



Residential House Solar Modelling through Electrical Energy Audit

K.Ganesh¹| K.Kanimozhi²

¹Assistant Professor, Department of EEE, Nadar Saraswathi College of Engineering & Technology, Theni

²Professor, Department of EEE, Sethu Institute of Technology, Kariapatti

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ABSTRACT

Reducing electricity consumption in commercial buildings is important in addressing the growing concerns of global warming, atmospheric quality and energy security. Energy audit is a proven effective measure for energy savings through identification of energy management opportunities for improvement by means of buildings. The energy study of various sector of commercial, industrial and residential area indicates that 5 to 20% of the energy can be saved. The power auditing is done in a residential home and concluded with suitable recommendations on solar modeling with ETAP to cut off electricity bill reasonably. From our Energy audit we prove that we can save upto 2358 units yearly.

KEYWORDS : Energy Audit, Energy Management and Energy Saving.

I. INTRODUCTION

This Energy is the ability to do work and work is the transfer of one form of energy. Energy exists in several forms such as heat, kinetic, light, electrical energy. The entire progress of a country is dependent only on Energy. Recent days, energy saving has become essential rather than electricity generation. If we think for potential cost saving in each of the components (energy, material, employees), energy would invariably emerge at the top, so efficient use of energy and its conservation is the least cost option in any strategy. The energy demand is increasing because of the increasing population in country hence; country is facing peak power and average electricity shortage of 12% and 7% respectively. To satisfy the energy needs of Tamil Nadu, TNEB has a total installed capacity of 20103MW [1] which include of all, State Government, Central Government, Independent

power producer and renewable power generation. To meet the ever increasing energy demand, TNEB has proposed a number of next generation projects to be constructed. The per capita consumption of Tamil Nadu is 1000 units. It was found from the survey that India is the world's fifth largest electricity generator but still there are many places in India which are in dark and they are very far away from the term "electricity". So it's the time for energy saving. It is possible only by effective Energy Audit and Energy management.

II. DATA OBSERVATION

An energy audit is an inspection, survey and analysis of energy flows for energy conservation in a building, process to reduce the amount of energy input into the system without negatively affecting the output. It shows where the power consumption is more in the given system. It can also be called as

controlling of the power to avoid losses for maximize efficiency. Energy savings of the order of 5 to 20% are possible by optimizing use of Energy with better housekeeping, low cost retrofitting measures and use of Energy efficient equipment at the time of replacement, renovation or up gradation. Energy Audit will help to understand more about the ways energy and fuel are used in any industry, and help in identifying the areas where waste can occur and where scope for improvement exists. The Energy Audit would give a positive orientation to the energy cost reduction, preventive maintenance and quality control programs which are vital for production and utility activities. The audit conducted in the residential home with the recommended procedure and collected all the data from the existing layout.

III. PROCEDURE

- Record the phase, line to line voltage of the house.
- Check the status of earthing and measure earth voltage.
- Collect the data with respect to data sheet format.
- Draw the single line diagram of the house.
- Collect the energy meter tariff survey for five years.
- Collect the data for daily load curve.
- Real time load collection, voltage, current and power factor.
- Collect the answers for survey questions.
- Energy wastage audit.
- Observation for regular fault occur in a house.
- Observation of safety measures.
- Preparation of energy audit report with suitable recommendation.

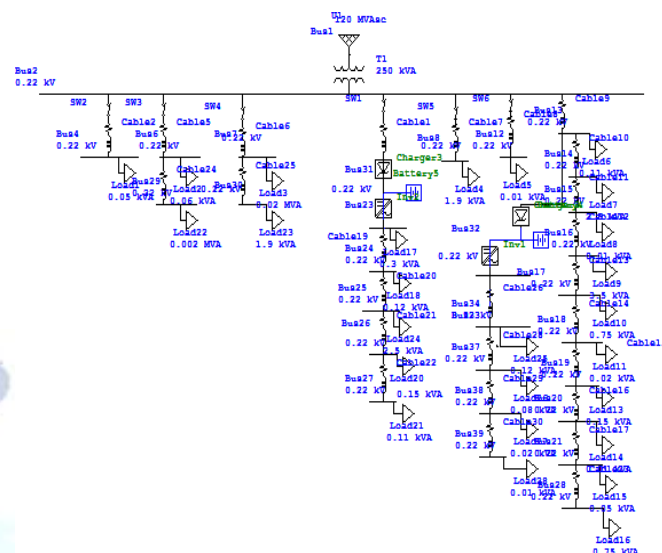


Fig.1 Existing equipment layout

Power consumption Chart:

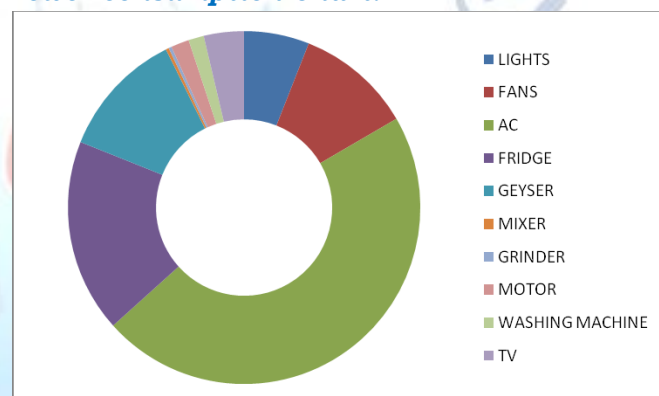


Fig.2 Total Power consumption chart

The above graph explains about power consumption of each equipment.

From the pie chart we can see the maximum power is being used by air conditioner, fridge, geyser, fans, lights and others

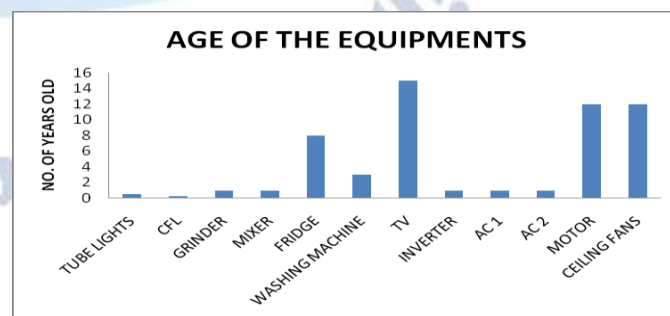


Fig.3 Age of Equipments

Fig. 3 shows that the age of equipment which is used in the house. It gives an idea about the

performance and power consumption of the equipment. It's also giving some rough idea about past performance of the equipment. According to the graph, we show that TV, fans and motor are the most oldequipments of the house.

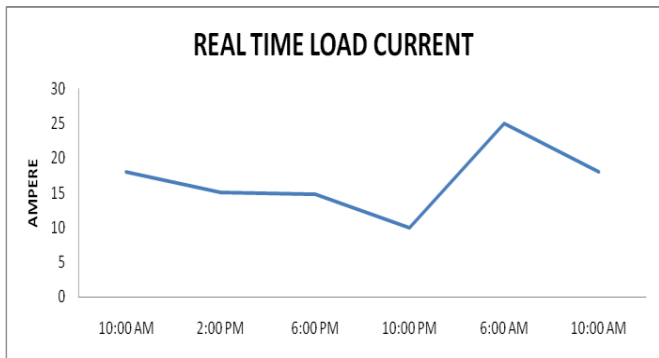


Fig.4 Real time load current

Fig.4 represents the real time load current between specific time interval.The real time load curve reading shows when specific electrical and electronics items are turned on. From the graph we came to know that current consumption between 6:00 am to 10:00 am is maximum.. The major current reading was obtained from AC, Grinder, fans and washingmachine.

