



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 5, May 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

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Review of “Energy Audit”

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ABSTRACT: An energy audit involves a thorough and structured examination of how energy is consumed and utilized within a building or facility. An energy audit’s main objective is to pinpoint areas that could benefit from increased energy efficiency which can lead to reduced energy consumption, lower operating costs, and environmental benefits. This process involves collecting and analyzing data on energy consumption, identifying energy-saving opportunities, and developing recommendations to improve energy efficiency. An energy audit can be executed by an authorized energy professional. Auditors who measure and analyse energy use using highly sophisticated methods and equipment.

After conducting an energy audit, building owners and managers receive crucial information that enables them to make informed decisions regarding energy efficiency enhancements and investments in energy-efficient technologies

I.INTRODUCTION

An energy audit is a systematic evaluation of a building's energy consumption patterns and efficiency. The primary purpose of an energy audit is to identify areas of energy waste or inefficiency, and recommend strategies to reduce energy usage, save money on energy bills, and improve environmental performance. Energy audits can be performed on any type of building, from residential homes to large commercial and industrial facilities. During an energy audit, an energy professional will conduct a detailed analysis of the building's energy systems, including lighting, heating, ventilation, and air conditioning, appliances, and insulation. They may also evaluate the building envelope, including walls, windows, and doors, to identify areas of air leakage or poor insulation. Once the audit is complete, the energy professional will provide a comprehensive report outlining the energy usage patterns of the building, identifying areas of energy waste or inefficiency, and recommending specific strategies for reducing energy usage and improving energy efficiency. These strategies may include upgrading to more energy-efficient lighting, improving insulation, installing programmable thermostats, or utilizing renewable energy sources like solar or wind power. Energy audits can provide significant benefits, including reduced energy costs, improved environmental performance, and enhanced occupant comfort and productivity. They can also help businesses and organizations to meet energy efficiency and sustainability goals, and may be required by local or national regulations or certifications .Energy audits are a crucial tool that building owners and managers can utilize to decrease their energy usage, enhance their environmental sustainability, and save money on energy expenses.

A. NEED OF ENERGY AUDIT

- a. Cost savings: Energy audits can help identify areas of energy waste or inefficiency, which can lead to significant cost savings on energy bills. Building owners and managers can reduce their energy usage and expenses by adopting the energy efficiency measures recommended in the audit.
- b. Environmental benefits: Reducing energy consumption and improving energy efficiency can also lead to significant environmental benefits, including reduced carbon emissions and a smaller carbon footprint. This can help to mitigate climate change and improve environmental sustainability.
- c. Occupant comfort and productivity: Energy audits can also help to improve the comfort and productivity of building occupants. By improving the efficiency of heating, ventilation, and air conditioning systems, for example, building owners and managers can create a more comfortable and productive indoor environment for occupants.
- d. Compliance with regulations: Energy audits may be required by local or national regulations or

certifications, such as LEED certification for green buildings. By conducting an energy audit and implementing recommended energy efficiency measures, building owners and managers can ensure compliance with these regulations and certifications.

e. Increased property value: Improving the energy efficiency of a building can also increase its property value, making it more attractive to potential buyers or tenants.

B. TYPES OF ENERGY AUDIT

The nature and purpose of the industry, the desired depth of the final audit, and the type of audit to be undertaken are all variables that affect the sort of energy audit needed for a certain industry or facility.

The desired cost reduction size and probability are also significant factors that determine the category of energy audits. Therefore, energy audits can be broadly categorized into two groups. 1) Preliminary Audit 2) Detailed Audit

1) *PRELIMINARY AUDIT* : In the context of energy audits, a preliminary audit is typically the first step in the audit process. It involves a preliminary analysis of the energy consumption patterns, energy bills, and basic operating parameters of a facility or building. The primary aim of a preliminary audit is to pinpoint potential areas where energy savings can be achieved and to prioritize areas that require more in-depth investigation.

During a preliminary audit, the auditor may gather information about the facility's lighting systems, HVAC systems, insulation, and other energy-consuming systems. They may also collect data on the facility's occupancy patterns, operating schedules, and equipment usage. Based on this information, the auditor can provide the facility with a preliminary estimate of potential energy savings and identify areas that require further investigation.

