenario

The Sanjeevan Knowledge City started in year 1994 has taken electrical installation of 11 KV from Maharashtra State electricity Board. The institute has both residential and commercial zones depending on requirement. The total sanctioned maximum demand is 240 KVA but the actual demand ranges from 110-155 KVA. For the financial year 2018 the electricity bill is 1,08,94,666 Rs with 6,94,296 unit consumption. The residential charges are 5.73/unit whereas the commercial charges are 9.65/unit. The average of this both gives 7.69/unit but according to the bill of year 2018 the charge happens to be 14.36/unit. This is due to the debit bill adjustment and penalty due to power factor.

Following chart shows the year 2018 power factor variation



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 switchgears 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 % of the amount of monthly energy bill (excluding of Demand Charges, FOCA, Electricity Duty and Regulatory Liability Charge etc.)

For power factor of 0.99, the effective incentive will amount to 5% reduction in the energy bill and for unity power factor the effective incentive will amount to 7% reduction in the energy bill

Study of Month wise Electricity Bill :

Sr. No	Month	Electricity Bill Amount (Rs.)
1	Jan-18	541,803.65
2	Feb -18	496,777.21
3	Mar-18	518,393.72
4	Apr-18	408,348.91
5	May-18	302,355.02
6	Jun-18	390,747.99
7	Jul-18	629,493.28
8	Aug-18	610,473.69
9	Sep-18	760,739.20

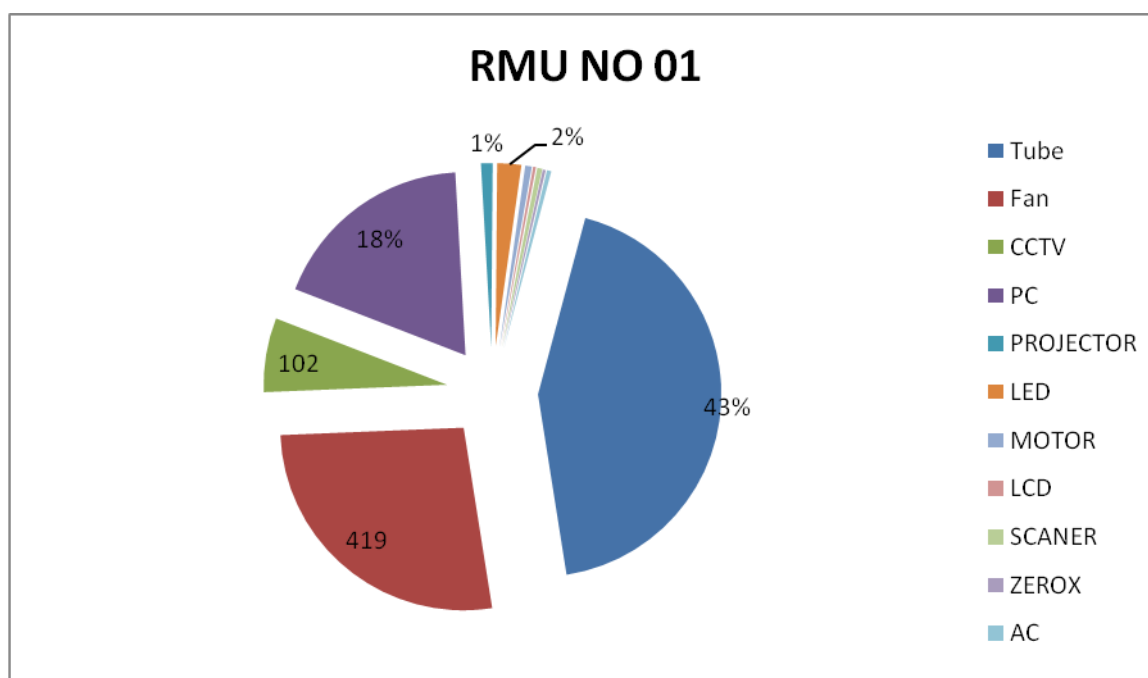
10	Oct-18	1,067,987.08
11	Nov-18	719,624.75
12	Dec-18	907,888.89
13	Jan -19	8,38,970.00
14	Feb -19	7,40,410.00
15	Mar-19	5,80,250.00

General Observations based on Electricity Bill:

- 1 .For College Campus the contract Demand (CD) is 240kVA and minimum billing Demand is 60% of the Contract Demand (i.e. 110-155 kVA) or the 75% of previous Maximum Demand recorded whichever is higher. Since, the MD recorded is less than 155 kVA.
2. The average electricity cost is Rs. 7.69rs/- considering the last twelve months.
3. Average monthly Power Factor is maintained near 0.99.
4. Load Factor need to be improved to maximum value.

