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Energy Audit in a College Building – A Case Study

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***Abstract*—** For a developing country like India, scarcity of energy brings an impact in the development of the country. In India, Energy Demand is always more than the Energy Generated, due to the wastage of energy that is wasted in our daily life . In order to meet the energy need in a particular region some other region is being deprived from the Electrical Energy Supply . The monitoring of proper utilization of energy can contribute in the development of our country. Energy Audit is an analysis indicating how energy can be reduced and the study evaluate the energy consumption and to minimize the wastage of energy by implementing several techniques in our surrounding. Huge amount of energy gets wasted in industries, firms and educational institutes a huge amount of energy consumed in these area are comparatively more than that used in domestic need. The energy audit report draws the need for the organization to monitor its energy need and to reduce the demand and to make a cost effective system as it will also reduce the expense of the organization and will benefit the society as well as the organization.

***Keywords*—** Energy conservation , Energy Audit, Energy Demand, Bill Study

I. INTRODUCTION

In the present day of modernization, development plays an important role where growth in industries and organization results to increase in demand of the energy where the generation of energy fails to meet the need. For developing countries like India, the generated energy contributes in the development of the country. Thus energy conservation plays an important role leading to a practice of Energy Audit [1]. Energy audit is a study of inspection, survey and analysis of flow of energy to monitor energy conservation [2]. It seeks opportunity to reduce the amount of energy input into the system without affecting the output by using proper audit methods where the account of energy used or misused can be taken into consideration in an organization [3]. Energy audit is an essential parameter for the management program of the organization and firms for energy control and is an approach to identify the usage and wastage and to make proper use of the limited resource [4]. The energy auditor has to keep in mind several parameters before performing an analysis as the output has to be unaffected by the audit procedure [5]. From a study review it can be concluded that energy audit and its monitoring can save almost 5% - 20% of the energy from an organization or industries [6] and implementation of energy efficient schemes can reduce the need of energy.

To reduce the energy conservation in an educational building, an Energy Audit is performed in Pailan Technical Campus obtaining data from college building and developing a probable plan to minimize energy consumption implementing several techniques and to save energy.

II. OBJECTIVE OF THE ENERGY AUDIT IN PAILAN TECHNICAL CAMPUS

The objective behind the Energy Audit in Pailan Technical Campus is to establish the idea of Energy conservation in the college campus. The sole purpose is to draw the awareness in the campus and to calculate the energy consumed out of which a part is wasted and the rest is utilized. The study gives the data of the entire connected load in PTC and to study the need of energy saving and control the excess consumption.

The factors considered during the study of Energy Audit are:

- To identify the total connected equipment.
- To identify the area of energy consumption and energy wasted in the college campus.
- The electrical energy bill for last one year is studied for average estimation of the cost.
- Several methods that can be implemented are taken into consideration for the proposed scheme to reduce energy demand.

- Graphs are plotted in the basis of data obtained from bill study.
- Possible use of renewable energy is to be implemented.

III. A BRIEF CASE STUDY

A. Methodology of this Audit:

The methodology of the procedure of energy audit is attached:

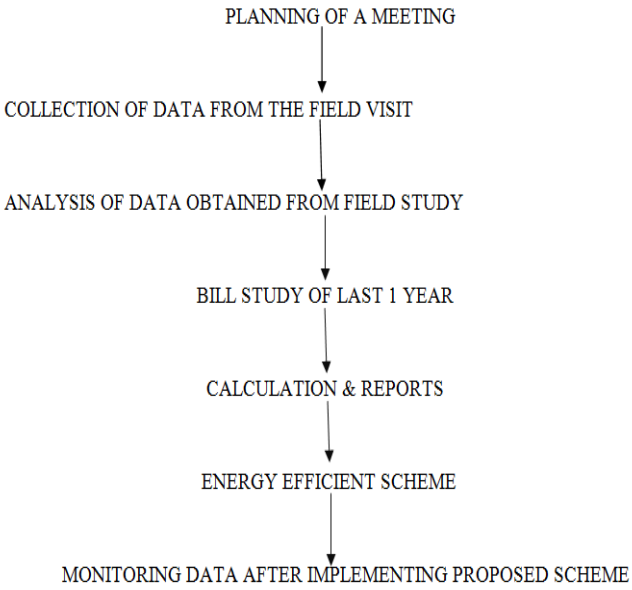

Figure 1. Methodology of Energy Audit in PTC

- The data obtained from the field survey gives a clear idea about the conservation of energy in the college campus.
- Firstly, the total count of the number of equipment connected in each of the floor of the building viz classroom, corridor, faculty room, washroom, laboratory etc.
- The total loads of the connected equipments are calculated from each floor considering the entire connected load in that floor.
- The total load of the building is calculated from the summation of data obtained from each floor and common space.
- The total load (Wattage) and the estimation of the no. of equipments are obtained from field work.
- Secondly, the study of electricity bill of the past one year is evaluated and the electrical parameters (kVA, kVAh, KW, Maximum Demand, rebate etc.) are obtained.
- From the above data, a proposed scheme is developed to reduce the energy consumption in the college premise resulting in the conservation of energy.

B. Measurement of Connected load:

We have measure all the connected load in our institute, and this table shows this data.

