7.1.3-2
Energy Audit

REPORT OF ENERGY AUDIT

Submitted to

Date of Audit: 19-7-2021 (Monday)

Prepared by

SQC CERTIFICATION SERVICES PVT. LTD.

Contents

1. Introduction

An energy audit is a survey that looks at how an organisation uses its energy and looks for ways to conserve it. It refers to a method or system designed to lower the organization's energy consumption without lowering output. The audit offers recommendations for additional strategies and techniques for maximising energy savings. Traditionally, fossil fuels, water, and wind have been used to produce electrical energy. The availability of fossil fuels and their rate of depletion reinforce the need for alternative energy sources and electric energy conservation. Offering goods or services at the lowest cost and with the least amount of environmental impact is typically the main goal of an energy auditing and management of energy consumption (Backlund and Thollander, 2015). Energy audits are necessary to find areas for improvement, identify cost-saving opportunities, comprehend how fuel is used, where waste occurs, and identify potential savings.

To make sure that energy-saving practises are adopted and followed in educational institutions and the industrial sectors in a sustainable way, an energy audit is suggested and carried out. The audit process includes the creation and completion of a questionnaire, a physical inspection of the campus, the observation and analysis of documentation, key person interviews, data analysis, measurements, and suggestions. Energy audits take into account a variety of information, such as potential energy savings, energy management, alternative research, etc. In 2010 (Cabrera et al.) Given these details, the audit's specific goals are to evaluate the departments' adherence to relevant laws, policies, and standards as well as the effectiveness of the sustainability management and control system. It has the potential to have a significant impact on both the environmental impact and the organization's operational costs (Singh et al., 2012).

The Energy Conservation Building Code (ECBC), established in 2017, establishes minimum standards for the design and construction of energy-efficient buildings throughout India. Additionally, it offers two additional sets of incremental specifications that buildings must meet in order to achieve higher than necessary levels of energy efficiency (Gnanamangai et al., 2021). In an effort to implement energy-saving procedures in an organisation, the Bureau of Energy Efficiency (BEE) was established in 2002. Affixed to manufactured goods, energy-efficiency labels provide information about the products' energy efficiency (Ingle, 2014). BEE has created a system for labelling buildings' energy efficiency that coincides with their star ratings in an effort to speed up energy efficiency efforts. The BEE Star Rating Scheme is based on actual performance of the building and equipment in terms of specific energy usage referred to as "Energy Performance Indicator," by using star ratings labelled products used which will be helpful for energy savings in a sustainable manner (Mishraand and Patel, 2016).

Energy audit programmes assist in keeping a focus on changes in energy prices, the availability and efficiency of energy supplies, choosing an appropriate energy mix, identifying energy-saving technology, retrofitting for energy-saving equipment, and other issues. Generally speaking, an energy audit process focused on implementing conservation concepts by providing technically feasible solutions within a set timeframe.

while also taking into account organisational and economic issues (Asnani and Bhawana, 2015). Additionally, it discussed ways to find savings by lowering operating costs or the amount of energy used for each unit of output. It acts as a "benchmark" (reference point) for managing energy in the company and planning more energy-efficient use all around (Cabrera et al., 2010).

2. Need for an Energy Audit

Energy (both electrical and thermal), labour, and materials are frequently found to be the top three operating costs in any organisation. Energy would invariably rank as the highest manageable cost or potential cost saver in each of the aforementioned components, making the function of managing energy a strategic area for cost cutting. Understanding how energy and fuel are used in various industries will be made easier with the aid of an energy audit, which will also point out potential wasteful practises and areas for improvement. The energy audit would provide a helpful orientation for programmes that are essential for production and utility activities, such as reducing energy costs, preventive maintenance, and quality control. Such an audit programme will assist in maintaining focus on variations in energy costs, the availability and dependability of the energy supply, choosing the right energy mix, identifying energy-saving technologies, retrofitting for energy-saving equipment, etc. Energy audits generally involve providing technically feasible solutions with economic and other organisational considerations within a time frame in order to make conservation ideas a reality. Finding ways to lower operating costs or energy consumption per unit of output is the main goal of an energy audit. Energy audits serve as a "bench-mark" (Reference point) for managing energy within an organisation and also as the foundation for developing plans for more efficient use of energy across the board.

The idea of an eco-campus primarily focuses on sustainable energy use and conservation, as well as opportunities for savings. Additionally, it emphasises reducing carbon emissions, calculating carbon footprints, purchasing energy-efficient equipment for cost-effective and secure energy supply, promoting and enhancing energy conservation in all buildings, lowering the organization's energy use, lowering waste sent to landfills, and incorporating environmental considerations into all agreements and services deemed to have a significant environmental impact.