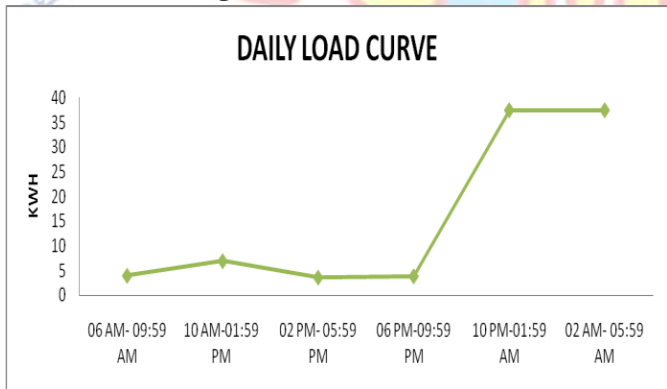


Fig.5 Daily Load Curve

Fig.5 indicates the daily load curve that is the daily power consumption between specific interval of time. From the graph we came to know that the power consumption is maximum between 10 pm to 6 am. The power consumption is maximum due the continous use of the AC's , fans and freeze.

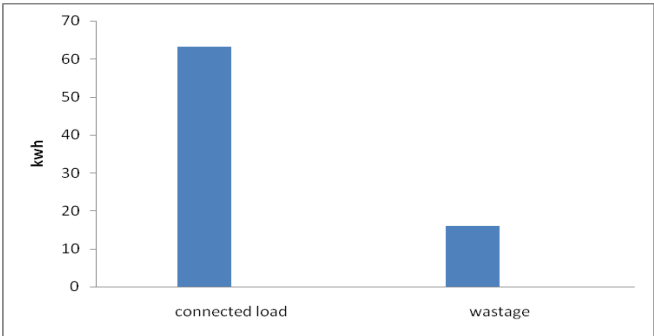


Fig.6 wastage Comparison

From the graph we can see that the connected load is 63.09 kwh and wastage is 10.93 kwh.

IV. RECOMMENDATION

According to our team we have given three recommendations after doing energy audit. First is **“WithoutInvestment”**, second is **“With investment”**, and third is microgridwithsolarimplementation

A.Recommendation Withoutinvestment

- R Y B does not have a balanced load. It is found that in $R=9.109\text{ A}$, $Y=.707\text{ A}$ and $B= 2.756\text{ A}$ so our first recommendation is to change the unbalanced load into a balanced one, so that we can get good inputvoltage.
- We found that the gap between refrigerator and the wall is very close, which reduces the efficiency of the refrigerator and it also consumes more power. So we recommend the house owner to maintain properdistance.
- Utenstils made up of steel should be avoided inside therefrigerator.
- Never use fans with air conditioners which results in unusual use ofpower.
- Close the door when using airconditioners.

B. Recommendation WithLED

It is recommended to use LED instead of flourscent light and CFL. According to the survey the there were about 8 tube lights and 8 cfl and 2 outside lights presently working. So by replacing them with LED a considerable amount of the power can be saved.

TABLEI. **LED CONVERSION CALCULATION CHART**

Present energy uses	
Total number of florescent light=	8

Total power in watts=	320w
Total units consumed=	817.6 unit/yr
Cost annually=	Rs.2452.8
If tube light(8) replaced by LED's	
Total number of LED's=	8
Total number of watts=	160w
Total units consumed in a year=	408.8Units/year
Cost annually=	Rs.1226.4
Saving in units per year	408.8 units
Saving in cost per year	Rs.1226.4

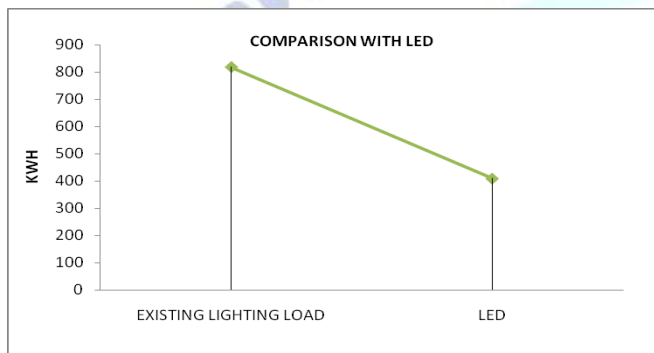


Fig.7 Comparidion to LED with respect to units

The above graph shows the comparison of led with existing lighting loads. By using led 408.8kwh of the power can be saved.