A preliminary audit is typically less detailed than a comprehensive energy audit, but it can provide valuable insights into a facility's energy consumption patterns and potential for energy savings. It can help facility managers prioritize energy efficiency measures and plan for a more comprehensive energy audit.

2) *DETAILED AUDIT* : A detailed audit is an essential step towards developing an effective energy project implementation plan for any facility. This type of audit involves a comprehensive assessment of all major energy-consuming systems, and it provides a precise evaluation of energy savings and costs. By taking into account the interaction impacts of all projects and accounting for the energy usage of all critical equipment, a detailed audit provides the most accurate projection of energy cost savings and project cost estimates.

The objective of a comprehensive energy audit is to determine the actual energy performance of selected end-users and operations, based on the energy conservation potential identified during the preliminary assessment. The long-term inspection process, known as DEA (Detailed Energy Audit), encompasses all types of data, including industrial processing, equipment performance, energy usage, and financial and economic information. The evaluation of energy performance improvement methods also involves an examination of costs and benefits.

A report summarizing the audit results must include an action plan outlining the priorities for implementing the performance improvement project. This plan must detail the steps necessary to achieve the identified energy savings and cost reductions, including any equipment upgrades or modifications, changes to operational procedures, and training requirements for facility personnel.

The energy balance is one of the crucial components of a thorough audit. This is based on calculations of energy usage, an inventory of systems that utilize energy, and assumptions about how things operate right now. The costs on a utility account are then compared to this projected utilization. A comprehensive energy audit is done in three stages: I, II, and III.

Phase I is the pre-audit phase; Phase II is the audit phase; and Phase III is the post-audit phase.

II.METHODOLOGY

The methodology of an energy audit typically includes the following steps:

- a. Gathering information: The primary step is to collect information about the building, including its size, age, construction materials, occupancy patterns, and energy consumption data.
- b. Site inspection: A physical inspection of the building is conducted to identify energy consumption patterns,

building envelope characteristics, HVAC systems, lighting, and other equipment that consume energy.

c. Energy analysis: Energy usage data is analyzed to identify energy consumption patterns, peak demand times, and potential energy savings opportunities.

d. Equipment and system analysis: The energy auditor assesses the efficiency of heating, cooling, ventilation, lighting, and other systems, as well as insulation levels, windows and doors, and other components that affect energy usage.

e. Bench-marking: The energy usage of the building is compared to similar buildings to determine how it performs in terms of energy efficiency.

f. Energy efficiency recommendation The energy auditor provides recommendations for energy efficiency improvements, which may include upgrading equipment, improving building insulation, optimizing HVAC and lighting systems, and implementing energy management practices.

g. Cost-benefit analysis: The energy auditor provides a cost-benefit analysis to help building owners understand the financial implications of implementing energy efficiency measures.

h. Implementation plan: The energy auditor delivers an implementation plan that details the required steps to execute the recommended energy efficiency enhancements.

i. Monitoring and verification: The energy auditor is responsible for monitoring and confirming the energy savings achieved as a result of implementing the recommended energy efficiency improvements.

A. Preparation for a Comprehensive Energy Audit: Initial Site Visit and Tasks:

The energy auditor or engineer can get to know the team, get acquainted with the location, and determine the actions necessary to do the energy audit during the first site visit, which could last a day.

The energy auditor or engineer should carry out the following duties during the first site visit:

- a. Go over the objectives of the energy audit with the site's top management.
- b. Go over the economic principles related to the audit's recommendations.
- c. Examine the key facts on energy use with the appropriate staff.
- d. Acquire site plans for buildings, steam distribution, compressed air distribution, electrical distribution, etc., if they are accessible.
- e. Go on a site tour with the engineering/production team.

B. The major goals of this visit are to:

- a. To identify the critical plant parts and energy-intensive locations that the audit needs to look at.
- b. To determine whether current equipment or more metering is required.
- c. To determine whether meters such as those for kWh, steam, oil, or gas need to be installed prior to the audit.
- d. To establish the equipment needed to carry out the audit.
- e. To create plans with deadlines.
- f. To compile thorough data on the facility's energy resources and key energy-consuming regions.



