

Energy Audit: A Case Study

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Abstract: Today, the uses of energy are increased very sharply. Electricity audit is an survey and study to reduce the electrical ower consumption of the various electrical and electronic appliances. An energy audit help to determine the energy-wastes area in the institution and can be easily short out that problem, even more it's provide more benefits point of saving of energy. By energy audit survey or study of data gives a result about how much money and energy we can save each year by apply the recommendations. In this paper, study about electricity consumption in our college campus. This paper just goes to achieve more efficiency in college campus. Determine how and where energy is used and to identify methods for energy savings. Energy can be saved by use of more efficient machinery, high quality of equipment's and by better technique.

Keywords: Energy audit, energy consumption, energy appliances, savings techniques.

I. INTRODUCTION

In this world, we are use AC supply as our input, generation of electricity possible by renewable sources or non-renewable sources. Renewable energy sources are scare in the world. By Non-renewable sources generation of electricity is very costly so, we need to studies about energy conservation, how to save energy. In order to reduce consumption of energy for a building or plant and makes it's more efficient, it's only possible by continuous process of energy audit. Energy audit minimize cost of energy and provide a proper planning, controlling of electricity supply [1]. As per the energy Conservation Act. 2001 "Energy Audit" is define as the verification, monitoring and analysis of use of energy including submission of technical report containing, recommendation for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption [2]. We have more of techniques for saving energy [3]. Systematic approach, to analysis building energy consumption and to pin point source of wastage, is known as energy audit. A process for auditing is shown in fig 1.

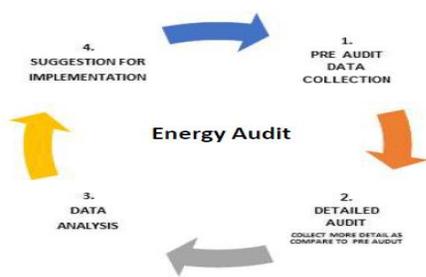


Fig:1 Process of Energy Audit

II. PRELIMINARY ENERGY AUDIT

The preliminary energy audit also called a simple audit or walk through energy audit, is the very simplest and fastest type of audit. This type of audit takes limited time and its focus on energy supply and demands. It consists with collection of energy data, Meetings with facility department, collection of electricity bills and other operating data and identify energy wastage area or inefficiency. This type of audit can't be covered major problem. This level of data detail, not sufficient for searching a final decision, for implementation need brief detail of data [5,6].

The preliminary energy audit as step to step explained below: -

- A. Find out energy consumption in the organization.
- B. Estimate scope for saving.
- C. Identify no cost/ low cost improvements and savings.
- D. Set a reference point.
- E. Identify areas for more study or detailed measurement [6].

III. GENERAL ENERGY AUDIT

This type of audit is also called mini audit, site energy audit or complete site energy audit. General energy audit is next step of preliminary audit, it expanded form of pre audit by collecting more detailed information about equipment operation, electricity bill 12 to 36 months' period for best decision. This type of audit will be able to thinking all the point of energy conservation by measure operating parameters and identify that area where energy is not required. Sufficient detail is provided to justify project implementation [5].

IV. DETAILED ENERGY AUDIT

This audit is also called investment grader audit or comprehensive audit. It expands on the general energy audit. This audit will be completed in a period of three to five weeks. Detailed energy audit estimation of energy input for different processes, collection of past data and accurate study on energy consumption. It should be saved 8 to 10 percent of energy. Thus, the scope of this audit is to reduce total energy costs, consumption of energy. Detail energy audit gives the most accurate estimate of energy savings and cost. In this audit, one of most important factor is the energy balance.

Detailed energy auditing can be classified in three phases as

[5,6]:-

Phase I – Pre-Audit

Phase II – Audit Phase

Phase III – Post-Audit

V. ENERGY CONSERVATION

Energy conservation is the act of use of energy in more efficient and effective way [7]. According to law of conservation of energy, energy can neither be created nor be destroyed. Less use of energy can be define as energy conservation. It is a result of change in behaviour. For example: Turn off light when not required, make use of daylight in the morning hours etc. [8].

