

## ELECTRICAL ENERGY AUDIT

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**Abstract:** An energy audit is an inspection, survey and analysis of energy flows in building, processes or system with the objective of understanding the energy dynamics of the system under study. Typically an energy audit is conducted to seek opportunities to reduce the amount of energy input into the system without negatively affecting the outputs when the object of study is an occupied building then reducing energy consumption while maintaining or improving human comfort, health and safety are of primary concern. Beyond simply identifying the sources of energy use. An energy audit seeks to prioritize the energy uses according to the greatest to least cost effective opportunities for energy savings. The energy audit report establishes the needs for plant metering and monitoring enabling the plant manager to institutionalize the practice and hence, save money for the years to come. The steps and sets the preliminary budget for the energy management program.

**Keywords:** Energy, Energy Audit, Energy Dynamics, Management, Consumption

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### I INTRODUCTION

Electrical energy is the most extensively utilized form of energy due to its ease of usage. This high grade energy is utilized in various applications like melting, heating furnaces, mechanical drives such as pumps, fans and compressors, lighting etc. Electrical energy audit is carried out in two distinct parts of electrical system. The first part is to study in Electrical supply and distribution System covering Transformers, billing& tariff analyses, substation, PF improvement, MD reduction, cable optimization, motor load survey, DG set etc. The second part is to study all the end use like pumps, blowers, air compressors, HVAC system, and heating and illumination system.

We conduct electrical energy audit to establish electrical energy balance and to study for effective utilization of tariff structure and all electrical energy equipment's. Based on the energy losses & percentage loading of rotating equipment, energy conservation measures are presented with techno economic analysis. Energy substation and alternate energy application will be explored for sustainability.

### II. PROBLEM STATEMENT

Today, one of the vital factor in deciding the total production cost and maintenance costs is an Electrical Energy. Nowadays the demand of electrical energy will get increases day by day due its advantages. But according to the demand, the production of electrical energy is not sufficient and also it is costly as well as harmful for the environment as the emission of co2 during the generation of electricity. Hence it requires to conserves the energy. As the conservation of energy means while the generation of electricity. The prime tool for finding the energy conservation opportunities is doing the Energy Audit.

An energy audit gives not only the advantage of reducing cost but also improves the quality of energy supply. Wastage of energy needs to be avoided to cut down energy costs of the campus. It is therefore, necessary to conduct an energy audit covering analysis and evaluation of all equipments, operations and system components which have bearing on energy consumption, and identify scope for reduction in energy cost.

**AND ENGINEERING TRENDS**

**III. PROPOSED IDEA**

By using the previous 12 months data collection of the engineering building, like electricity bills, building maps, area covered, installed electrical equipments and machineries, etc. We can analyze the non required energy consumption and power losses in the system. To reduce these energy consumption, the recommendations like replacement of an efficient energy saving equipment and wherever can be possible, the recommendation of using natural resources. Which will reduce the energy consumption and hence the cost of energy bill also. Which will helps in not only economic balance but also the environment impact.

**IV. METHODOLOGY**

Energy conservation and Energy efficiency:

There are at least two demand side methods that can help cut energy usage:

First: Behavioural change that results in reducing the demand for energy based service is called energy conservation. An example of energy conservation is to switch off the equipments properly when it is not in use. Also other example is shifting to fan from AC, which cuts the need for energy by lowering the level of service received. We also use natural air by creating ventilation at the time of structure any building or houses.

Second: The Introduction of alternatives/replacement that maintains the level of service without reducing the energy required for its provision and known to have greater energy efficiency. An example of improved energy efficiency is the shift to LED bulbs from regular bulb like incandescent or CFL, which maintains the service but cuts energy consumption. The energy conservation and energy efficiency are considered as the Fifth Source of Energy after Thermal, renewable, hydro and Nuclear. Some even advocate that these to be considered as the First Source since it is much easier, economical and entirely in our control.

**V. SUGGESTIONS**

**A. Alternatives:**

The replacement of the energy consuming equipment's to the energy efficient appliances reduces considerable energy consumption. This is achieved with maintaining the same service level also.

Star rating grades according to the energy efficiency scaled in between 1 star to 5 stars. It gives least energy efficiency for one star and the most energy efficiency for five stars. It can helps to increase the quality of equipment and also reduces considerable co2 emission which gives overall better environmental quality.

For example, the following comparison of 3 starred refrigerator and 4 starred refrigerators gives the major difference in energy consuming factor.