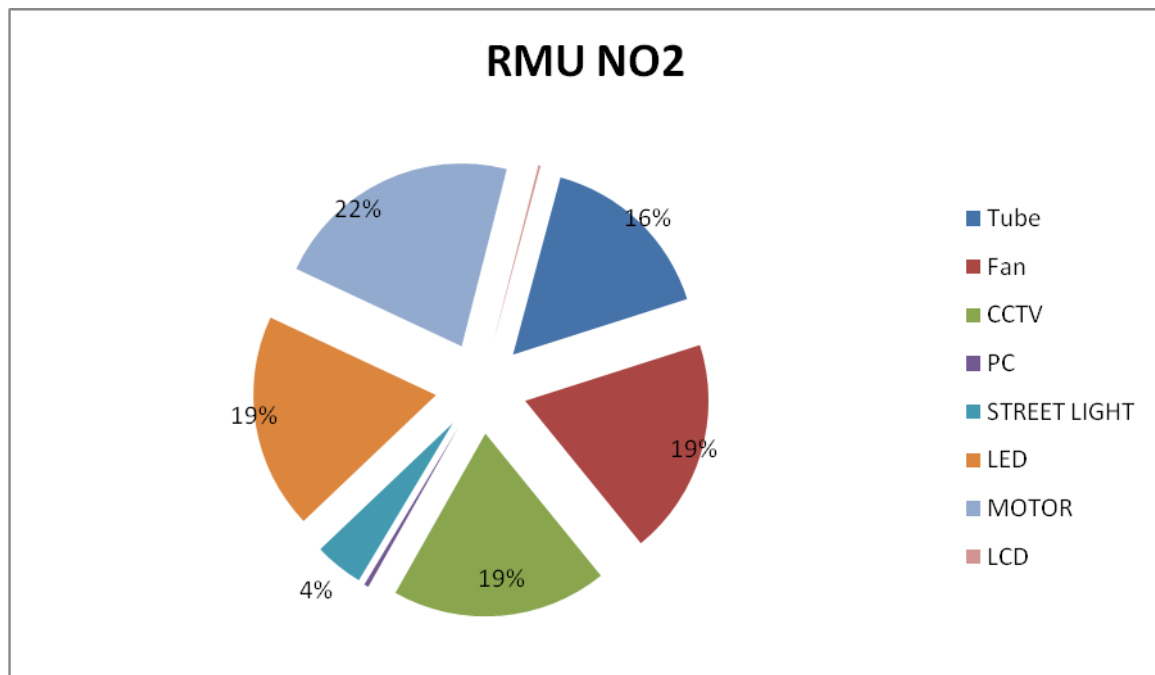
Total Load Distribution RMU wise :

RMU NO 01 (Engg. College)



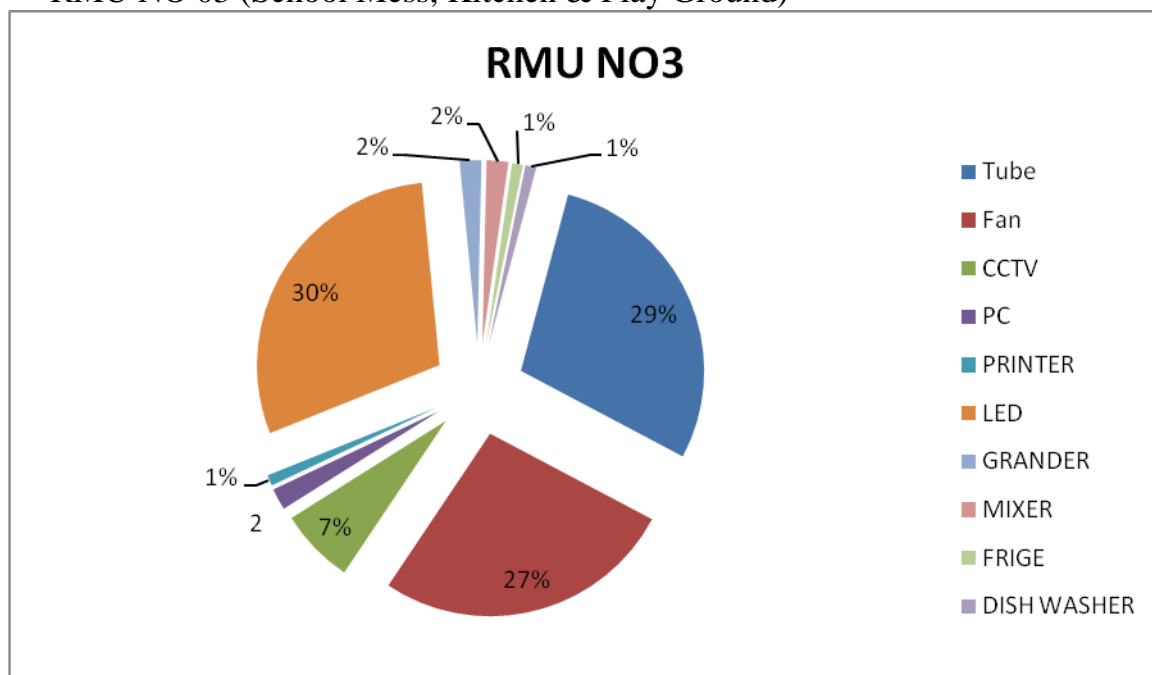
Total use wattage of this RMU= 935057.6816 kWatt

