

Study of Energy Distribution System and Cost Benefit Analysis with Solar Energy

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Abstract—Energy is very important constraints in all sectors for any country's economy. The economic development of any country is closely linked with consumption of energy. Coal and gas are conventional sources of energy and available in limited forms. Both these sources are important for electricity generation. It is very necessary to optimize use of natural resources and it is necessary to avoid energy crisis. Energy demand has increased as its consumption is increased so proper energy conservation methodology to be adopted. Energy conservation avoids wasteful use of energy. Energy saving achieved through energy efficiency and conservation also avoids capital investment in fuel, mining, transport, water and land required for power plant, thereby mitigating environmental pollution.

A study of energy audit and conservation is carried out in many different sectors like industrial and agriculture. Academic sector is one of the major energy consuming sectors. This paper has mainly focuses on identification of energy conservation in academic sector. Academic sector consist of many schools, colleges of different field. This paper deals with the energy audit of an engineering college.

Estimation of monthly energy consumption is studied through analysis of electric bills. Energy conservation areas are identified. The purpose of this paper is to carry out energy audit of the institute offering engineering programs. It will help to implement the energy efficient project for improving energy efficiency in academic building.

Index Terms—Energy Audit; Energy Conservation.

I. INTRODUCTION

Energy crisis is one of major problem in exiting world where demand of energy is increasing rapidly. Energy is prime focus due to rapid growth and development of technology. Proper utilization of Energy is one of the major aspects of any developing country. Today the need of energy has increased greatly in order to meet the demand of ever increasing consumption of it. This energy crisis problem will be solved through Energy conservation and use of energy efficient equipment [1].

This paper is an attempt to carry out energy audit of Canara Engineering College, Mangalore. The organization of paper is as follows; Section II describes about layout of institute building Section III discussed about the single line diagram of electrical distribution system in institute. Section IV discussed energy audit methodology. Section V discussed about load survey and replacement techniques. Section VI discussed about the conclusion and future plans.

II. ABOUT INSTITUTE

Canara Engineering College (CEC) is a premier engineering institute of the Mangalore region. The college is affiliated to Visvesvaraya Technological University, Belgaum. And it is also recognized by Government of Karnataka and approved by AICTE, New Delhi. The institute offers UG programs in five Core branches i.e. Electrical and Electronics, Mechanical, Electronics and Communication, Computer Science and Information Science. Electrical load can be categorized on layout in lighting, motor and other such as computers, printers.

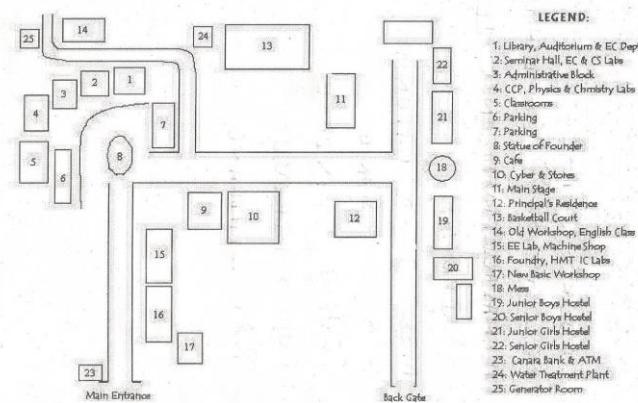


Figure 1: Layout of Canara engineering College

III. ELECTRICAL DISTRIBUTION SYSTEM

Institute is supplied through 315 KVA Transformer of 11 kV/440V range. The power supply is for academic sector and Hostel is provided through the same transformer with power factor close to unity. DG set of 125 and 250 KVA is used for emergency backup supply for essential loads of the college buildings. The incoming supply to college is 11 KV which is step down to 440 V by using 315 KVA transformers. This voltage is supplied to each department in college, workshop, library, boy's hostel and girl's hostel. Following figure gives the single line diagram.