Studying auditing for energy management in terms of energy savings and opportunities is possible. Despite the fact that energy is generally invisible, we can observe its effects in the form of heat, light, and power, so we know it exists in wire, pipes, and other non-living materials.

Energy use, energy sources, energy monitoring, lighting, vehicle movement, electrical and electronic appliances, and transportation are all covered by this indicator.
Energy use is undoubtedly a crucial component of campus sustainability, so its inclusion in the assessment doesn't call for any justification. While energy is heavily used, opportunities for energy conservation may be taken into account. An energy-efficient light emitting diode (LED) uses less than 10W compared to an old incandescent (tungsten) bulb, which shows a positive trend towards energy savings. Energy auditing focuses on energy efficiency and

ways to cut back on its consumption that won't harm the environment. Following an audit, suggestions and recommendations may be made, which are then helpful for reducing energy use. Any organisation that cares about the environment must therefore regularly use both internal and external auditors to review its energy usage procedures.

Any organization's energy management strategy depends heavily on the conduct of energy audits using both internal and external energy auditors. In order to find better ways to manage the impact on the environment, it is able to measure the impact of energy potential within an

organisation. Measurements of the carbon footprint within the organisation based on the quantity of carbon emissions produced by the electrical appliances, vehicles, and human population may be attempted in addition to the audits of the organization's water, liquid, and solid wastes, biomedical and electronic wastes, energy potential, and biodiversity. It measures the amount of carbon dioxide equivalents that are exhaled by the company that performs the carbon accounting. It is important to understand how much the organisation is doing in terms of energy management to support sustainable development. Therefore, it is advised that stakeholders measure each organization's carbon footprint in order to help keep the campus environmentally friendly.

3. Aims and Objectives of an Energy Audit

An effective tool for creating and implementing an organization's comprehensive energy management plans is an energy audit. A systematic identification of energy efficiency, conservation, and savings opportunities at the audit sites' premises is the goal of an energy audit. The auditing procedure is carried out in accordance with the next.

- Examining the energy-saving strategies and opportunities put in place at the audit sites.
- The discovery of additional energy-saving opportunities and conservation measures.
- The use of alternative energy sources to help with energy management decisions and energy-saving opportunities.
- Giving technical instructions on how to create an energy balance as well as advice on where to look for it for specific applications.
- A thorough examination of the methodology used to calculate energy consumption, examination of the campus' most recent electricity bill, and comprehension of the tariff plan offered by the State Electricity Board and the federal government.
- List the different ways that energy is used, including electricity, LPG, firewood, gasoline, diesel, and electric stoves, kettles, and microwaves.
- Analysis of the cost of the last two to three years' worth of electricity bills, the cost of LPG cylinders for the previous year, and the cost of water used for human consumption and plant watering.
- Utilization of tungsten (incandescent) and CFL (compact fluorescent) bulbs, fans, air conditioners, cooling devices, heaters, computers, photo copiers, inverters, generators, and laboratory apparatus and equipment installed in the organisation (for instance, a 60 watt bulb multiplied by four hours by the quantity of bulbs equals kwh).
- The organisation uses or has installed alternative energy sources or nontraditional energy sources (photovoltaic cells for solar energy, windmill, energy efficient stoves, Biogas, etc.).
- Raising awareness of energy usage and conservation among stakeholders.

4. Benefits of an Energy Audit

Reduced Energy Costs: The most obvious advantage is that the Organization will spend less money on energy costs the less energy it consumes.

Identifying issues with the equipment can also be done with the aid of an energy audit. The auditor might, for instance, discover tiny leaks in the compressed air system. If these leaks go unnoticed, they could end up costing a lot of money. Additionally, auditors can spot harmful health risks like carbon monoxide emissions from defectively vented equipment. The company will be able to quickly address these kinds of problems with a routine energy audit, ensuring the workers' health and safety.

Greater Employee Comfort: The Organization might learn during the audit about modifications made to the insulation and air sealing. The completion of these improvements will contribute to

the creation of a more dependable and efficiently heated or cooled workspace for the employees. Because more contented workers are typically more productive, the organisation will not only save money on energy but also potentially improve general health.
Personalized Recommendations: Talking to an energy expert can be a great way to learn about the latest energy-saving innovations. The expert will create a plan specifically for you and suggest the upgrades that will yield the highest ROI. These could include new HVAC equipment, updated lighting systems, weatherization techniques like air sealing and insulation, and more. While some of the suggestions may come at a high initial cost, many of them will quickly pay for themselves through significantly lower energy costs.

