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Practical approach for energy audit in Residential building

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***Abstract*- Energy consumption increasing day by day and energy production using conventional sources becomes limited. To reduce this energy consumption and for maximum utilization of energy, energy audit for residential building is playing vital role these days. By adopting this energy audit survey we can minimize the use of energy consumption. The energy audit surveys are mainly done for industries. But now a day's energy consumption is also increasing in residential building. So it is essential to adopt energy audit surveys for residential buildings too. This paper suggests the ways how we can minimize the losses and reduce the electricity bill for residential building. The paper is also useful for consumers as electrical energy audit survey is explained with procedure.**

Keyword- Energy Audit, Energy conservation, Unit Consumption, Demand Factor.

I. INTRODUCTION

India is a developing country and population of India is increasing every day. The demand of energy consumption is also increasing. To reduce this energy consumption energy audit is necessary for residential load also. Energy Audit is the translation of conservation ideas into realities, by lending technically feasible solution with economic. bill and action plan for this with a review on historical data for electricity bills with cost. Report also suggests some method to reduce losses and to reduce cost of electricity bills. This research paper is useful for the consumers to understand the procedure for energy audit survey for a residential building by reviewing historical data of their electricity bill. A residential building (two floors) is used for the consideration and recommendation is given on the basis of historical data of electricity bills (12 months) for this building. Age of the appliances is also considered here so that consumer can understand the effect of aging on electricity bills. Graph for unit consumption of energy is also represented here for this residential building for understanding the survey in a better way.

II. PROCEDURE

For energy auditing of a building we need to follow some steps. After that we draw some conclusion and recommendation is given on the basis of this data which we have collected by following these steps. The steps adopted for this work is represented below:

- Inspection of the residential building.
- Collect the data of all connected load in this building. Check rating of the equipment; find the maximum demand of the building on the one day (24 hours) basis, one month basis and for one year.
- Calculate the maximum demand and demand factor for this two story residential building.
- Collect the electricity bills and study the historical data for this residential building.
- Review the cost of the electricity bills in previous months. Find out on which month electricity bill cost is high and on which month cost is low.
- Data collection of all major equipment and find out the performance of the equipment.
- Identify the energy saving and conservation opportunities.
- Make a report with suitable recommendation and cost benefit analysis.

III. DETAIL ELECTRICALENERGY AUDIT

Table 1 Equipment Ratings

Equipment	Ratings
Electric Motor	368 Watts
Fans (11)	48 watts each fan
Tube light(8)	25 watts each tube light
Blubs(2)	100 watts each
LCD TV	57 Watts
Fridge (12 years old)	1.44 Kw per day (Rs5.76 per day)
Fridge new	0.60 kw per day (Rs.2.40 per day)
Geyser (6 litres)	2 KW
Air Coolers	175 Watts
Washing Machine	300 Watts
Immersion rod	1000 Watts

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For electrical energy audit survey of this residential building we follow the steps given above. According to this we inspect two story residential building after that we collect all the data of electrical load equipment. The equipment ratings here represented in the tabulated form Table 1.

Connected load = 6868 watt and Maximum demand = 4458 watt Therefore, Demand factor for this residential building = 0.64 After this over next step is to collect all the electricity bills and study the cost variations as the weather changes this is also represented in the tabulated form.

Table 2 Month wise unit consumption in Kwh and cost in Rs.