RMU NO 02 (Engineering Workshop ,Engineering Mess & Hostel)



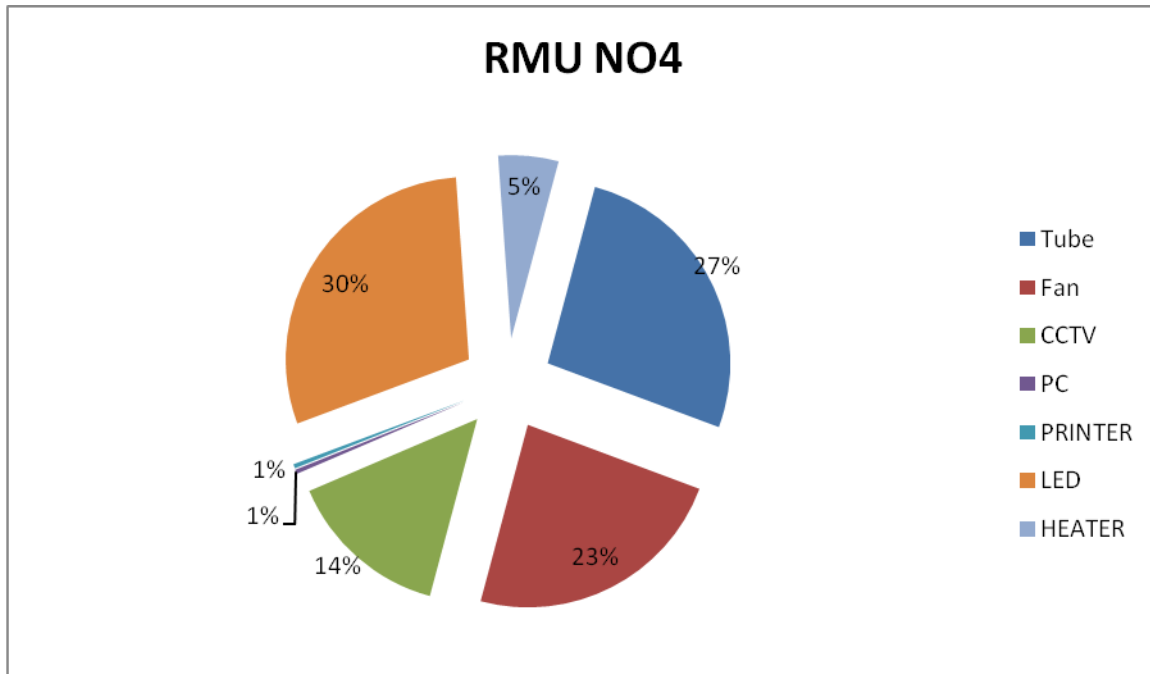
Total use wattage of this RMU= 161976.924 kWatt

RMU NO 03 (School Mess, Kitchen & Play Ground)