Table 1. Connected Load Calculation

Sl. No.	*Item*	*Power Ratting (kW)*
1	Light Load	13.0
2	Fan Load	14.0
3	Air Conditioner	50.0
4	Plug Socket	45.0
5	Computer	20.0
6	Other Load	50.0

C. Detail bill study

From the evaluation of the data obtained from Bill Study of last year (2018) we have come across the obtained data of supply voltage of 400 V, tariff Code B-IDI and Contact Load of 100 kVA. The connected load is calculated with the provided data obtained from bill study. A table depicting the connected equipments and energy consumption is shown.

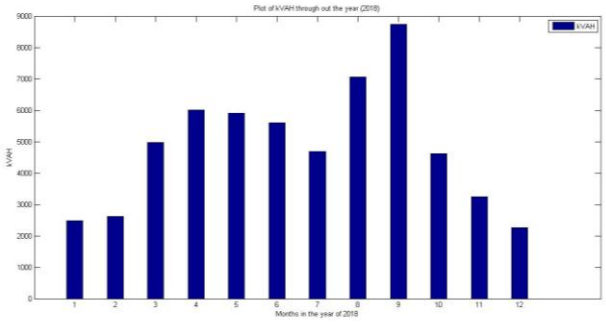

Figure 2. Plot of kVAH through out the year (2018)

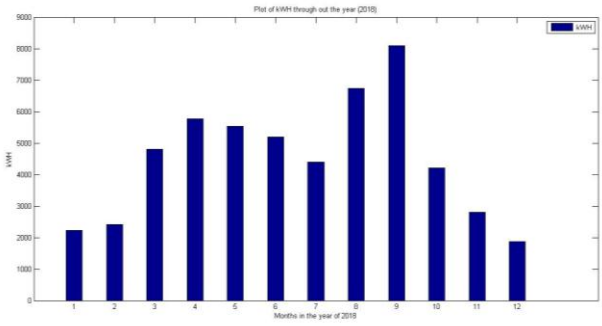

Figure 3. Plot of kWH through out the year (2018)

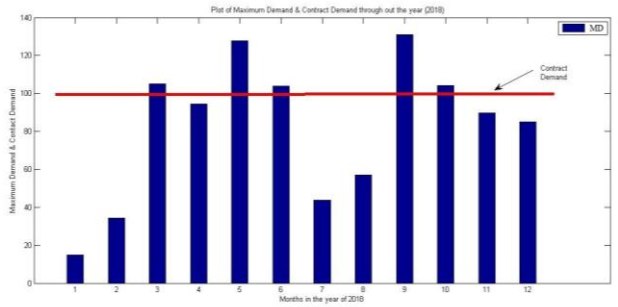

Figure 4. Plot of Maximum Demand & Contract Demand through out the year (2018)

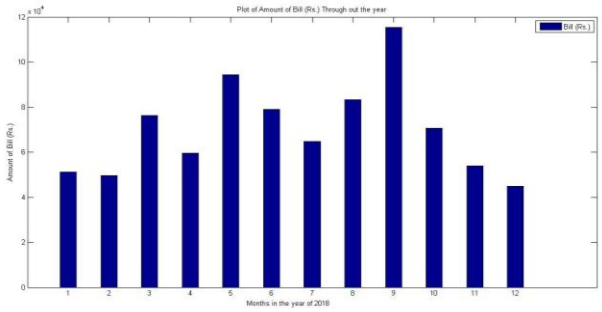

Figure 5. Plot of Bill (Rs.) through out the year (2018)

From the study of the data we have observed that often the Maximum Demand increases than the Contact Demand which results to a huge amount of penalty that has to be paid by the organisation. Thus to overcome this penalty we can introduce Demand Meter that will restrict further consumption of energy that will operate when it reaches 90% of the Contact Demand.

IV. PROBABLE MEASURES FOR ENERGY SAVING

From the data obtained from the energy audit performed in the college premise, several measured scheme are taken into consideration to reduce the reduce demand. The probable measures for energy conservation are:

- Proper lighting design is to be made to reduce the use of unnecessary lamp in several places.
- To utilize the daylight properly and implementing dimming control accordingly to reduce the energy consumption.
- Automation sensor based system is to be implemented that will automatically operate depending on the occupant leading to huge energy savings.
- To completely turn off the Air conditioners during the winter period.
- To replace the fluorescent tubular lamp with LED's to reduce energy consumption every day.
- To introduce renewable energy source in order to reduce non-renewable energy by implementing solar panel in the college rooftop.
- Properly monitoring the equipment efficiency and minimizing the waste of energy from it be published.

V. CONCLUSION AND FUTURE SCOPE

In the present era of energy crisis, the generation of energy fails to meet the Energy Demand. From the paper we can conclude that the drain of energy if minimised can save a huge amount of energy and reduce the need of generation. Thus from the above paper on Energy Audit, we can draw an estimation of the total load and the number of connected load and its evaluation gives a clear description of the wastage and need to energy.

After the study of Energy Audit, several proposed scheme for the conservation of energy can be adopted resulting in reduced energy consumption. Replacement of Fluorescent Tubular Lamp with LED's, Planting Solar Panel to use Solar Energy and proper utilization of daylight can result in the conservation of energy.
Thus if the industrial organisations, firms and educational institutions take proper measure a huge amount of energy can be conserved.

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