International Journal of Engineering Sciences 6(2) 2014 59-66

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCE

An Analysis to Save Electrical Energy in a Residential House

K.Keerthi jain,N Kishore Kumar *Std. Member IET*
Member **IET** Vision **10 MW,** EEE Department
Dr M.G.R Educational and Research Institute,
Chennai, India
E-mail address:- keerthijain@live.com

Prof.L.Ramesh,M.Madhusudhana Raju *Member IET*
Director and Coordinator **IET** Vision **10 MW**
EEE Department
Dr M.G.R Educational and Research Institute,
Chennai, India
E-mail address :-lramesh@theiet.org

Abstract

Energy as become our routine process in our lifestyle for every work to be done. In this paper we have discussed that how energy audit will help us to save energy in our electric bill with an analysis of a residential house. Nowadays saving energy has become an essential criteria rather than generation, we may find plenty ways for generation but we should also concentrate on consuming it also in a proper and appropriate manner. As a part of our IET Vision 10MW, initial work is started in this paper to conduct electrical energy audit for a double bedroom house in Chennai. The proposed procedure is adapted to conduct the electrical energy audit with suitable recommendation. After the critical analysis several suitable recommendations is suggested for the house to implement with and without investment including incorporating renewable power generation. The breakeven chart is presented to check the effectiveness of the recommendation. In future our team are planning for a big project that will cover 25 homes, 10 commercial buildings and 2 industries.

Keywords—*energysaving;energyaudi and renewableenergy.*

I. INTRODUCTION

Energy audit is a process of checking how energy is used and identifying the areas where wastage can be minimize if not totally eradicate. Energy audit consists of several tasks which can be carried out depending up on the type of audit and the function of audited facility. It starts with a review of the historical data of energy consumption which can be compiled from the electricity bills. These data is important in order to understand the patterns of energy used and their trend. After obtaining the information on energy consumption, the next step is to set up an energy audit program. This program should start with site survey in order to obtain information on present energy used. The energy utilization such as running hours of air-conditioning, lighting levels, locations of unnecessary air-conditioning and lighting due to unoccupied areas, temperature and humidity, chillers/pump scheduling and setting, efficiencies of equipments and machine and the areas of high energy consumption and the possibility to reduce consumption should be record for

***Corresponding author**
Email Id: keerthijain@live.com (K.Keerthi jain)

further analysis. This energy audit is especially done to save ten to thirty percentage of energy usage by changes in operation and maintenance. This paper will give an initiative to know how to start an energy audit in home. This ultimate work started under this IET vision 10MW.

IET Vision 10MW is an energy awareness initiative forum that was inaugurated in our university on 08/03/2014 this was inaugurated for reducing 10MW generation of electrical energy in 10 years. The initial part of its work is given in this paper.

PROCEDURE

How energy audit is done in home? The answer to the question is given ,the first initiative is for going for pre-site work, in this first we decide the location were to conduct this energy audit in home, industry, schools etc. In this paper the first initiative we done is doing auditing in one home and giving them a appropriate results and recommendation and suggestion regarding their usage of electricity and also making a assumption to reduce the tariff of electricity bill. According to this we started the analysis of the pre-site work and conclude the analysis and recommendation to reduce the usage of electricity and educate them for consumption of energy with cost analysis. An execution procedure model is given in the table 1, that is given below which will gives a brief knowledge how an energy audit is done and the recommendation is given to the clients as per the procedure to get an appropriate result based on the consumption and also reducing the energy tariff in electricity bills.The main vision for this auditing is to bring awareness among the society and save the demand for the nation.