Need of Energy Conservation [3,9]: -

- To reduce energy/fuel shortage.
- To reduce peak demand shortage.
- To save fuel, natural resources and money.
- To reduce environmental pollution.
- Only 1 % of natural resources available in India, while population is 16% of the world.
- Provides Energy security.

VI. METHODOLOGY FOR COLLEGE CAMPUS

- Collection of Data of all COLLEGE CAMPUS, KABLANA Building: In this step we collect the room wise details of electrical connected load, pervious two year’s electricity bill and other power consumption information.
- Calculation of Total Load: In this step we calculate the total load of all GANGA CAMPUS, KABLANA the building from the collected data of all kind of devices and equipment.
- Generator Data Collection: In this step we collect the information about generator like monthly diesel consumption, monthly running time of generator and monthly amount paid for diesel.
- Identification of Week Points of Installation: In this step we identify the week point in the wiring and lighting system of each floor of the building.
- Total Unit Consumed per Day/ per Month/ per Year: In this step of methodology we calculate the total unit of electricity consumed in a day, month and year.
- Total Amount Paid to Grid: In this step we calculate the total amount paid to the grid on day, monthly and yearly basis according to the unit consumption.
- Analysis of DG Data: In this step we analyse the whole data of generator and calculate the total amount paid for diesel and total amount of diesel consumed.
- CO2 Emission due to Burning of Diesel: In this step we have estimated the total emission of CO2 gas due

to DG set working.

- Total Cost Losses in Electricity: In this step of methodology we calculate the total amount of losses in the electricity.
- Suggestions for Reducing Power Consumption Cost and CO2 Emission: Solar power plant is proposed to reduce the consumption of diesel in DG set and to reduce the emission of CO2.
- Calculation of Payback Period: In this step we calculate the payback period on the basis of cost and saving.
- Implementation of Plant: After complete audit process plant are proposed to implement.

VII. ENERGY CONSUMPTION OF COLLEGE CAMPUS

Surveying the Energy Consumption: Energy audit has conducted in this college to estimate consumption of energy per year. For energy audit, it is necessary to analysis previous bill amount and all data records. The annual consumption of electricity in year 2015 is 2,10,963 and in year 2016 is 2,67,038. A pump operating system annual amount paid to grid is 92,846 in year 2015 and total monthly consumption of energy represent by plotted a graph. This graph offers possibilities of energy conservation. This collection of data of electricity and diesel generator was taken from the institute record. Total connected load of all college campus is 226090watt and 226.090 kw [10].

Year	Annual unit consumption of electricity	Annual Amount (Rs.)	Annual operating pump amount (Rs.)	DG Consumption in litre	Annual amount of DG (Rs.)	Yearly co2 emission	(Electricity+DG+Pump) Grand Total
2015	2,10,963	22,79,814	92,846	23,315	12,82,325	61,318.45kg	36,54,985
2016	2,67,038	29,20,572	82,763	14,090	7,75,003	37,056.7kg	37,78,338

Table:1: Annual energy consumption of college campus.

Table 1 Shows the total energy consumption during the year 2015 and 2016. The consumption of electricity is increasing each year.

The graphs for electricity bill and energy consumption by the institution during two years are plotted.