Demonstrate Environmental Concern: By taking steps to become more energy efficient, the Organization will demonstrate to its staff and customers that it is concerned about how its actions will affect the environment.
Enhanced Property Value: Making a facility more energy efficient in accordance with an energy auditor's recommendations may also help to raise its market value. A higher property value is a result of things like solar panels, high-efficiency LED lighting, and weatherization measures.
Longer Equipment Lifespan: For maximum energy savings, an energy auditor might advise updating some of the equipment. If the Organization decides to upgrade, it will save money on energy costs and get longer-lasting equipment as well. This is because newer, more energy-efficient equipment doesn't need to work as hard to provide the same level of performance as older, out-of-date units.
Energy audits will evaluate the Organization "as a whole," with the objective being to take into account a wide array of potential alternatives rather than just one or two (Electrical, Mechanical, Envelope and Water).
Opportunities from the energy audit will be disclosed. In addition, information with a financial analysis will be provided. Prioritization based on monetary gain and return on investment will then be possible. It gives technical details about the suggested energy-saving measures.
Energy audit quality analysis: A high-quality audit will use statistical techniques to analyse historical energy use and identify potential problems. To better understand the environmental advantages of the decisions, provide information with emissions analysis. Recognize where your energy goes and what needs the most of your attention. Give benchmark data so that we can compare our energy use performance to others.

5. Procedures followed in an Energy Audit

 Several techniques are used in the audit sites where walk-through audits are conducted to conduct energy audits. It is taken into account to balance the total energy inputs with the total energy outputs and to identify all energy streams in a facility. Each of its energy streams' individual energy consumption is calculated using the method outlined in the Manual of Gnanamangai et al (2021). Energy (both electrical and thermal), labour, and materials are typically observed to be the organization's top three operating costs. Physical inspections of lighting, ceiling, table, and exhaust fans, air conditioners, solar panels, heaters, generators, uninterruptible power supply devices, and ventilator load fixtures are performed during the audit, as well as capacity checks of installed energy-efficient systems. Energy always wins when the cost or potential cost savings for each of the aforementioned components are taken into account, making the task of managing energy a crucial area for cost reduction. The energy audit helped the organisation to gain a better understanding of how energy and fuel are used, as well as to identify wasteful practises and future development potential for energy-saving opportunities. The energy audit included recommendations for cutting energy costs, preventive

maintenance, and quality control activities after the audit process, all of which are crucial for the utility operations in the auditee (Organization).

The audit involved physically inspecting the installed loads and sources on campus. The entire campus is divided into various sections, each of which is audited to check the electrical fixtures and energy supply. Both the production process flow and electricity usage are examined. According to Indian Green Building Council (IGBC, 2021) and World Green Building Council regulations, the locations of the electrical machines, as well as their conditions and accessories, are physically verified (WGBC, 2021). The utility provider's energy bill is audited and evaluated for load demand requirements and energy efficiency (for instance, Tamil Nadu Electric Generation and Distribution Corporation Limited, Chennai). During the audit, stakeholders are involved in discussions about the areas for improvement and energy management. Potential areas have been identified and recommended to the Organization for implementation in terms of the scope of energy conservation and saving opportunities available in the current context. A portable CO2 analyzer may be used to measure the amount of carbon dioxide in various locations around the organization's campus in order to determine the carbon footprint. Look for areas with high carbon emission levels that could be considered for reduction.

The audit entails going to the actual location of the load and taking an inventory of the load. The electrical load on the circuit and the equipment is properly measured. The TNEB energy bill is audited and examined for KWH requirements and energy usage efficiency. In order to conduct an effective and result-oriented energy audit, various positions interact, become familiar with energy audits, and participate. Opportunities for energy conservation and savings are found during round and measurement for implementation.

6. Types of Energy Audit

The function and nature of the industry, the depth to which the final audit is required, and the potential and scope of the desired cost reduction determine the type of energy audit that should be conducted.

Thus, there are two categories into which energy audits can be divided.
Energy audits are divided into four categories: preliminary, detailed, potential, and comprehensive.

Methodology for a preliminary energy audit
A preliminary energy audit is a quick exercise to: establish the organization's energy consumption; estimate the scope for savings; identify the areas most likely to benefit from attention; identify immediate improvements or cost savings; establish a "reference point;" and identify areas that merit more in-depth investigation or measurement. Preliminary energy audits use readily available data.