	<b>Example of 3 Star Refrigerator</b>	<b>Example of 4 Star Refrigerator</b>
<b>Brand</b>	Whirlpool	Whirlpool
<b>Capacity</b>	292 Ltrs.	292 Ltrs.
<b>Price</b>	24,490/-	27,490/-

Table 1: Comparison of 3-star and 4-star refrigerator



Fig.1: Comparison of 3-star and 4-star refrigerator

The above comparison gives the difference of 3000/- Rs. For installation but the energy consumed by the 3 starred refrigerator is 259 units per year at the same time 4 starred refrigerator consumes only 194 units per year. It means, for every star it takes 65 units difference. We can be achieves major economic level by investing once a time.

**B. Power factor:**

Nowadays, we are using various types of machineries ad appliances which impacts on the power factor of the whole system. Most of the time, the system is affected due to the inductive type appliances and at the same time electronic applications also. This is also the reason by which the power factor gets affected.

**AND ENGINEERING TRENDS**

However, if this power factor does not improved, it takes penalty for it. Which is the reason to increases the energy bill.

To avoid this P.F. penalty, we should maintain the power factor to the unity. This can be gained by using APFC, stabilizers capacitor banks and the equipments like power compensators, etc.

**C. Maximum demand:**

The penalty for the maximum demand can be increase the billing numbers. This can be avoided by ensuring the value never exceed the contracted power. This is one of the ways to reduce the energy bill.

**D. Maintenance:**

As the time increases, the instruments get deteriorates and works less efficiently. This is probably occurs due to the layers of dust, humidity as well as the atmospheric conditions like temperature, air density, etc. So it will take more power consumption due to less efficient working.

Hence, there is a recommendation to do the preventive maintenance at regular base. This will gives the equipments more life as well as works at improved power quality.

**E.TOD:**

There are different tariff structures in which, one of the relevant tariff structure is Time of Day tariff. In which the tariff takes different rates for different time period in the day. It means for the pick hour timing, the energy rates for higher value. On the other hand, for the minimum load hour, the energy rates are also low.

Therefore, to reduce the energy bill, we can use the energy at the time of minimum load hours, which gives minimum energy charges and these will becomes lower energy bill and helps to maintain the demand side load.

These are the suggestions which coves by the “Electrical Energy Audit” project.

**VI. HARDWARE REQUIREMENT**

Power quality analyzer:

12 Kinds of Power Measurements for Power Control and Applicable to Power Quality Control including Harmonics Analysis.

- 1) One click easy-to-use operation helps complicated setting and processing of large data through the setting / analyzing software provided as accessory.
- 2) Direct communication with PC via USB cable Built-in Input / Output Function of external signal enables the signal transmission to alarms.
- 3) 2 Way power supply by AC and Battery, and Nickel hydrogen battery usable with rechargeable function. Pull / Insert of CF card possible whenever on recording under the function of memory backup device (1GB usable).
- 4) Can monitor insulation at leakage current by using optional leak clamp sensors.
- 5) Built-in Print Screen Function enables to record display screen (Records 512 screens by using CF card: 1 screen 40KB). Can display Waveform and Vector, and can confirm the wiring connection, too.
- 6) Complies fully with International Safety Standards IEC61010-1 CAT. 600V.



Fig. 2: Power quality analyzer.

**VII.CONCLUSION**

In order to reduce energy consumption and save energy costs an energy audit is an analysis of a facility, indicating how and where that facility can. Its insight to energy efficiency and conservation can lead to significant savings on the company's utility bill. From this energy

auditing we can manage the usage of electricity and improve the significant power quality.

“Audits are great investments for the future, often resulting in immediate returns and a quick payback”

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#### REFERENCES

- [1] N M Ijumba and J Ross “Electrical Energy Audit And Load Management For Low Income Consumers” IEEE,AFRICON’96, 27 September 1996.
- [2]R. Saravanakumar, Naga chetan, Pranav chakaravathy, Karthickkeyan, Sava rakesh, Ramkiran “M Energy Audit Report”, 3rd international conference, IEEE standard 2017.
- [3]Ahmed F. “The Handbook Of Renewable Energy Technology”,January 2011.
- [4] Vivek Jadhav, Rushikesh Jadhav, Pramod Magar, Sandip Kharat “Energy Conservation through Energy Audit” International Conference on Trends in Electronics and Informatics ICEI 2017, Page No. 481-485.
- [5] Nissanga Nishad Rasanajan Mendis “Energy Audit: A Case Study”, ICIA 2006, page no. 45-50.
- [6] Rakiba Rayhana, “Electric and Lighting Energy Audit: A Case Study of Selective Commercial Buildings in Dhaka”,December 2015, page no. 301-304.

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