International Journal of Scientific Research in Science, Engineering and Technology (www.ijsrset.com)
© 2020 IJSRSET | Volume 7 | Issue 1 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
DOI : https://doi.org/10.32628/IJSRSET207122

Study of Energy Management and Audit

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ABSTRACT

The economic development of a country is often closely linked to its consumption of energy. The government has taken new steps for the development of renewable energy sources and less consideration in conservation of electrical energy in the society. According to the current scenario the demand of energy has increased and became a routine process in our lifestyle. Why electrical auditing and management is essential? Energy audit is the survey of wastage power in different areas like domestic houses, commercial buildings and industries etc. For getting solution to save electrical energy, energy auditing is best way. So we found in India the demand of electrical power rises at the rate of 9-10 % per annum while the generation of electrical power rises at the rate of 5-6 % per annum, ultimately the gap between demand and generation of electrical power is widening at the rate of 3-4 % per annum. Electrical energy auditing and management program can have an originating within one division of saving, motivating people in all forms to undergo conservation activities. In this project we had done the Energy audit in residential house.

Keywords : Energy Audit, Energy Conservation, Efficiency, Auditing Types, Energy Conservation Opportunities

I. INTRODUCTION

Energy crisis is one of the major problems in the existing world. An energy crisis is any great bottleneck in the supply of energy resources to an economy. There has been an enormous increase in the global demand for energy in recent years as a result of industrial development and population growth. Since the early 2000s the demand for energy, especially from liquid fuels, and limits on the rate of fuel production has created such a bottleneck leading to the current energy crisis. This problem will solved through Energy conservation and use of energy efficient equipment. With the use of energy efficient measures in different sectors of consumption like Lighting, Refrigeration and HVAC helps energy conservation. An energy efficient lighting design with controls reduces the power consumption and will be a major energy saving component along with commercial and residential sectors. A proper light Design will be able to percept the surroundings and can reduce energy consumption. Similarly HVAC, Heating, ventilation and Air conditioning (HVAC) is a significant operating expense in commercial buildings, accounting for 51% of energy use, An HVAC economizer is a damper vent designed to save energy and give the cooling system a break. Sensors within the economizer compare the outdoor temperature and humidity with that inside the building. If the outside air is cool enough, the damper is opened to bring outside air in, thereby

reducing the need for mechanically cooled air. If the outside air is not cool enough, which is indicated by the Economizer's sensors, the damper are closed.

II. ENERGY MANAGEMENT

Energy management includes planning and operation of energy production and energy units. Energy Audit may be defined as "an audit which serves the purpose of identifying where building or plant facility uses energy and identifies energy conservation options

A. Need for Energy Audit

1. To minimize the cost of energy.
2. To minimize the operational cost
3. To minimize the cost for repair and reconstruction.
4. To increase the quality of environment that contributes to increased work productivity.
5. Preventive measure for energy wastage.
6. Maintenance and quality control programmes.

The primary objective of Energy Audit is to determine ways to reduce energy consumption per unit of product output or to lower operating costs.
Energy Audit provides a "bench- mark" for managing energy in the organization and also provides the basis for planning a more effective use of energy throughout the organization.

B. Types of Energy Audit

The type of Energy Audit to be performed depends on:

- Function and type of industry
- Depth to which final audit is needed, and
- Potential and magnitude of cost reduction desired Thus, Energy Audit can be classified into the following two types.
  ii) Preliminary Audit
  iii) Detailed Audit

C. Preliminary Energy Audit Methodology

Preliminary energy audit is a relatively quick exercise to:

- Establish energy consumption in the organization
- Estimate the scope for saving
- Identify the most likely (and the easiest areas for attention
- Identify immediate (especially no-/low-cost) improvements/ savings
- Set a 'reference point'
- Identify areas for more detailed study/measurement
- Preliminary energy audit uses existing, or easily obtained data

D. Detailed Energy Audit Methodology

A comprehensive audit provides a detailed energy project implementation plan for a facility, since it evaluates all major energy using systems.

This type of audit offers the most accurate estimate of energy savings and cost. It considers the interactive effects of all projects, accounts for the energy use of all major equipment, and includes detailed energy cost saving calculations and project cost.

In a comprehensive audit, one of the key elements is the energy balance. This is based on an inventory of energy using systems, assumptions of current operating conditions and calculations of energy use. This estimated use is then compared to utility bill charges.