Months	Unit Consumption	Cost
Jan- Feb	446 Kwh	Rs. 3122
Mar-Apr	563 Kwh	Rs. 3941
May- June	464 Kwh	Rs. 3248
July-August	699 Kwh	Rs. 4893
Sept- Oct	829 Kwh	Rs. 5803
Nov- Dec	632 Kwh	Rs. 4424

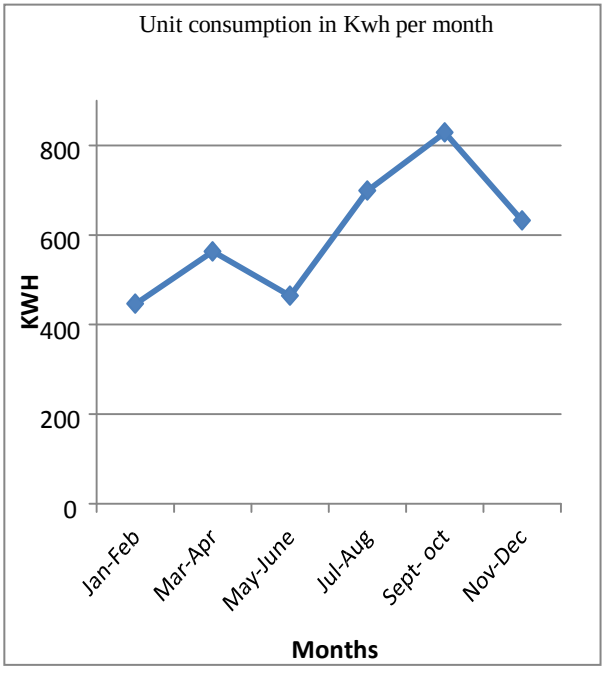

Fig. 1. Monthly consumption of electricity bills in Rupees.

This residential building is located in Jaipur, Rajasthan, India. In this location summer days are hottest and winters are very harsh but by studied above table we can draw the conclusion that unit consumption is more in the month of September- October. This gives us a shocking result. The average unit consumption is 605.5 KWh which is higher for the normal residential building.

As shown in graph which is drawn by collecting the historical data of electricity bills of this residential building we found that electricity consumed more in the month of September-October. This building is situated in the Rajasthan, India where in summer temperature in the month of May-June reached up to 50 degree Celsius. So electricity consumption is more in the month of May-June but it is not happened here. The electricity bill is more in the month of September October as shown in graph 2.

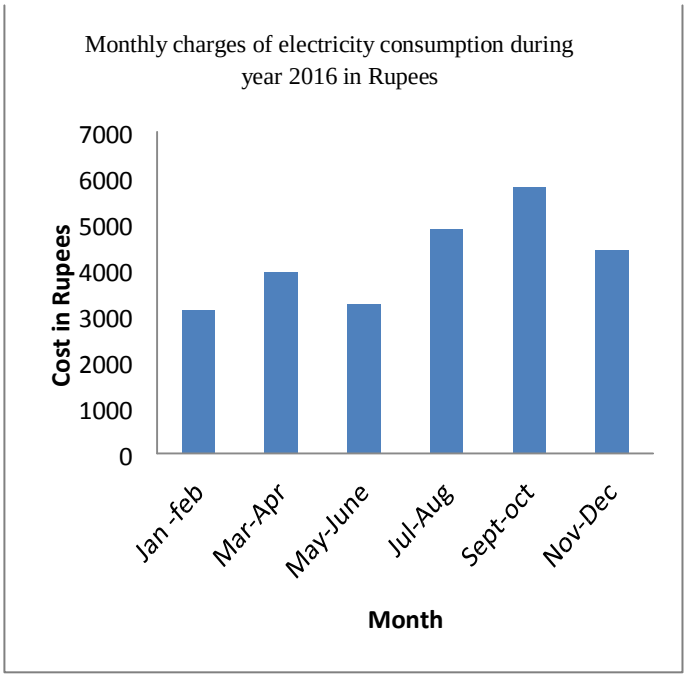

Fig. 2 Monthly charges of electricity consumption.