In Tamil Nadu the demand graph is given below in the fig .1 the power deficit is around 18% .The government is behind the ways to generate power to reduce the demand but we are taking initiative to reduce the demand by electrical energy audit this is our vision of IET 10MW. The motto behind it is “SAVE ENERGY TO REDUCE DEMAND”

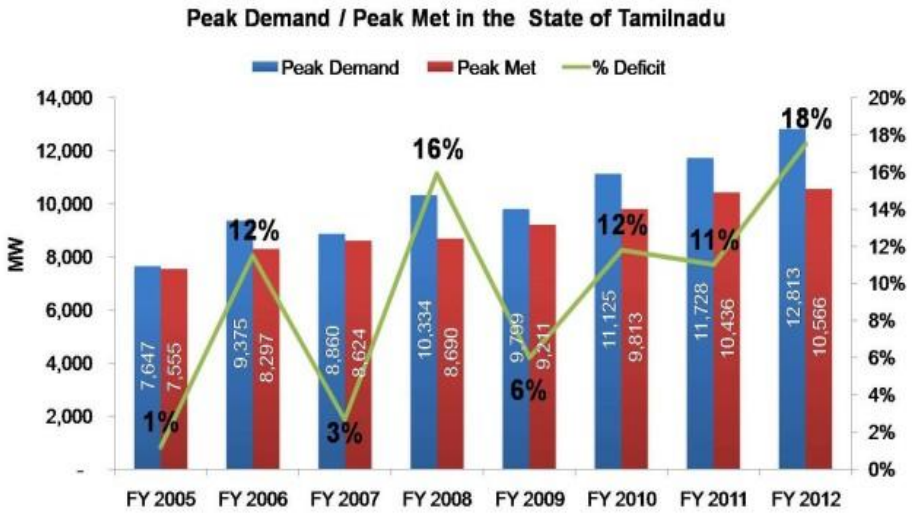

Figure 1 Energy Demand Graph

But we have made an Executive activity to conduct this electrical energy audit and its is given below;

- Collect all the Load details with maximum demand of the Electrical Equipment ,Calculate the Usage Load After single line diagram put the values
- Plot Real time load curve by taking the energy meter KWHR for 20 days.
- Calculate the connected load with respective to single diagram.

- Plot a graph in between years and Tariff
- Identify and Calculate the unnecessary usage of power wastage in the layout with graph
- Draw the Power Utilization Chart with respect to the Layout
- Calculate the daily utilization of Power by all the equipments and convert to pie chart.
- Data Collection of all the major equipments and find out the performance
- Interaction about the energy usage with suitable survey
- Identify the Energy Saving and Conservations Opportunity
- Report on suitable recommendation with existing and implementation suggestions
- Plot Cost Benefit Analysis with Breakeven Chart
- Check the earth resistance and report on the status of earthling in that concern
- Provide Awareness' on Electrical Safety to the Person there.
- Submission of Suitable Energy Audit Report with Breakeven Analysis……

ELECTRICAL ENERGY AUDIT SURVEY

The EA was done in Mr. R.Subramani home as he is one of the relative of our team member who is studying in Dr M.G.R University .The house consist of 3-phase supply which is connected to double bedroom apartment that is located in Chennai.

The initial work started with the study of single line diagram of the double bed room house. The single line diagram of the house is shown in figure 2.