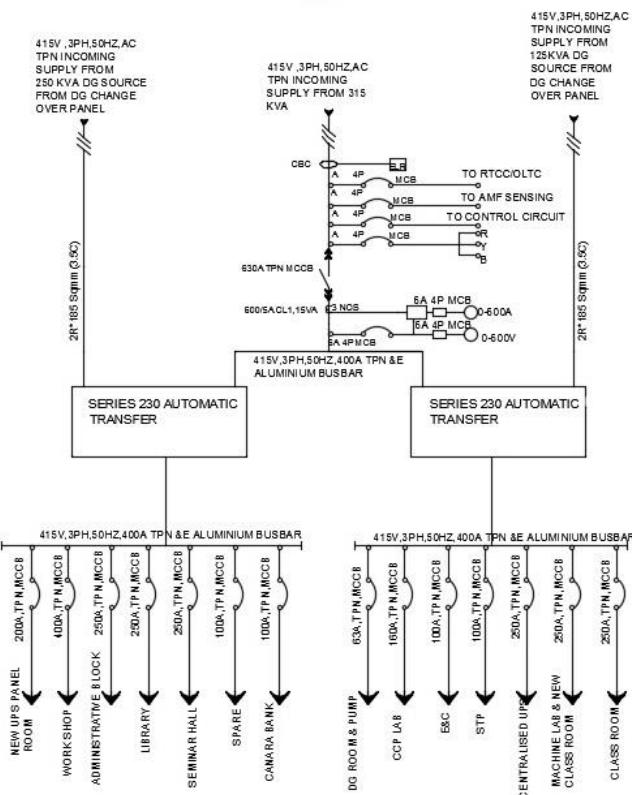


Figure 2: single line diagram for electrical distribution network of college.

IV. ENERGY AUDIT METHODOLOGIES

As per Indian Energy Conservation Act 2001, Energy Audit is defined as: "The verification, monitoring and analysis of use of energy including submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption."

Energy audit is one of the important tools for energy conservation in order to achieve energy efficiency. Energy auditing of any institute or building can be possible by collecting energy consuming data and analyse those data to find out unnecessary use of energy. Following methodology adopted for energy audit.

A. Data Collection

Data collection is very important step in energy audit. Data collection includes,

- Relevant data like electricity bills for the year 2017-18.
- List of lighting load, fan, computer and air conditioner for each department.
- Voltage, Current and Power are measured at each feeder.

B. Data Analysis

Data analysis is next important step after data collection. The areas for implementation and energy conservation opportunities are identified.

C. Action Taken

Action taken involved the implementation strategies based on measurement of actual energy consumption. In this methodology different areas of energy consumption are identified.

V. SURVEY OF LOADS

The survey of electrical load is carried out to determine the connected load of institute. The number of quantity of connected load in the institute is measured and presented in table 1. Load is categorized in different category like lighting, fan, AC, projector and computer.

Place	Quantity of connected load				
	Lighting load	Fan load	AC load	Projector	Computer
Ground Floor	631	171	22	8	45
First Floor	427	202	9	12	89
Second Floor	407	191	1	15	124
Third Floor	147	52	1	6	0
E&C (M-Tech Classes)	66	28	0	2	12
Basic Workshop	28	9	0	0	0
Electrical M/C Lab	122	32	2	0	0
Mechanical M/C Lab	129	14	2	0	0
Total	1957	699	37	43	270
Total KW rating	1957*36 =70.452KW	699*80 =55.92KW	37*1.5KW =55.5KW	43*275 =11.875KW	270*100 =27KW

Table 1: Quantity of connected load

Table 1 shows the quantity of connected load of institute and their KW rating. From this table energy consumption usage is calculated. The lighting load consumes 70.452 KW. It includes 1957 fluorescent tube lights of 36 watt each.

Another important load which consumes energy is fan load. The institute consists of 699 fans of 80 watt each. The total fan load consumes 55.92 KW.

Computer and air conditioner load are also plays an important role in energy consumption. The total computer load consumes 27KW. The total numbers of computers are 270 but all the computers are not in running condition during whole day. Only for few hours in a day, that is during practical's hours and sometime for official work computers are required.

