Energy Audit & Management of ITMU -Vadodara

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Abstract:- One of the major problems in the world is Energy Crises. 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 projections for the future. The opportunities lie in the use of standing renewable energy technologies and greater efforts at energy efficiency. In organizations like Engineering Colleges, the top operating expenditure is often found to be electrical energy. In most assessments of the manageability of the cost or potential cost savings in the above component, would invariably appear as a top priority, and thus energy Audit. Energy constitutes a strategic area for cost reduction. A well done energy audit will always help owners to understand more about the ways energy is used in their organizations, and help to identify areas where waste can occur and where possibility of improvement exists. The energy audit would give a positive orientation to the energy cost reduction, preventive maintenance, and quality control plans which are vital for production and utility activities. The purpose of our project - 'Energy Audit and Management of ITMU -Vadodara' is to categorize, quantify, describe and prioritize cost saving measures relating to energy use in the academic area, laboratories, library, hostel & guest house. This project is just one step, a mere mile marker towards our destination of making our campus 'ITM Universe' as one of the most energy efficient campuses in Gujarat

Keywords:- Energy Conservation, Energy Management, Energy Audit, Tariff Plan

I. INTRODUCTION

The objective of Energy Audit is to make ITM-Vadodara campus energy efficient. From last few months, the ITM electricity bill was drastically increasing. As the campus was facing over loading condition during peak hours, the main switch at distribution panel was tripping frequently during June-2014.

Hence this energy audit was aimed at obtaining a detailed idea about the various end use energy consumption activities and detecting, computing and evaluating the possible energy saving opportunities. The target is to achieve saving in the electrical energy consumption to the extent of 15% as well as to set a balanced load on the distribution system.

The work for Energy Audit should be directed towards [1]:

- Identification of areas of energy wastage and estimation of energy saving potential in
- Classrooms, laboratories, guest house, library and administration department.
- Recommending cost-effective measures to improve the efficiency of energy use.
- Estimation of implementation costs and payback periods for each recommended action.
- Documenting results & vital information generated through these activities.
- Identification of possible usages of co-generation, recommendations for implementation, wherever possible, with cost benefits analysis.

II. METHODOLOGY[2]

- Visual inspection and data gathering
- Observations on the overall condition of the facility and equipment and quantification
- Identification / verification of energy consumption and other parameters by Measurements
- Detailed calculations, analysis and assumptions
- Possible energy saving opportunities
- Execution

This methodology can be explained by dividing whole procedure into three parts i.e., Data collection, Data analysis and Recommendation.

III. ANALYSIS OF CONNECTED LOAD

Building wise Connected Load[3]:

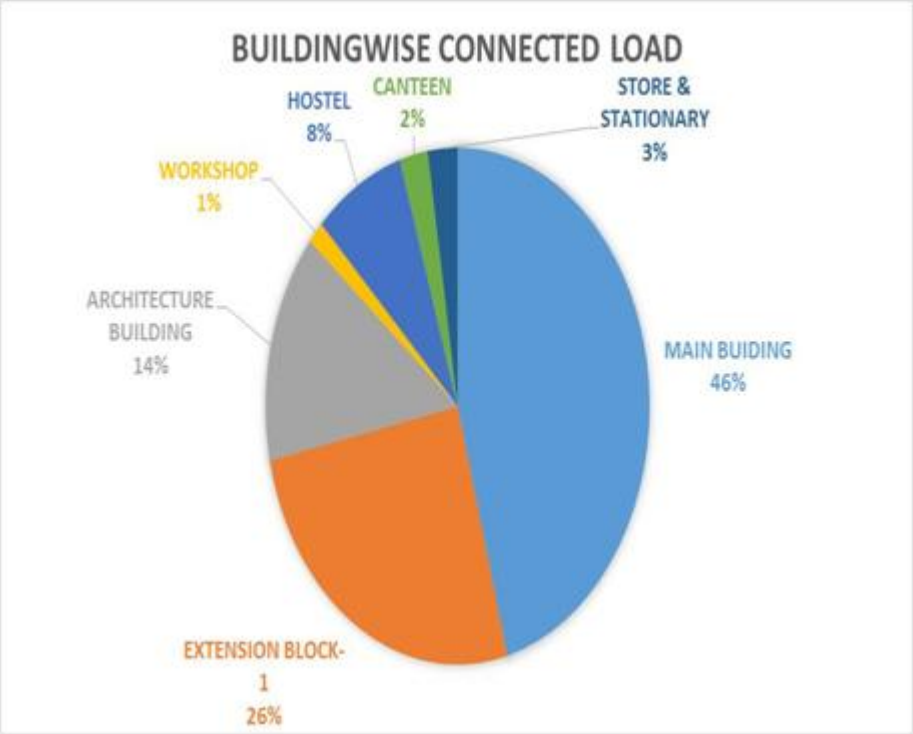

Diagram 1 - Building wise Connected Load

The analysis implies that Main Building has more connected load than any other building. Chart shown above represents percentage of connected load with respect to total connected load in the campus.
A point to note in the above chart is the higher percentage of connected load in Main Building as compared to other buildings. This describes how air conditioners and computers affect the consumption distribution. Workshop has lower consumption in spite of having lathe machines and furnaces, as maximum eight lathe machines are operated at a time, also the operating hours of these machines are very less.