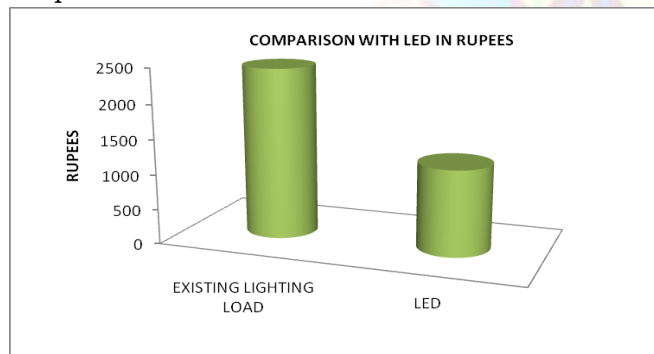


Fig.8 Comparrision to LED with respect to Rupees

the above graph shows comparison of the lighting loads in rupees. From the above graph we came to know that a considerable amount of Rs. 1226.4 can be saved.

C. Recommendation With inverterAC

TABLE II. A.C CONVERSION CALCULATION CHART

Present energy uses	
Total number of existed AC=	
Total power in watts=	
Total units consumed=	

Cost annually=	Rs.23490
If existing AC are(2) replaced by star rated AC	
ptal number of star rated AC=	2
Total number of watts=	
Total units consumed in a year=	
Cost annually=	
Saving in units per year	
Saving in cost per year	Rs.10530

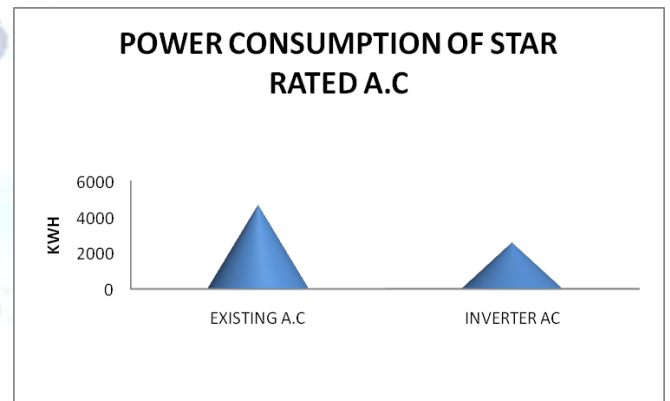


Fig.9 Star rated AC power comparission in units

According to the survey we came to know that there were about 2 AC installed of total 4350 watts and consumes about 4698uits per year which is a huge amount which can be seen in fig 9 . So by using inverter AC's a considerable amount of 1950 units of power can besaved.

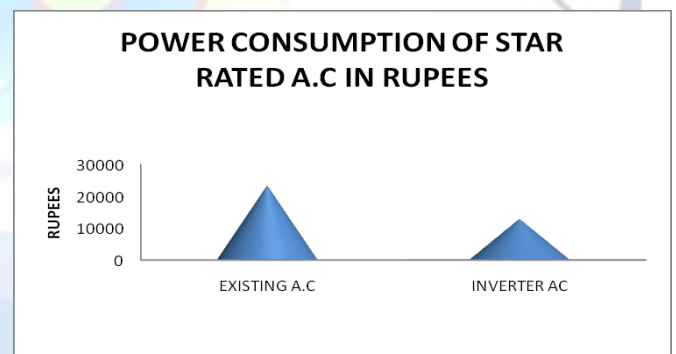


Fig.10 Star rated AC power comparission in rupees

Fig 10 shows the power consumption in rupees for star rated AC's. A sum of Rs 10530 can be saved by using inverter AC's.

D. Recommendation With efficientgyser

From the table we came to know that there were about 2 gysers installed in the home. Each of which consumes about 3500 watts of power. So a by recommending efficient gyser a considerable amount of power can besaved.