Detailed energy auditing is carried out in three phases: Phase I, II and III.
Phase I - Pre-Audit Phase
Phase II - Audit Phase
Phase III - Post Audit Phase

E. Steps Involves in Energy Auditing

1) Interview with key facility person: In this,

Meeting is scheduled with auditor and all key auditing personals the meeting is focussed on Audit objectives, scope of work, facility rules and regulations, Roles and Responsibilities of members. In addition to these administrative issues, the discussion during this meeting seeks to establish: operating characteristics of the facility, energy system specifications, operating and maintenance procedures, preliminary areas of investigation, unusual operating constraints, anticipated future plant expansions or changes in product mix, and other concerns related to facility operations.

2) Facility Tour: After the initial meeting, a tour of the facility is arranged to observe the various operations first hand,focusing on the major energy consuming systems identified during the interview, including the architectural, lighting and power, mechanical, and process energy systems.
3) Document Review: During the initial visit and subsequent kick-off meeting, available facility documentation are reviewed with facility representatives. This documentation should include all available architectural and engineering plans, facility operation and maintenance procedures and logs, and utility billsfor the previous three years. It should be noted that the available plans should represent "as-built" rather than "design" conditions. Otherwise, there may be some minor discrepancies between the systems evaluated as part of the audit and those actually installed at the facility.
4) Facility Inspection: After a thorough review of the construction and operating documentation, the major energy consuming Processes in the facility are further investigated. Where appropriate, field measurements are collected to substantiate operating parameters.
5) Staff Interviews: Subsequent to the facility inspection, the audit team meets again with the facility staff to review preliminary findings and the recommendations being considered. Given that the objective of the audit is to identify projects that have high value to the customer, management input at this junction helps establish the priorities that form the foundation of the energy audit. In addition, interviews were scheduled with key representatives designated by the facility as having information relevant to the energy audit. These representatives may include major energy consuming system service and maintenance contractors and utility representatives.
6) Utility Analysis: The utility analysis is a detailed review of energy bills from the previous 12 to 36 months. This should include all purchased energy, including electricity, natural gas, and fuel oil, liquefied petroleum gas (LPG) and purchased steam, as well as any energy generated on site.
7) Identify/Evaluate Feasible ECMs: Typically, an energy audit will uncover both major facility modifications requiring detailed economic analysis and minor operation modifications offering simple and/or quick paybacks. A list of major ECMs is developed for each of the major energy consuming systems (i.e., envelope, HVAC, lighting, power, and process). Based upon a final review of all information and data gathered about the facility, and based on the reactions obtained from the facility personnel at the conclusion of the field survey review, a finalized list of ECMs (energy conservation measures) is developed and reviewed with the facility manager.
8) Economic Analysis: Data collected during the audit is processed and analyzed back in our offices. We build models and simulations with software to reproduce our field observations and develop a baseline against which to measure the energy savings potential of ECMs identified. We then calculate the implementation cost, energy savings and simple payback for each of the ECMs being investigated.

9) Prepare a Report Summarizing Audit Findings: The result of our findings and recommendations are summarized in a final report. The report includes a description of the facilities and their operation, a discussion of all major energy consuming systems, a description of all recommended ECMs with their specific energy impact, implementation costs, benefits and Payback. The report incorporates a summary of all the activities and effort performed throughout the project with specific conclusions and recommendations.
10) Review Recommendations with Facility Management: A formal presentation of the final recommendations is presented to facility management to supply them with sufficient data on benefits and costs to make a decision on which ECMs to be implemented.

III. ENERGY CONSERVATION

Energy is an integral part of today's modern life. It has become the blood of our day to day life. But it is not free. It comes at a monetary price but more than that it comes at environment cost too.

It is very difficult to think about our modern life without energy. But the generation of energy requires natural resources which are depleting day by day. On the other side, use of energy is increasing exponentially. In developing nation like India, about 49% of total commercial energy is consumed in industries and utilities like Compressed Air, Air Conditioning, Steam, Hot water, Electrical systems, fuel, water system consumes substantial part of total energy in these industries. Thus, the need to improve and maintain energy efficiency in industrial utilities is strongly felt to survive in present scenario of rising energy costs and volatile energy markets and to gain competitive advantage.

Energy Conservation is saving energy. For example when we turn off the light, we're conserving energy. Energy efficiency also is the one of important process for saving energy because it is focus on the energy efficiency of products that's means don't waste energy. For example the ordinary light bulbs generate heat energy which is simply wasted. An energy efficient light bulb turns almost energy to light. It is very important to save energy because energy isn't free and unlimited. So everyone needs to pay for the use of energy that means saving energy is finally we are saving our money. Wasting energy is also not conducive to the environment. Many forms of energy we rely on, such as coal and natural gas, etc. are non-renewable.