Analysis of collected electricity bills: -

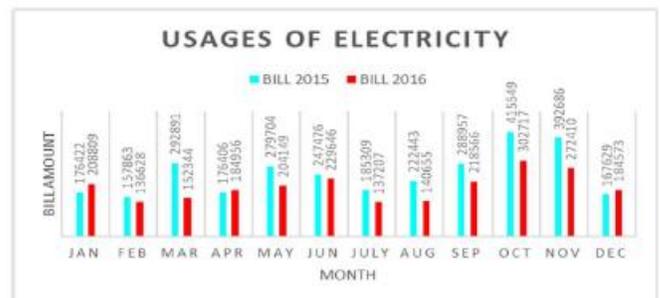


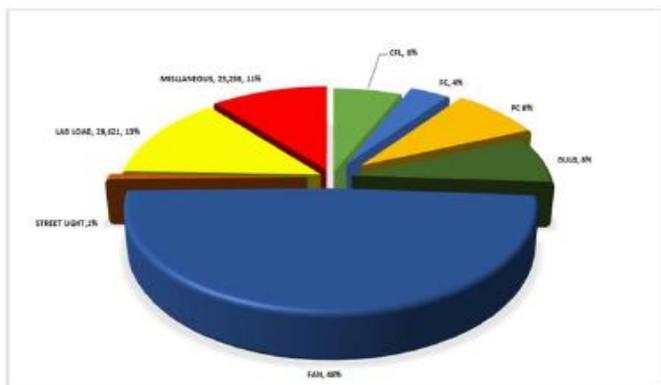
Fig 2 Shows the pattern of the energy consumption.

The amount of electricity increases per year as show in fig2. In year 2015 the amount paid to grid for electricity is 22,79,814 and for pump operating system amount paid in 2015 is 92,846. Total amount spent on electricity in 2015 is 23,72,660. There is a sudden increase in the energy consumption during the months of October, November of both years.

Connected Load of College Campus: -

LOAD	QUANTITY	PER WATT	ENERGY CONSUMPTION (IN WATT)
CFL	618	22	13,596
FC	198	40	7,920
PC	255	70	17850
BULB	159	100	15,900
FAN	1585	65	1,03,025
STREET LIGHT	25	75	1,875
LAB LOAD			28,621
MISCELLANEOUS			23,239
		TOTAL	2,12,026

Pie Chart of Connected Load: -



VIII. ENERGY SAVING CALCULATION

A. Replace CFL with LED: - In college campus, there are 618 CFL. On the average a CFL Consume 22 watt while a LED Consume only 12 watt. This saving of 10 watt per CFL is very large.

Cost analysis:

Total No. of CFL in College Campus =618 Power saved per CFL =10 watt

Total Power saving =618*10 w =6180 w =6.180 kw Average Use of CFL per year =5*295 =1475 h

Total Energy saved per year =1475*6.180 =9115.5 kwh Saving in Rs. Per year =9115.5*7.75 =70645.12 Rs

B. Replace FC with LED Tube: -

Total No. of FC in College Campus =198 Power saved per FC =20 w

Total Power saving =198*20 w =3960W =3.960 kw Average Use of FC per year =7*295 =2065 h Total Energy saved per year =2065*3.960 =8177.400 kwh Saving in Rs. Per year =8177.4*7.75 =63374.85 Rs

C. Replace PC with Green PC 7th Generation: -

Total No. of PC in College Campus =255 Power saved per PC =45 w

Total Power saving =255*45 w =11,475 w =11.475 kw Average Use of PC per year =9*295 =2655 h Total Energy saved per year =2655*11.475 =30466.125 kwh Saving in Rs. Per year =119475*7.75 =236112.47 Rs

D. Replace Bulb with LED: - Total No. of BULB in College Campus =159 Power saved per Bulb =88 w

Total Power saving =159*88 w =13992 w =13.992 kw Average Use of BULB per year =3*295 =885 h Total Energy saved per year =885*13.992=12382.92 kwh Saving in Rs. Per year = 12382.92*7.75=95967.63 Rs

E. Replace Fan with low power consuming Fan: -

Total No. of Fan in College Campus =1585 Power saved per Fan =15 w

Total Power saving =1585*15 =23775 w =23.775 kw Average Use of Fan per year =10*295 =2950 h Total Energy saved per year =2950*23.775 =70136.25 kwh Saving in Rs. Per year = 70136.25*7.75 =543555.94 Rs

F. Replace Street light with LED TUBE: -

Total No. of Street Light in College Campus =25 Power saved per Street Light =45 w Total Power saving =25*45 =1125 w =1.125 kw Average Use of Street Light per year =10*295 =2950 h

Total Energy saved per year =2950*1.125=3318.75 kwh Saving in Rs. Per year =3318.75*7.75=25720.31 Rs

IX. CONCLUSION

This paper represent idea to reducing energy losses in college campus by replacing high power consuming devices to low power consuming devices such as CFL can be replace by LED. In this way the energy consumption can be reduces. It is possible to reduce the energy consumption by 20%.

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