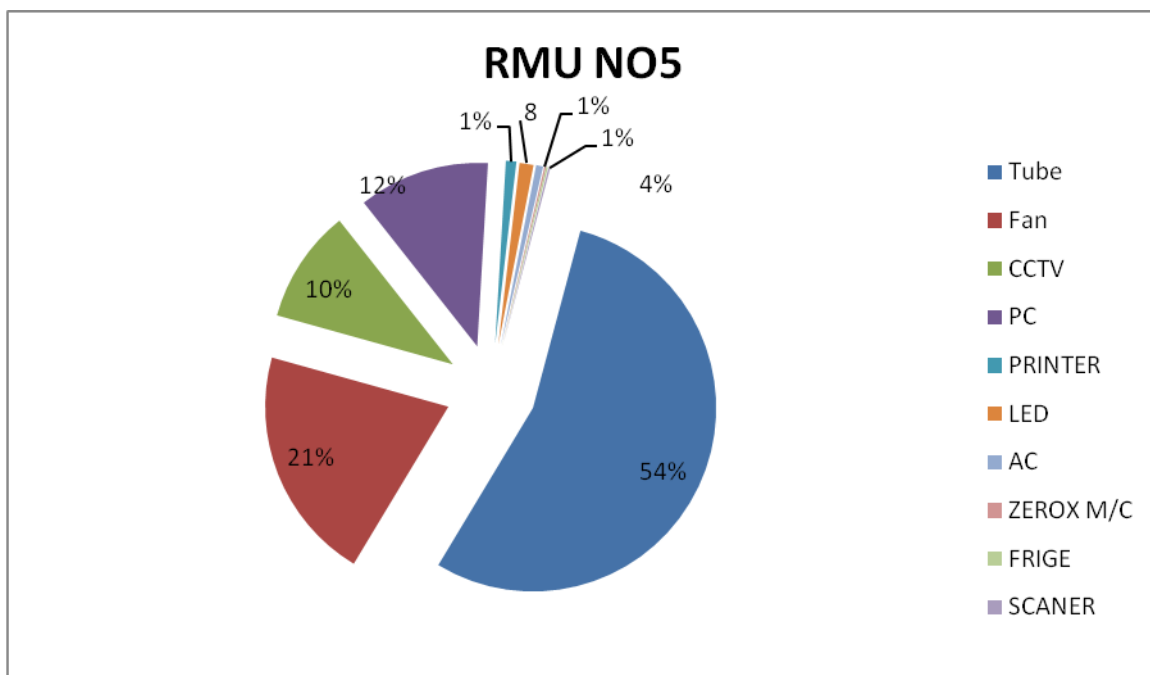
Total use wattage of this RMU=21789.254 kWatt

RMU NO 04 (Panchaganga, Koyana, Marathi Medium Hostel)



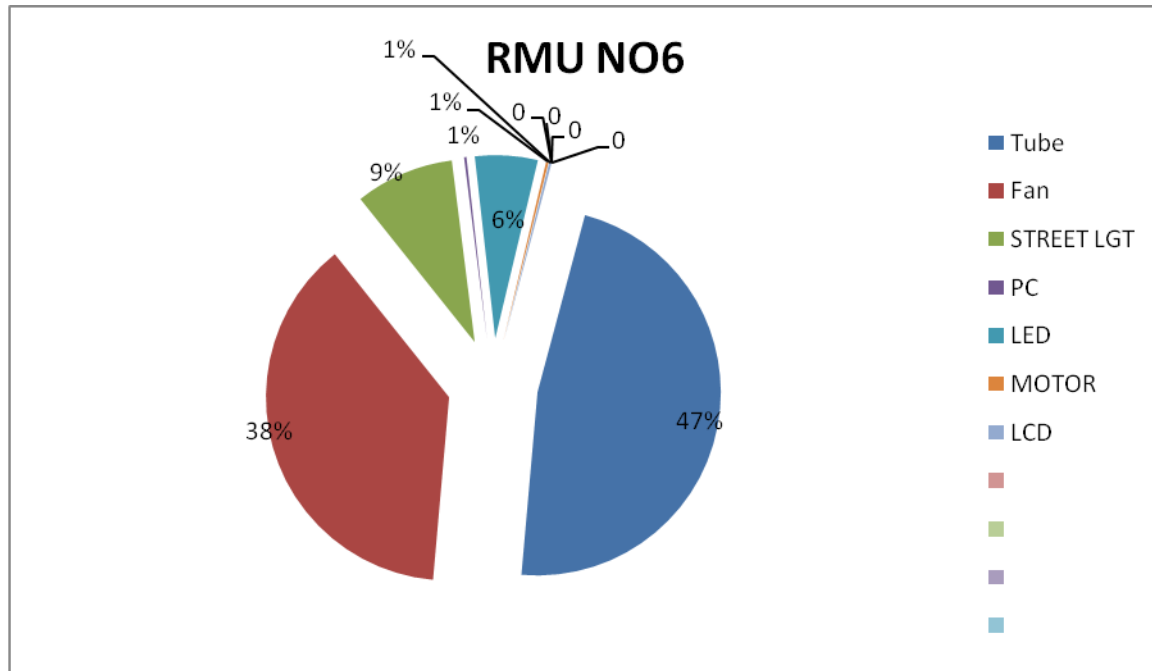
Total use wattage of this RMU= 24479.52kwatt