IV. INVESTIGATION OF POWER CONSUMPTION IN A HOME

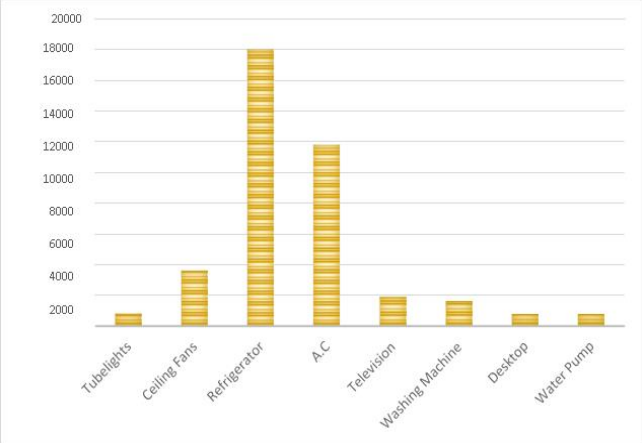
As in Homes & Buildings the power consuming areas are: Lighting includes of Bulbs, Tubes.
Cooling includes of Ceiling Fans, Air Conditioners, and Refrigerators etc... Entertainment comprises of Radio, Television, and Desktops, Laptops etc other appliances include Mixers, Pump motor, Washing Machines etc.

Normal Equipment's Power Consumption
1-Unit =1 kWh=1000 W-h

1) Total number of T12 Tube lights with 40w is 4 with 4 hours daily, then daily consumption= 4*5hrs*40W=800watts per day= 0.8kWh.
2) Total number of Ceiling fans with 75w rating is 4 with 12 hours daily usage, then daily consumption =4*12hrs*75=3600W=3.6kWh.
3) Refrigerator (Single door) with 200 litres capacity=750W*24 hours=18000 Watts per day= 18 kWh.
4) Air conditioner 1.5 Ton=2360Watt*5hrs=11800 Watts per day= 11.8 kWh
5) Entertainment: Television=188W*10 hours daily=1880 Watts= 1.88 kWh.
6) Desktop computer=250W*3hours=750Watts per day= 0.75 kWh.

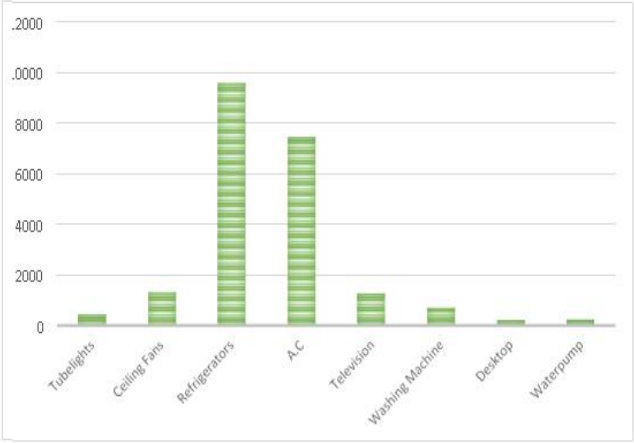
7) Washing Machine=800w*2hrs=1600Watts = 1.6 kWh.
8) Water Pump 1 HP=750*1hrs=750Watts= 0.75 kWh.

Total power consumed by these regular Appliances is= 39180 Watts= 39.18 kWh per day.