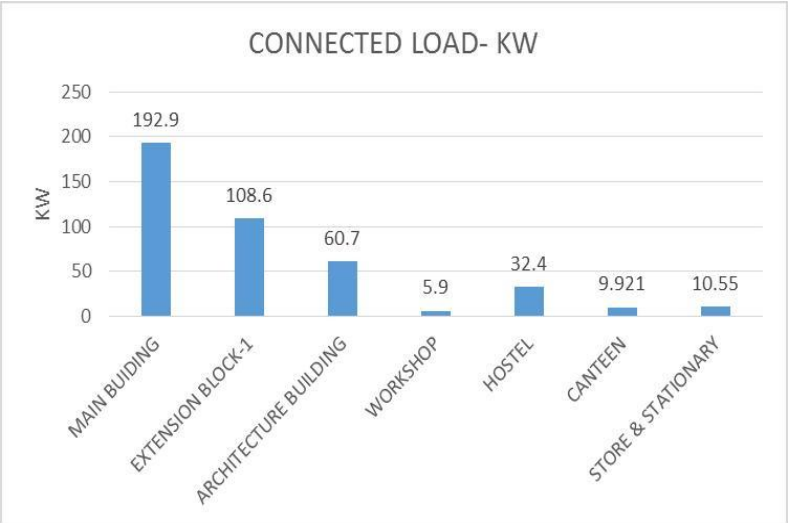

Diagram 2- Connected Load in KW

From the above graph, we can find that lighting system, ventilation system and computers affect the factor of power consumption most. Main building and extension blocks are engineering building having number of laboratories and computer centers, which consumes more power. Computers in all the buildings consume less power with compare to traditional computers as all the monitors are LCD/LED. Hence, power consumption can only be reduced by reducing operating hours and proper usage.

Equipment wise connected Load[4]:

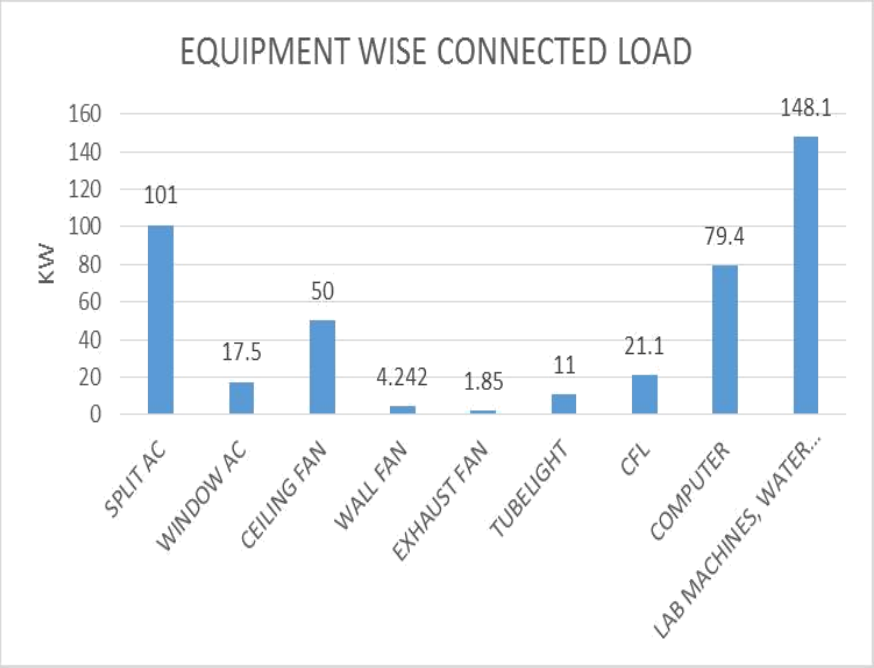

Diagram 3- Equipment wise Connected Load

The above graph represents that Lab machines and ACs play an important role in calculation of connected load, whereas ventilation system consisting of ceiling fan, wall fans and exhaust fan consumes less power with compare to other equipment.