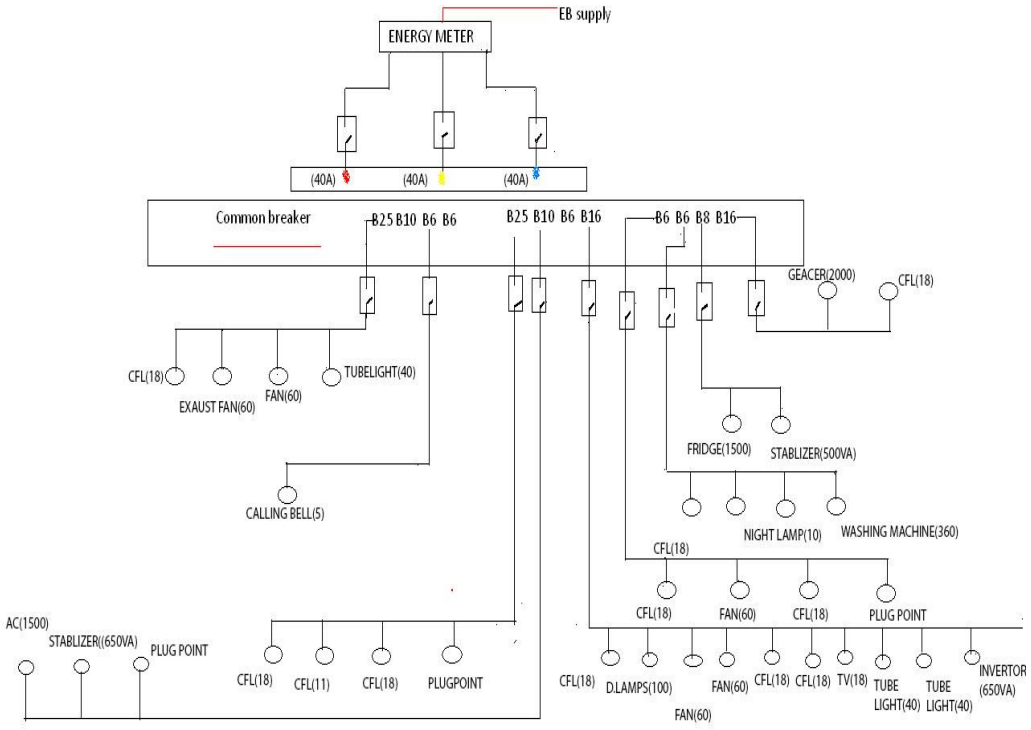

Figure1. Single line diagram

The work continued with the data study of all the rooms in the house. The table 1 shows the detailed data analysis of all the rooms in the house.

The real time power usage of the equipment chart is made with the help of operating all the equipments with their usage load current. The figure 3 shows the graphical representation of load current with respect to all the equipments in that house.

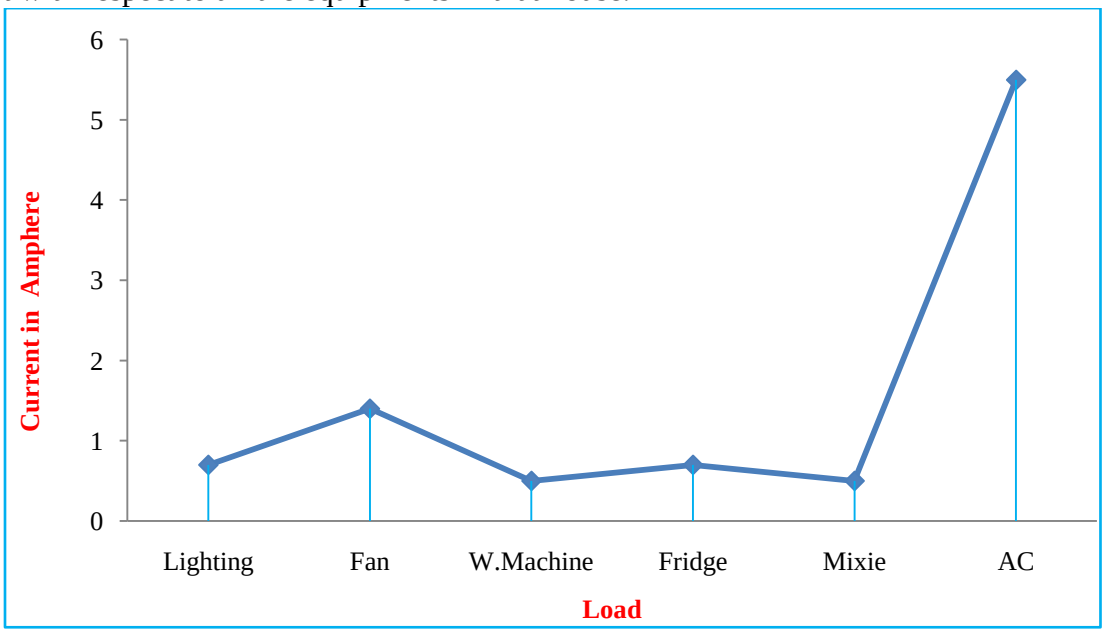

Figure 3.Real Time Load

It is important to check the unit consumption and tariff of the houses for the past three years to know the power usage of the house and to calculate the average unit consumption. The table 2 shows the representation of last three years unit consumption and the tariff paid.