Figure below shows the table of replacement of fluorescent with LED tube lights there will be huge difference in energy consumption which helps to conserve energy.

Place	REPLACEMENT OF FLUORESCENT TO LED	
	FLUORESCENT	LED
Ground Floor	631	631
First Floor	427	427
Second Floor	407	407
Third Floor	147	147
E&C (M-Tech Classes)	66	66
Basic Workshop	28	28
Electrical M/C Lab	122	122
Mechanical M/C Lab	129	129
Total	1957	1957
Total KW rating	1957*36 =70.452KW	1957*18 =35.226KW

Table 2: Replacement of fluorescent with LED

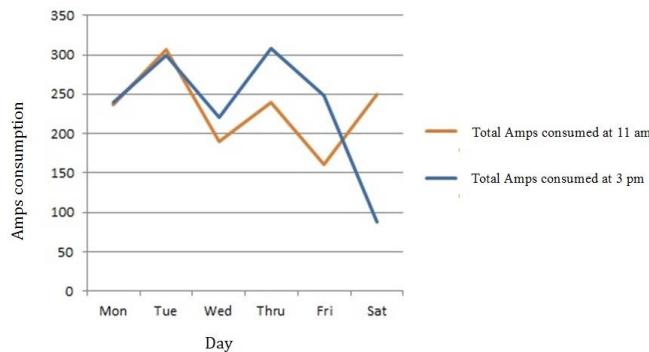


Figure 3: Graphical representation of amps consumption for one week.

The graph above shows the total consumption of amps for a week at a scheduled time of 11:00 am and 3:00 pm. This was conducted from 19th march to 24th march 2018.

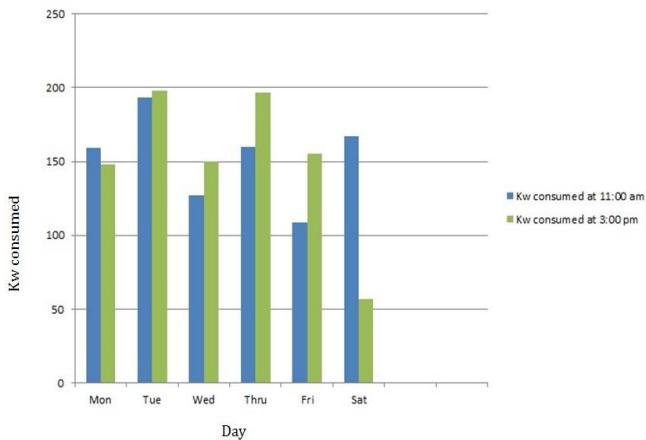


Figure 4: Graphical representation of Kw consumption for one week.

The graph above shows the total consumption of Kw for a week at a scheduled time of 11:00 am and 3:00 pm. This was conducted from 19th march to 24th march 2018.

VI. CONCLUSION AND FUTURE PLANS

Energy audit is an effective tool in identifying problems associated with energy management program. A careful audit in any organization will lead to manage energy system in organization at minimum energy cost. In development process to cope with increasing energy demands, energy conservation and energy audit are two parallel paths.

In this paper we have considered the academic sector for evaluation of energy audit and energy conservation of Canara Engineering College. Key issues pertaining to the implementation of Energy Conservation proposal and methodology have been discussed. Based on the exhaustive literature survey were presented for energy conservation and energy audit in keeping mind the present Energy scenario and future condition.

And our future plan is to estimate the installation cost of grid connected solar power plant to the hostel block and calculate the payback period.

REFERENCES

- [1] R. K. Gera Yunus Parvej and Himanshu Soni "Renewable Energy Scenario in India: Opportunities Challenges", Indian Journal of Electrical and Biomedical Engineering Volume 1 No.1 Jan-Jun 2013 PP.10-16@ Academic Research Journals (India)
- [2] Soma Bhattacharya and Maureen L. Cropper, " Options for Energy Efficiency in India and Barriers to Their Adoption: A Scoping Study", 1616 P St. NW Washington, DC 20036 202-328-5000 www.rff.org.