Fig -1: Flowchart for detailed energy audit

III.DEMAND RESPONSE

Demand response is a strategy that involves modifying electricity usage during periods of high demand, typically in response to signals from the grid operator or utility company. Energy audit, on the other hand, is a process of analyzing energy usage in a building or facility to identify opportunities for energy efficiency improvements.

Incorporating demand response into an energy audit can be beneficial in several ways. By analyzing electricity usage patterns and identifying peak demand periods, an energy audit can help to determine where demand response measures can be most effective. This may include identifying equipment or processes that can be temporarily shut down or adjusted during periods of high demand to reduce overall electricity usage.

In addition, an energy audit can help to identify opportunities for permanent energy efficiency improvements that can reduce overall electricity usage and make demand response measures more effective. For example, replacing inefficient lighting or HVAC systems with more efficient models can reduce overall electricity usage and make it easier to manage demand during peak periods.

Overall, combining demand response with an energy audit can help to reduce electricity usage, lower costs, and improve overall energy efficiency.

A. *EXPLORING THE RELATIONSHIP BETWEEN ENERGY EFFICIENCY AND DEMAND RESPONSE*

Energy efficiency and demand response are both important strategies for managing energy consumption and reducing costs. While they have different objectives and approaches, they are closely related and can complement each other when used together in an energy audit.

Energy efficiency measures aim to reduce overall energy consumption by improving the efficiency of equipment, appliances, and buildings. By reducing the amount of energy required to perform a given task, energy efficiency measures can help to lower energy costs and reduce greenhouse gas emissions.

Demand response, on the other hand, involves reducing electricity usage during periods of high demand, typically through voluntary or mandatory programs that offer incentives to customers who participate. By reducing peak demand, demand response can help to reduce the need for expensive peak generating capacity, which can help to lower overall energy costs and improve grid stability.

In an energy audit, the combination of energy efficiency and demand response measures can be utilized to achieve maximum energy savings and cost reduction. For example, an energy audit may identify opportunities for energy efficiency improvements that can reduce overall energy consumption and make it easier to manage demand during peak periods. By implementing these energy efficiency measures, it may be possible to reduce energy usage during peak periods and avoid or delay the need for demand response measures.

In addition, demand response measures can help to complement energy efficiency improvements by providing additional flexibility to manage peak demand. For example, if energy efficiency measures have already been implemented, but peak demand still exceeds available capacity, demand response measures can be used to further reduce electricity usage during peak periods.

The connection between energy efficiency and demand response is a mutually beneficial one, where both strategies reinforce each other to achieve the shared objective of minimizing energy usage and expenses. Incorporating both strategies into an energy audit can help to maximize the benefits of each and achieve the greatest possible energy savings.

B. *DEMAND SIDE MANAGEMENT*

Demand side management (DSM) is a strategy that aims to manage and control the demand for energy by consumers, with the goal of reducing overall energy consumption during periods of high demand. DSM is a crucial component of an energy audit as it can aid in recognizing possibilities for minimizing energy consumption during periods of high demand.

DSM strategies can include both energy efficiency measures and demand response measures. The primary objective of energy efficiency measures is to decrease the total energy usage by enhancing the efficiency of equipment, appliances, and buildings. These measures may include upgrading lighting systems, installing energy efficient HVAC systems, or implementing building automation systems to optimize energy usage.

Demand response measures involve reducing electricity usage during periods of high demand, typically through voluntary or mandatory programs that offer incentives to customers who participate. Demand response measures may include temporarily reducing energy usage, such as turning off non-essential equipment or shifting energy-intensive activities to off-peak hours.

An energy audit can help to identify opportunities for DSM by analyzing energy usage patterns and identifying peak demand periods. This analysis can help to determine where DSM measures can be most effective, such as identifying equipment or processes that can be temporarily shut down or adjusted during periods of high demand to reduce overall electricity usage.

DSM plays a vital role in an energy audit as it can assist in recognizing potential areas for reducing energy consumption and decreasing expenses through a blend of energy efficiency and demand response strategies. Incorporating DSM strategies into an energy audit can help to maximize energy savings and reduce greenhouse gas emissions while improving grid stability.