Table 2: Tariff and Unit Consumed

Date Of Reading	Consumption	Rupees
16.03.12	430	746
17.05.12	630	2282
17.07.12	490	1300
17.09.12	510	1898
16.11.12	480	270
21.01.13	390	1000
21.03.13	420	1090
21.05.13	610	2473
24.07.13	970	4543
22.09.13	520	1955
22.11.13	450	1180
22.01.14	260	610
24.03.14	330	820
21.05.14	870	3968
23.07.14	930	4313

This is the energy tariff survey for the past 2 years in this survey the average amount of energy consumption is 520W .In this survey we can see that the energy consumption is increasing but not decreasing at the end the consumption has reached to 930W . It is also surprising to see that in the

month of 22.01.2014 only 260W consumption is made this may be because the family had gone for a vacation. The average price for the consumption from the past two years is 1960 Rs. In the month of July 2014 it reached its peak that is up to 4313Rs.According to tariff and consumption analysis energy audit is very essential for this house.

It is important to check the unit consumption and tariff of the houses for the past three years to know the power usage of the house and to calculate the average unit consumption. The table 3 shows the representation of last three years unit consumption and the tariff paid.

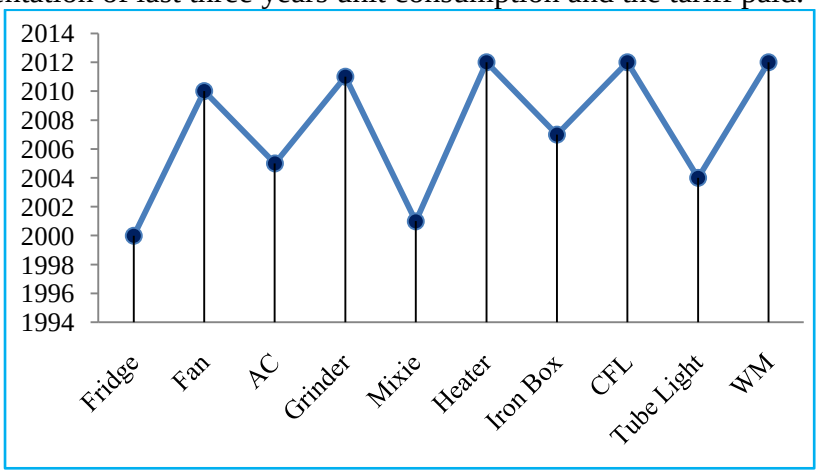

Figure 4 Ages of Equipments

Goodness is to check the life cycle of the equipment which is to help us to take good decision for good Recommendation for effective energy usage. The figure 4 represents the life cycle analysis chart of the audited house.

IV .ELECTRICAL ENERGY AUDIT RECOMMENDATION

Recommendation 1: WITHOUT INVESTMENT

According to the layout of the home, we have recommended some of the best saving tips by which you can save electrical energy and tariff without any investment by proper utilization you can conserve energy and also reduce the tariff in your monthly bills. These are some important tips to save energy in home.

- In Refrigerator regularly defrost manual- defrost refrigerator and freezers; as frost buildup increases the amount of energy needed to keep the motor running.
- Don't keep your refrigerator or freezer too cold
- Avoid putting hot and warm food and also avoid using big vessels inside the fridge.
- Do not open the doors of the refrigerator frequently. As it costs around 0.15 paisa
- Proper dusting and cleaning of exhaust fan should be done.
- Using tube light in kitchen is good .If CFL is also there you can use CFL in morning and tube light in night time
- Instead of two fans you can replace it to one which you use frequently.
- Instead of three CFL used in hall only one CFL can be used as the other two are not necessary .
- Decoration light should be especially used only occasionally

- In living room 1 Instead of two mosquitoes repellant you can use one mosquito repellant as it's a small
- In living room 2Decoration lamp is not required in the room as it consume lots of energy.
- In washing machine always wash only with full load
- Use optimal quantity of water in washing machine
- Use timer facility to save energy
- Use the correct amount of detergent
- Use hot water only for dirty clothes
- Always use cold water in the rinse cycle
- Prefer natural dying over electric dryness
- In Study room as the room space is small there is no need of tube light instead of tube light you can use CFL and use the same tube light in other purpose.
- Orient fan is placed in the room but the suspension from the wall is not proper.
- You can use table fan as the room size is 25 sq ft only.