TABLEIII **GEYSER CONVERSION CALCULATION CHART**

Present energy uses	
Total number of existed gyser=	2
Total power in watts=	7000w
Total units consumed=	1916 unit/yr
Cost annually=	Rs.7664
If all existing Geyser are(3) replaced by star rated gyser	
Total number of gyser=	2
Total number of watts=	3600
Total units consumed in a year=	492.75 units per year
Cost annually=	Rs.1231.87
Saving in units per year	3400 units
Saving in cost per year	Rs.6432.13

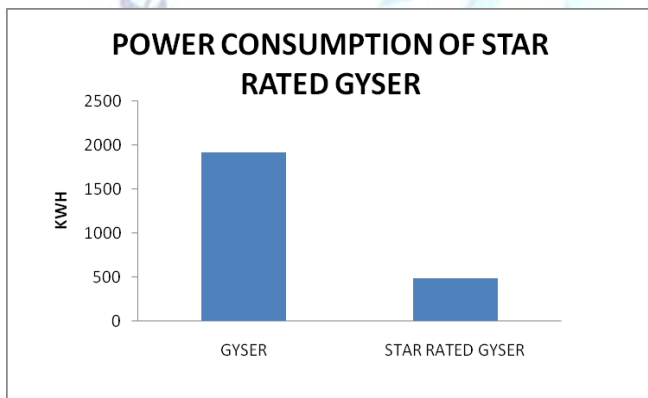


Fig. 11 Star rated Gyser power comparission in units

From the fig.11 we cocclude that the power consumption of the installed gyser is1916 kwh. The power consumption of the efficient gyser is 492.75. so about 1423.25 kwh can besaved.

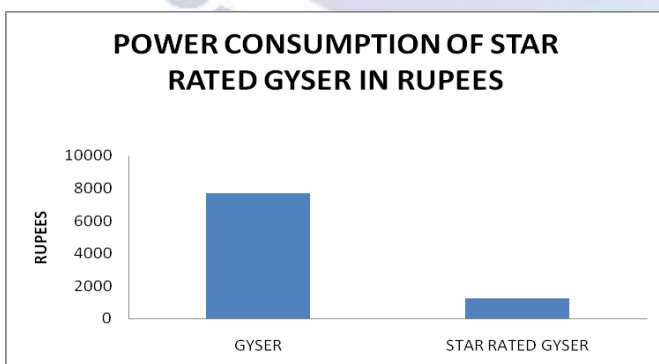


Fig.12 Star rated Gyser power comparission in rupees

From the above graph we can see that the existing gyser consumes about Rs. 7664 and the star rated gyser consumes about Rs.1231.87. so by recommending star rated gyser a sum of Rs. 6432 can be saved.

E. Recommendation With star ratedfans

TABLEI . **FANS CONVERSION CALCULATION CHART**

Present energy uses	
Total number of existed fans=	
Total power in watts=	
Total units consumed=	
Cost annually=	Rs.3679.2
If existing fans are(6) replaced by star rated fans	
total number of star rated fans=	6
Total number of watts=	
Total units consumed in a year=	
Cost annually=	
Saving in units per year	
Saving in cost per year	Rs.1086.75

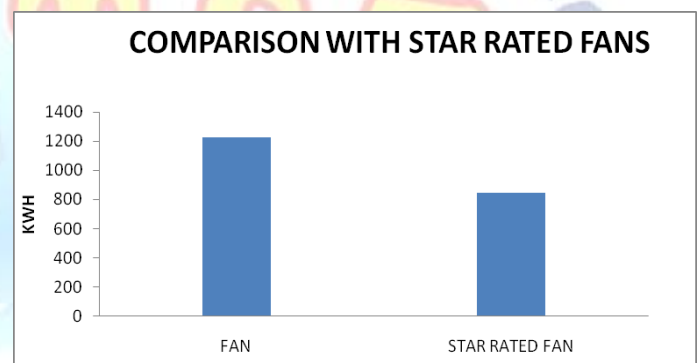


Fig.13 Star rated Fans power comparission in units

From figure 13 we conclude that the existing fan consumes 1226.4kwh. So by recommending star rated fans the consumption reduces to 843.15 kwh. A sum of 383.25kwh can be saved per year