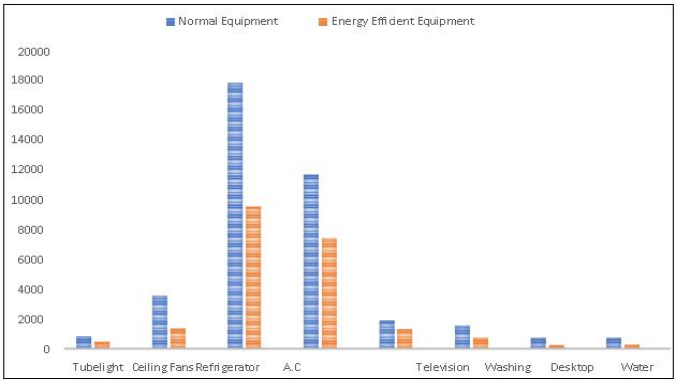
By Using Energy Efficient Equipments

1) In Lighting, if we replace regular lighting with T5 Tube lights then, 22W*4no*4hrs=440W=0.44kWh. Therefore, Net savings=800-440=360 Watts.
2) In Ceiling Fans if we replace with Energy Efficient Fans then, 28W*4no*12hrs=1340Watts. Therefore, Net savings=3600-1340=2260 Watts
3) In Refrigerators if we reduce the number of openings of fridge door and using Energy Efficient (5 star rating) then, 400w*24hrs=9600 watts/day
4) Therefore, Net savings=18000-9600=8400 watts
5) AC require 2400 W, but 5 star require only 1490W*5hrs=7450Watts. Therefore, Net savings =11800-7450=4350Watts.
6) In Television if we use energy efficient LED TV then, ratings is 128W*10 hours=1280Watts per day. Therefore, Net savings=600Watts.
7) If we replace desktop with laptop then 70W*3hours=210Watts. Therefore, Net Savings=750-210=540 Watts.
8) If we use controller and sensors in water pump there will be 500 Watts savings. Therefore, Net Savings=250 Watts
9) Energy efficient Washing machine=360*2=720Watts. Therefore, net savings=1600-720=880Watts.
10) Total Watts consumed by replacing Energy efficient Equipment is: 21290Watts.



- With normal appliances the units consumed are: 39.180 units per day.
- But replacing normal appliances with Energy Efficient Appliances the units consumed is 21.290units only. There is nearly 18 units savings per day i.e., 18units*30days=540 units saved per month.
- Therefore, 540units*12 months=6480 units saved per year.

Comparison of Power Consumption between Normal equipment and Energy Efficient equipment



V. RECOMMENDATIONS FOR LOW POWER CONSUMPTION

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 build up 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 repellent you can use one mosquito repellent as it's a small.
- In living room 2 Decoration 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.
- Prefer natural dying over electric dryness.
- 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 25sqft
- 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.

VI. CONCLUSION

Energy Audit deals with verification, monitoring and analysis of use of energy including submission of technical report containing recommendations for improving Energy Efficient with cost benefit analysis and an action plan to reduce energy consumption. Energy Saving is a Social Responsibility for every individual. In this paper we have analysed the amount of wattage consumed by different devices and suggested necessary replacements and showed the net savings. By this analysis, if we implement Energy Efficient Equipment we can conserve a lot of power being wastage with current devices without disturbing the output and we can use it for some other devices. By using Energy Efficient Devices we can save and reduce shortage of Power and can reduce power inflation.

VII. REFERENCES

[1]. prof. www.bee.gov.in

[2]. Moncef Krarti, Energy Audit of Building system- An Engineering Approach.., CRC Press LLC

[3]. W. T. Snyder. W. Symonds, "The energy audit what it is how to conduct it , how to use the results", Proceedings of Energy Use Management International Conference, Arizona,

[4]. Greely K., Harris J., and Hatcher A., Measured Saving and Cost-Effectiveness of Conservation Retrofits in Commercial Buildings, Lawrence

Berkely National Laboratory Berkeley, CA, 2007.

[5]. Mr G Joga Rao, BPSK Modulation and Demodulation with Power Line Carrier Communication andGSM Communication for Smart Metering, International Journal of Power Electronics and Drive System ISSN: 2088-8694,), Vol. 7, No. 3, pp. 713-722 Sept-2016. DOI: http://doi.org/10.11591/ijpeds.v7.i3.pp713-722

[6]. Fels, J., Special Issue Devoted to Measuring Energy Savings: The Scorekeeping Approach, Energy and Buildings.

[7]. Thumann, A., and Mehta, P., Handbook of Energy Engineering. The Fairmont Press Inc., Librun, GA 2002.

[8]. Tuluca A., and Steven Winter Associates, Energy Efficient Design and Construction for Commercial Buildings, Mc-Graw Hills, 201

[9]. D.V.N. Ananth, G. Joga Rao, Ch. Satish, J. Shyam, K.Santosh, U.V.V.S.S.V.Prasad, K. Ramya, "Smart Electricity Billing Using Node-MCU", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Volume 6 Issue 2, pp. 287-292, March-April 2019.

Cite this article as :

G. Joga Rao, K. Pavan Srihari, "Study of Energy Management and Audit", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Online ISSN : 2394-4099, Print ISSN : 2395-1990, Volume 7 Issue 7, pp. 146-152, January-February 2020. Available at doi : https://doi.org/10.32628/IJSRSET207122
Journal URL : http://ijsrset.com/IJSRSET207122