4. ENERGY SAVING AND CONSERVATION OPPORTUNITY

In residential building there is 35% of energy is consumed. Lightning control is very necessary in residential buildings for energy savings this can be achieved using various methods. One of the best methods is using Led bulbs instead of using Fluorescent tube lights this can save up to 21% of energy and cost saved is up to 33%. Lighting control should be achieved in such a way so that not only electricity is saved but also meet health and safety requirements. We can also replace inefficient luminaries, by replacing obsolete lights with low consumption/high-performance alternatives and by

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installing electronic ballasts or LED. The passive energy saving measures described above leave further scope for making savings. The aim of lighting controlprogrammes is to give users the required levels ofaccessibility and elasticity, whilst supporting active energy savings and cost decline by switching lights off as soon as they are no longer needed.

There are a number of technologies available with various degrees of complexity, although the time taken to recuperate investments is generally short at six to twelve months.Replace conventional regulators with electric regulators for celling fans. Remove dust from all appliances time to time as it increases load on the appliances. Refrigerator should be defrost time to time manually as frost up increases the amount of energy needed for motor running. The Refrigerator should be kept away from the wall so that air can circulate easily. Do not open refrigerator frequently and do not kept it open for the long time as the cold air escape easily and load on motor increases to maintain that temperature.

V. RECOMMENDATION

1 Recommendation excluding Investment

As per the construct technology of the housing edifices we have proposed probably the best economy proposals by which they can minimise the consumption of electrical energy and bills additionally by appropriate utilization of source. Some huge recommendations are as follows.

To lessen no-load losses the electrical gadgets of apparatus may be unplugged or switched off when they are not in utilize. Exceptionally the cell phone charger may be eliminated from the charging point after the phone is fully charged.Clean the residue from tube lights and bulbs routinely as a substantial layer of residue can obstruct half of light yield. Dust must be cleaned from fans routinely as substantial layer of residue in fan blades diminishes motor proficiency and yield. The temperature of refrigerator must be set according to the weather conditions. The refrigerator should be defrosted as the need; the refrigerator must not be left open, about 30% of chill air wasted in the said activity. Similarly, 30% hot air is wasted when microwave is left open.The washing machine should be used with full load. Weighty burden machines should be utilized the in the nonpeak hours.

2 Recommendation alongwith investment

In this course of action as indicated by the site inspection, it very well may be seen that tube light is utilized to a great deal. Particularly it is noted as a habit that in a drawing hall three or more tube lights are utilized. Along these lines, it is prescribed to supplant tube light with LED light. A two-year guarantee is committed with the LED light and it likewise spares the utilization of units contrast with the CFL and tube light. About 30% of cost is decreased in the wake of utilizing the LED light. Moreover the light emitted from LED light is more pleasing and effective furthermore it extremely minimizes the consumption of electrical energy. On comparing between the consumption of electrical energy by two refrigerators in a room it is found that the a 12 years old refrigerator consumes 3.5 units every day which costs Rs.3000-4000 every year while the second refrigerator what is one year old with 5-star consumes 2 units for each day that costs just Rs.1000-1500. It is prescribed to supplant the old refrigerator with 5-star rated new fridge. The research uncovers that 1kW capacity of solar power can fulfill the need of basic electrical power for a housing building of 20 x 50 square foot with its basic electrical equipments. A cost of about Rs 70, 000 after subsidy is required for a said solar plant. 4-5 kW power produced every day from 1kw panel by the heat radiation in Rajasthan. The estimated saving in unit utilization and cost is 25% of the current expense with the pay time of 5 years.

V. CONCLUSIONS

In this paper we have done energy audit by collecting all the data of load demand and by collecting tariff for one year of the residential building. The electrical energy audit for this residential building is provided for substantial saving in the residential building. These recommendations is communicated to the consumer and they are ready to implement them within the duration of 6 months if these recommendations were implemented then there will be great saving in the power consumption and the tariff bills. The effective recommendation is offered along with different graphs and tables. The owner of building agreed to appliance the idea presented in this paper and also recommended the use of different methods of renewable energy sources, tree plantation around the building and changes in the installation procedure for an effective, efficient, cleaner and greener environment.
This paper suggests the ways how we can minimize the losses and reduce the electricity tariffs for residential building.

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