Methodology for Detailed Energy Audits
Since it assesses all significant energy-using systems, a thorough audit offers a facility a detailed plan for implementing an energy project. The most accurate estimate of energy savings and costs is provided by this kind of audit. It accounts for the energy consumption of all significant equipment, takes into account the interactive effects of every project, and provides thorough calculations for energy cost savings and project costs. The energy balance is one of the crucial components of a thorough audit. This is based on calculations of energy use,

an inventory of systems that use energy, and assumptions about how things operate right now. The charges on a utility bill are then compared to this estimated use. A thorough energy audit is completed in three stages: I, II, and III phases.
Pre-audit phase of Phase I Audit Phase, Phase II Post-audit phase of Phase III

Energy Audit Potential and Amount
For effective operation, an energy audit must be performed using a structured methodology. It is always advisable to conduct a preliminary site assessment because the planning of the audit's required procedures is of utmost importance.
Preparation for Detailed Auditing Requires an Initial Site Visit
An initial site visit may last for one day and provides the Energy Auditor/Engineer with the chance to get to know the relevant personnel, become familiar with the location, and assess the procedures required to conduct the energy audit.
The Energy Auditor/Engineer should perform the following tasks during the initial site visit: - • Go over the objectives of the energy audit with the site's senior management.
• Go over the economic principles related to the audit's recommendations.
• Examine the key data on energy consumption with the appropriate personnel.
• Obtain site plans for buildings, steam distribution, compressed air distribution, electricity distribution, etc., if they are available.
• Go on a site tour with the engineering/production team.

This visit's primary goals are to: • Establish the Energy Audit team; and • Identify the key energy-consuming areas that will be examined during the audit.
• To determine whether any additional metering or existing instrumentation is needed.
• To determine whether any metres, such as kWh, steam, oil, or gas metres, need to be installed before the audit.
• To determine the equipment needed to conduct the audit.
• To make time-sensitive plans.
• To compile large-scale data on significant energy-consuming centres
• To raise awareness through events or other programmes.

Detailed Energy Audit
The length of a thorough audit can range from several weeks to several months, depending on the nature and complexity of the site. The establishment and investigation of energy and material balances for particular plant departments or pieces of process equipment is done in-depth studies.

To make sure nothing is missed, checks of plant operations are made whenever possible over long periods of time, including nights, weekends, and regular working hours.

The audit report will evaluate the effectiveness of each step the Organization takes, as well as a description of energy inputs and product outputs by major department or by major processing function. The ways to increase these efficiencies will be listed, and at the very least, a rough estimate of the cost of the improvements will be made to show the anticipated return on any necessary capital investment. In the audit report's conclusion, specific suggestions for thorough engineering studies and feasibility analyses should be made. These studies must then be carried out to support the implementation of those conservation measures that demand financial investments. The comprehensive energy audit may be helpful in determining the consuming

areas to be examined during the audit and any necessary additional metering or existing instrumentation. It is important to take care to determine the equipment needed for the audit and to plan with a timeline that includes the collection of macro data on the major energy-consuming centres. There is no doubt that it will help with energy management and opportunities for energy savings.

The following data will be gathered during the thorough audit: 1. Energy consumption by energy type, department, major process equipment, and end-use
2. Data on energy prices and tariffs
3. Creating and providing site services (eg. compressed air, steam).
4. Energy supply sources (e.g. electricity from the grid or self-generation)
5. Possibilities for process changes, fuel substitutions, and the use of co-generation systems (combined heat and power generation).
6. The establishment's internal training programmes on energy awareness and energy management.

- To determine consumption patterns, it is helpful to review baseline data and reports.
- The audit team should gather the following baseline information:
- Information on the technology, processes, and equipment used;
- Capacity utilisation;
- Water consumption;
- Fuel consumption;
- Electrical energy consumption;
- Steam consumption; and
- Efficiencies / yield.