- Instead of CFL used outside you can install LED bulb as it consume less energy.
- For air conditioner use windows with sun films and curtains
- Don't set your thermostat at a colder setting than normal when you turn on your air conditioner. It will not cool your home any faster and could result in excessive cooling.
- Seal the door and windows properly.

A. ***Recommendation 2: WITH INVESTMENT***

As per table 2 given above we can analysis that none of the equipment is star rated it is essential to have all equipments as star rated but due to finance we can't recommend all the equipments to change but according to the present criteria refrigerator should be immediately replaced by some of the best star rated refrigerator its save more energy .Talking about energy saving, mixer should also be replaced as its very old and the efficiency of the mixer is very low in hall two fans are installed in that one fan should be replaced to 5star rating. In study room there is no need of tube light as it is only 25sq ft it is better to install a LED light.

B. ***Recommendation 3: MANDATORY IMPLEMENTATION OF SOLAR***

According to the layout of the home we have a tube light of 40 watts outside as its usage is around 12 hours daily and it consumes 14.4 units per month and it costs around Rs. 44 per month and for one year it will cost 530Rs. The recommendation is to install solar tube light outside that will cost around 1500Rs.As you install this solar tube light you can get the payback amount in 3 years and after that you can gain over 530Rs yearly.

Figure5Solar tube light

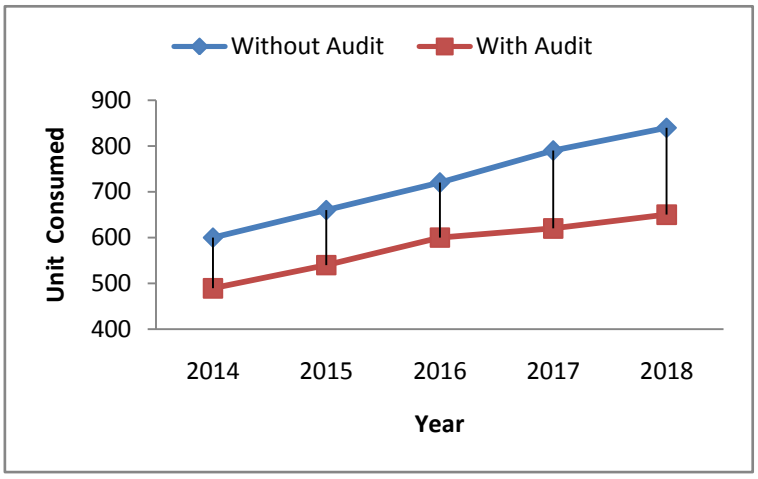

Figure 6 Comparison chart of Pre and Post Audit

D Recommendation 4: Implementation of DG

The implementation of DG is based upon the layout of the house and the analysis data by which this recommendation was proposed and the implementation was recommended.

Solar panel capacity:1kwp

Area required instalation solar panel :25sqft

Cost for 1kwo solar panel:rs85000

Subsidy (30)%=Rs 20000

Final investment cost :Rs 85000-20000=Rs65000

Solar power generation in chennai:4 to 5 kw per day for 1 kw panel

No of working days: 300 per year

Total energy produced: 4*1*300=1200 units per year, 5*1*300 =1500 units per year

Cost of grid power: Rs3 per unit

Power saving per year: 1200*3=Rs3600

1500*3=Rs4500

Payback time (65000/3600)*12 (investment cost /annual saving)*12months
(65000/3600)*12=216.6(18yrs)
(Investment cost/annual saving)* 12 months (65000/3600)*12
(65000/4500)*12=173.3 (14.4years)

V CONCLUSION

This paper delivers a electrical energy audit of a residential house in Chennai with a suitable four types of recommendation to save energy as per the motto 'SAVE ENERGY TO REDUCE DEMAND' .the outcome of all the recommendation clearly shows that the payback period will reach within four years as per today the client is agreed to implement all the recommendation within the span of two months.