RMU NO 05 (Jr. College & Main School Building)



Total use wattage of this RMU = 56060.112 kwatt

RMU NO 06 (Engg.Collg. Boys Hostel, Virangana , BalUdyan ,Hospital)



Total use wattage of this RMU = 19854.7kwatt

4.Requirement

1.Make Positive awareness of energy saving.

Some people waste the electrical energy without requirement . So we need to reduce waste of energy , because the electrical energy requirement is increase in day to day life .It also increase the energy consumption per person Due to positive awareness of energy we can reduce the losses of west of not require energy.

2.Proper monthly and yearly maintenance of equipment.

For better efficiency the maintenance of the equipment is require. So the equipment maintenance is most important to the better operation after provide supply. It want to do weekly and monthly.

3.Proper substation Bus bar maintenance .

The substation is provide supply to whole system , if failure of supply is incenses then the supply availability is decreases . if proper maintenance of the substation is not provide then it also increase other losses and unexpected supply failure.

4.Take N/G voltage every month

The neutral to ground voltage can indicate the better supply availability of earthing and neutral. If the neutral of the supply system get fail to provide neutral then another problems will produce.

If proper earthing is not provided then it can be Abel to make any accident while supply is working through equipment.

5.Take thermal images of the all bus bar at load condition and unload condition

For better operation of bus bar the thermal image is most important to identify the load function to the bus bar performance , if the load on the bus bar is high than bus bar limit or any lug or connection have loos then it produce I²R loss and bus bar get heated.

6.Maintain TOD consumption

The TOD Factor is the reduce the energy consumption form mail total consumption. The TOD is reduce by 1.90Rs/unit charges of TOD period.

In our institute the TOD Factor is not maintain . the TOD consumption is not minimize form total bill .

We also be increase the TOD factor by changing the cycle of swimming pool water filtration plant and pump house water feeding timing. This two operations are increase the TOD tariff



7. Used human detector for all toilet lighting.

Many times the toilet lights are switched on continuously, but it is not required to switch on continuously. It increases energy consumption. When we connect the human detector in toilet then it can start the lighting as per requirement and reduce electric energy consumption.

8. Provide Net metering to solar plant

We have 20 kW solar plant it has better generation. But it does not have net metering but it connects to grid line that's why the consumption is not reduced from the bill. So it wants to provide the procedure for the net metering

5. Implementation

A. The APFC Panel cannot maintain unity Power Factor. Because of the low P.F. We pay penalty for low P.F. It is in high amount.

Solution –

We can implement our project in January 2019 first on APFC panel we can do maintenance of APFC panel.

The fuses of the capacitors are getting damaged then we can replace it by new fuses and start it. Now the panel is maintained at unity power factor.

Requirement –

The APFC Panel maintains the unity P.F. So this panel is more important in power house. For better working of panel the monthly maintenance is most required. We need to check the position of fuses weakly. We need to check the capacitance of the capacitor monthly.

Result

We reduced energy bill penalty from next month after APFC maintenance. So due to this we can reduce the payment for original bill per month..

B. On solar power plant the two strings of the solar got disconnected. So we connect it and increase the solar generation.

Total no. of 11 strings was connected after adding two connections 13 strings are connected.

C. Identify the TOD calculation is not measured in energy bill of institute. The TOD of the total consumption is not calculated in the energy bill it wants to be added, so we identified it and informed to MSEDCL for reduction of the previous bill payment.

D. We analysed all electrical data which we don't know EX.(ALL RMU & STREET LIGHT CALCULATION)

Heavy load information, total no. of tube, total no. of fans, total no. of PC and other information about the load

E.) We also identified the unsafe points

In our institute there are some unsafe points present by the audit we can identify them and make proper solution on it

6. Conclusion

Energy audit is an effective tool in identifying and performing a comprehensive energy management program. A careful audit of any type will give the organization a plan with which it can effectively manage the organization with energy system at minimum energy cost. In this paper, a detailed study has been made to reduce the electrical energy consumption in the complete campus of Sanjeevan Knowledge City. It highlights the amount of energy savings that can be obtained in an educational institution, thereby energy crisis can be reduced considerably.

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