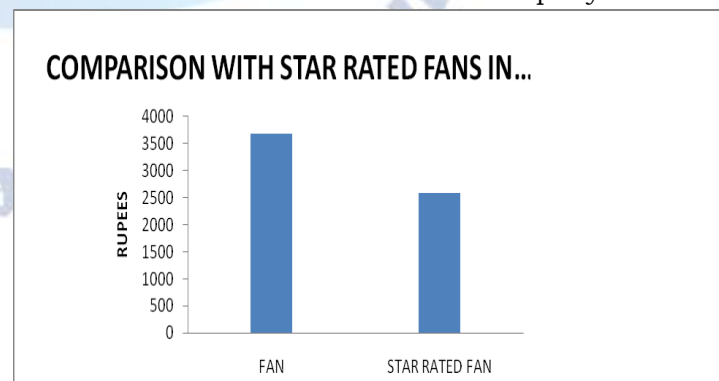


Fig.14 Star rated Fans power comparission in rupees

From the fig14 we can see that the present power consumption in rupees is Rs 3679.2 and with star rated fans is Rs.2592.45. so Rs 1086.75 can be saved.

F. Recommendation With rearranged loads

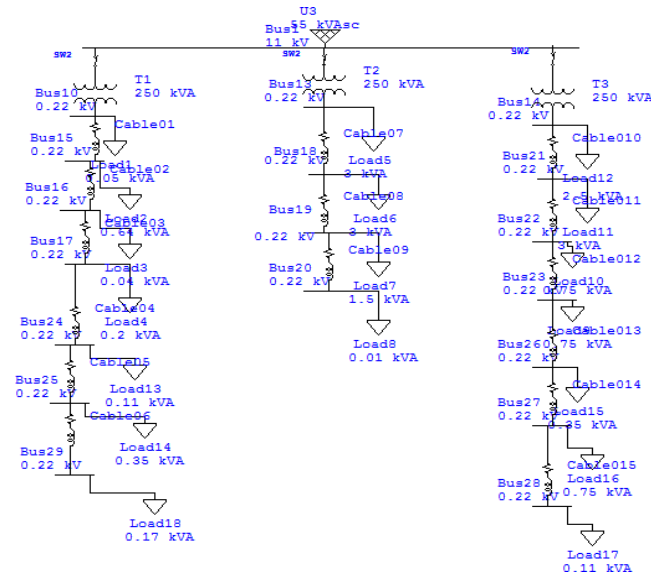


Fig.15 Rearranged load structures

In fig.15 it is recommended to rearrange the loads equally in three phases. this will increase the voltage rating of each of the bus bar.

G. Recommendation With microgrid

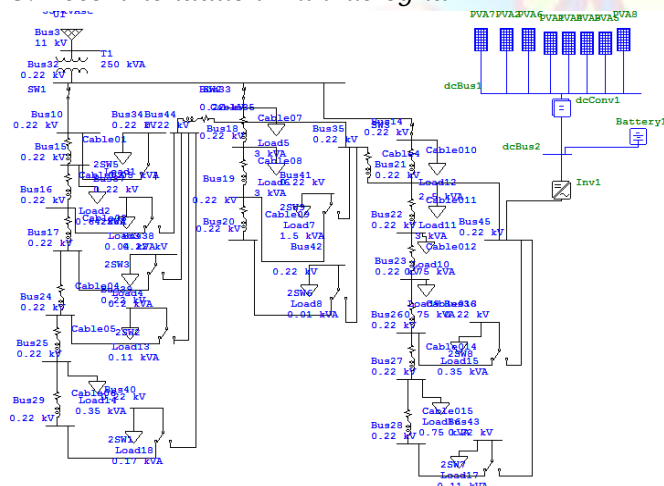


Fig.16 Recommendation with micro grid

Microgrid is recommend in the flat for the lighting loads and fans. Solar power is used for the microgrid implementation. It is recommended to use 1.5 KW solar panel for microgrid.

IV. CONCLUSION

After successfully completion of auditing at residential house we came to know there are three things that consumes more power that is

lighting, cooling and heating. lights are replaced wt. Using of LED lights instead of CFL tubes, with LED lights star rated Ac's instead of normal one and wall fans . Using IED lights 408.8 units can be saved yearly and by using star rated A.C1950 units can be saved yearly. Energy audit process must be carried out accurately enough to identify and quantify energy cost saving that are likely to be realized through investment in Energy saving measures.

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