IV. ANALYSIS OF ELECTRICITY BILLS

Per Month Electricity Bill Amount [5]:

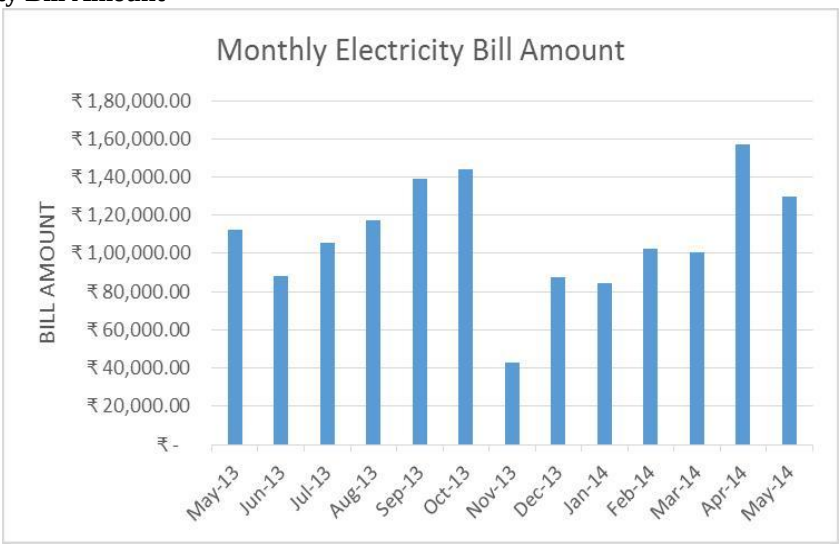

Diagram 4- Month wise Electricity Bills

From the graph, it can be concluded that electricity bill goes high during April to October period due to summer. The electricity bill goes high in the month, in which all the days are working days i.e. April-May and September-October.

Per Month Active Power Usage:

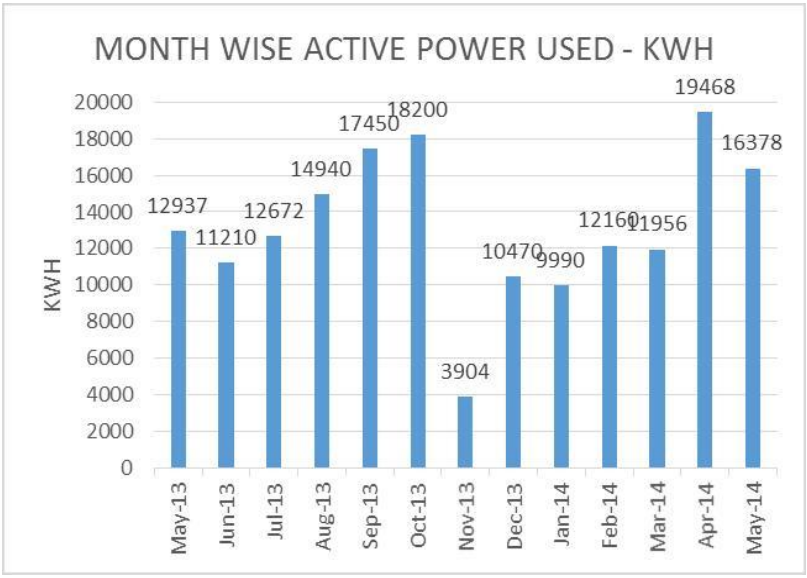

Diagram 5- Month wise Active Power Usage (KWH)

As stated above, in the month October-2013 and April-2014, active power used was above 18000 KWH or 18000 units, which is higher than any other months.

V. TARIFF PLAN

ITM Universe gets power from Jarod Sub-Station at 11 KV and has LTMD tariff plan.

A: LTMD[6]: This tariff is applicable to the services for the premises those are not covered in any other tariff categories and having aggregate load above 40kW and up to 100kW.

Tariff Structure:

1. Fixed Charges:

A	For billing demand up to the contract demand	
	(i) For first 40 kW of billing demand	Rs. 85/- per kW per month
	(ii) Next 20 kW of billing demand	Rs. 120/- per kW per month
	(iii) Above 60 kW of billing demand	Rs. 185/- per kW per month
B	For billing demand in excess of the contract demand	Rs. 255/- per kW per month

Plus

2. Energy Charges:

For the entire consumption during the month	460 Paise per Unit

Plus

3. Reactive Charges:

For all the reactive units (KVARH) drawn during the month	10 Paise per KVARH

Billing Demand:

The billing demand shall be highest of the following:

(A) Eighty-five percent of the contract demand.