3.3. ZERO ENERGY BUILDING

A zero-energy building (ZEB) refers to a building that generates an equivalent amount of energy to what it consumes over the course of a year. Typically, energy efficiency initiatives and on-site generation of renewable energy are used in order to accomplish this. In an energy audit, a ZEB can be used as a benchmark to identify opportunities for improving energy efficiency and reducing energy consumption.

The first step in an energy audit of a building is to establish a baseline for energy consumption. This involves analyzing energy usage patterns and identifying areas where energy is being wasted or used inefficiently. After determining the baseline energy consumption of a building or facility, energy efficiency measures can then be identified and implemented to decrease energy usage.

In a ZEB, energy efficiency measures are typically the first line of defense for reducing energy consumption. These measures may include upgrading lighting systems, improving insulation, and installing energy-efficient HVAC systems. By reducing energy consumption through energy efficiency measures, it may be possible to offset the remaining energy needs through on-site renewable energy generation, such as solar panels or wind turbines.

In an energy audit, a zero-energy building (ZEB) can serve as a valuable reference point to identify areas where energy efficiency improvements can be made. By combining energy efficiency measures and on-site renewable energy generation, a ZEB can produce the same amount of energy that it consumes annually. Thus, implementing such measures can transform a building into a ZEB and significantly reduce its energy consumption.

IV. REVIEW OF DETAILED ENERGY AUDIT

We discovered crucial information about the existing industry during the energy audit. This graph illustrates the examination of the present industry's system. These graphs make it simple to understand the system in use in the present sector of industry. We performed a comprehensive energy audit on the industry utilizing various tools such as a power analyzer, digital multi-meter, tachometer, lux meter etc.

V. CONCLUSION

To conclude, an energy audit plays a crucial role in recognizing possibilities to decrease energy usage and expenses in various buildings. By analyzing energy consumption patterns and identifying areas where energy is being wasted or used inefficiently, an energy audit can help building owners and operators to implement energy efficiency measures and demand response strategies that can lead to significant energy savings.

Energy efficiency measures can include upgrades to equipment and systems, improvements to insulation, and the installation of energy-efficient lighting systems. Demand response strategies can involve temporarily reducing energy usage during periods of high demand, such as by turning off non-essential equipment or shifting energy-intensive activities to off-peak hours.

Conducting a comprehensive energy audit can offer building owners and operators beneficial insights into their energy usage patterns, which can help them identify areas for enhancing energy efficiency and lowering energy costs. The implementation of the energy savings plan can result in reduced energy consumption, cost savings on energy bills, and a contribution towards a sustainable future.

REFERENCES

- [1] Mr. Raturaj A. Mohite, Mrs. S.N. Chaphekar, "Energy Monitoring by Energy Audit and Supply Side Management"
- [2] Rajalakshmi, S., Kavitha, G. and Vinoth Kumar, D. 2021. Energy and Environment Management Audit. AkiNik Publishing, New Delhi, India
- [3] Singh, M., Singh, G. and Singh, H. 2012. Energy Audit: A case study to reduce lighting cost. Asian Journal of Computer Science and Information Technology
- [4] O. E. Atiba, U. K. Efemwenkiele, R. O. Olatunji, O. S. Ohunakin, D. S. Adelekan, and O. A. Oyeleke, "Walk through energy audit of an institutional building," Journal of Physics: Conference Series, vol. 1378, no. 3, Article ID 032051, 2019.



- [5] Energy management handbook, John Wiley and Sons - Wayne C. Turner
- [6] Mr. P.S. Magdum, Mr. S.R. Lokhande, Mr. P.M. Mhaskar, Mr. I.D. Pharne, “A case study : Energy audit at commercial and educational building”
- [7] Chandraia.V,Lakshmi P.B,Mahmood.V,(2010) Investment grading audit of pumping machinery at water treatment plant at mindi India
- [8] Suresh, Kumar. K.S (2001) Electrical energy conservation and auditing in plant electrical distribution systems India
- [9] C.Palanichamy, C.Nadarajan, P.Naveen, Natarajan sundar babu, and Dhanalakshmi ; “Budget constrained energy conservation – An experience with a Textile Industry



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