(b) Actual maximum demand registered during the month

(c) 15 KW

B. GLP:[6] This tariff is applicable to the educational institutes and other institutions registered with the Charity Commissioner and research and development laboratories.

A	Fixed Charges	Rs. 60/- per month
B	Energy Charges	380 Paise per Unit

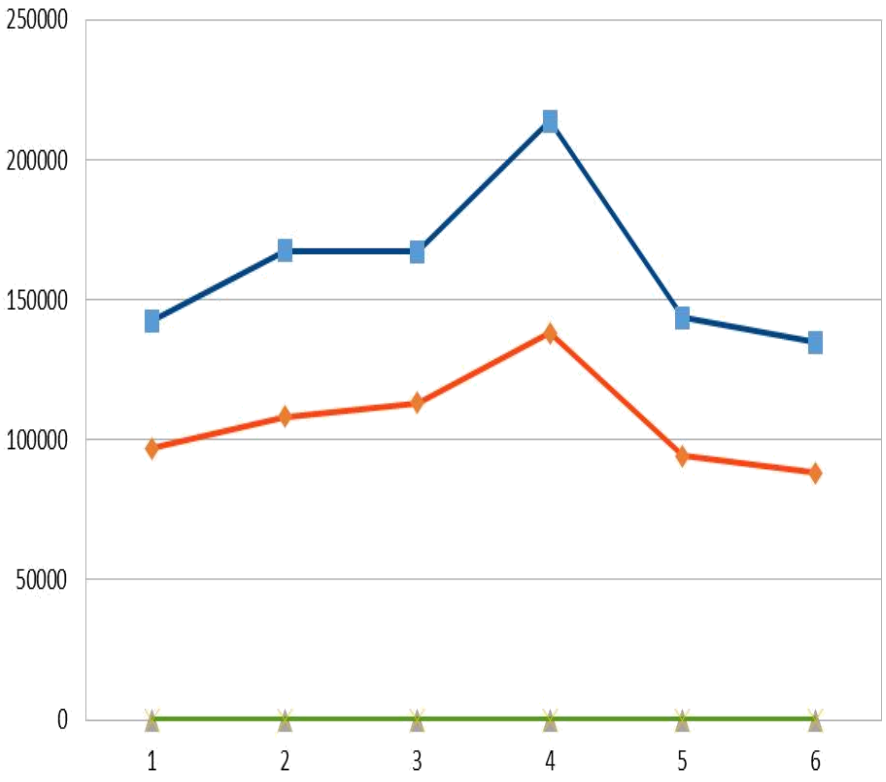

Diagram 6- Comparison between GLP & LTMD Tariff Plan

Comparison between bills for LTMD & GLP tariff plan is as per given below:

Sr No	MONTH	FOR **LTMD**	FOR **GLP**	**SAVINGS** PER MONTH	**% SAVING** PER MONTH
1	JUNE	Rs.1,42,453	Rs.96,916	Rs.45,537	31.96%
2	JULY	Rs.1,67,373	Rs.1,08,314	Rs.59,059	35.28%
3	SEPTEMBER	Rs.1,67,076	Rs.1,13,152	Rs.53,924	32.27%
4	OCTOBER	Rs.2,13,860	Rs.1,38,044	Rs.75,816	35.45%
5	NOVEMBER	Rs.1,43,515	Rs.94,196	Rs.49,319	34.36%
6	DECEMBER	Rs.1,34,800	Rs.88,207	Rs.46,593	34.56%
TOTAL SAVING FROM JUNE TO DECEMBER					Rs.3,30,247

Table 1- Comparison between LTMD & GLP Tarif Plan

VI. RECOMMENDATIONS

- Change In Tariff Plan (LTMD To GLP)
- 3rd Level Protection of Laboratories
- Proper Earthing
- Interchanging of Bus Bars
- Installation of Capacitor Banks
- Installation of Operation Penal at Main Distribution Point

VII. CONCLUSION

In order to save energy in the campus, it is necessary to categorize, quantify, describe and prioritize cost saving measures relating to energy use in the academic area, laboratories, library, guest house and hostel. With the help of the calculation, data of connected load, single line diagrams, electrical power can be distributed as per the requirement and power consumption can be reduced. By analyzing lighting load and replacing it as per the standards, illumination system can be made more effective. The other recommendations to save and use energy properly are: capacitor bank can be installed in order to overcome/reduce reactive power, operating panel can be set up at distribution side and bus-bar interchange mechanism can be formed to ensure power continuity. The electricity bills can be reduced by changing tariff plan of connection.

Hence, as per todays' need, educational buildings, engineering laboratories, R&D labs as well as local electrical power utility can be made energy efficient.

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