7. Carbon footprint by measuring Carbon dioxide level in the Campus

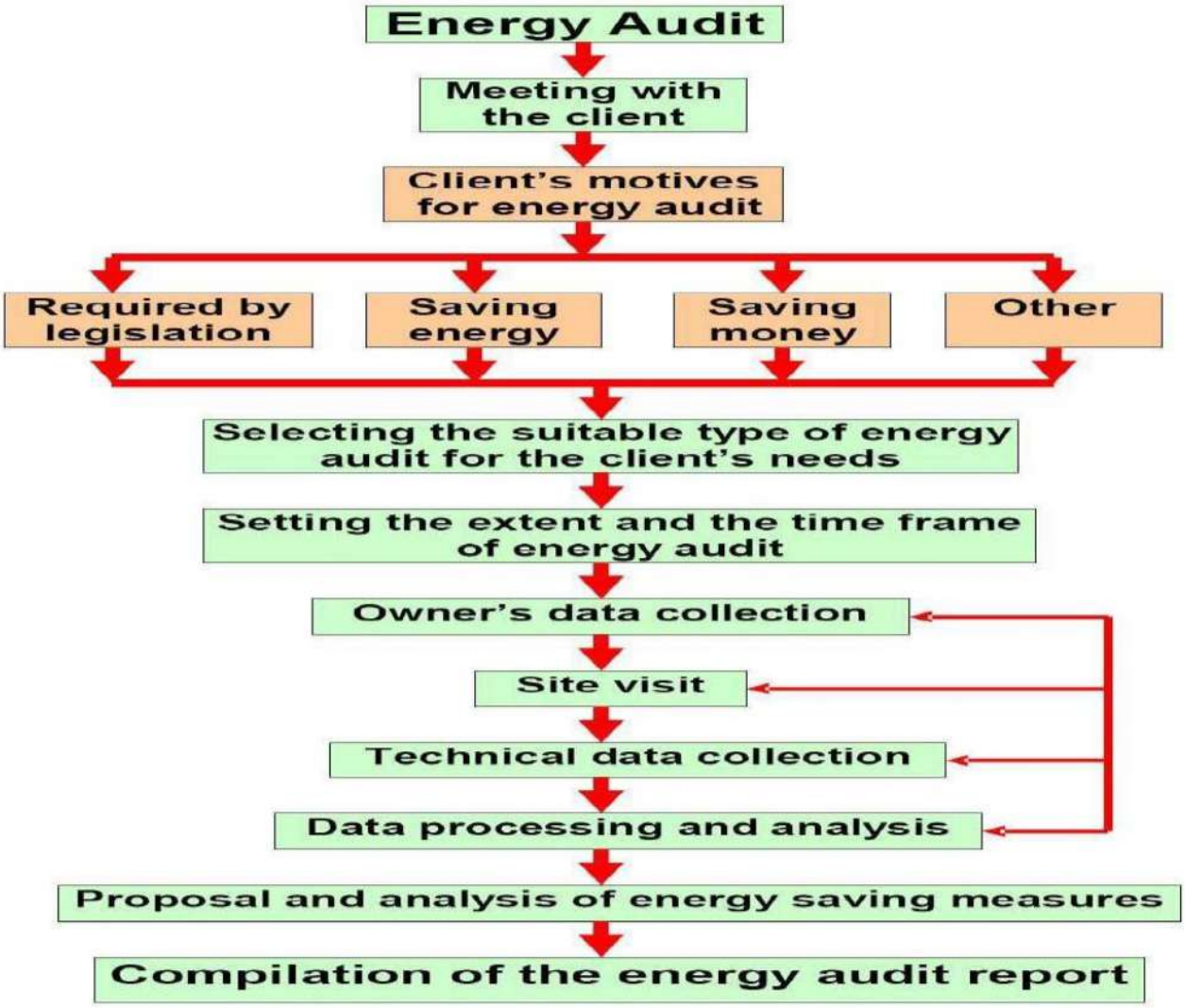
A portable CO2 Analyzer is used to measure the amount of carbon dioxide in various locations around the organization's campus (Non dispersive infra-red meter). The atmospheric temperature, relative humidity, and dew point readings are also shown on the CO2 metre in the locations where the CO2 level is measured. After being turned ON, the metre began measuring the amount of CO2 in the atmosphere and updated the readings every second on the display.

If the operating environment is changed (for instance, from high to low temperature), the CO2 sensor will respond in 30 seconds and the relative humidity sensor will respond in 30 minutes. When the CO2 concentration exceeds the predetermined limit, the metre has an audible alarm that issues a warning. When the CO2 level exceeds the preset value, it emits beeps (roughly 80 dB) and stops when any key (other than SET) is depressed or the readings drop below the preset levels.

The annual carbon footprint is calculated (www.carbonfootprint.com) based on electricity consumption, which results in CO2 emissions from electricity, and the total amount of transportation per year, including the number of shuttle buses the organisation operates as well as the number of cars, motorcycles, and trucks that enter its campus. To determine the amount of CO2 emitted in metric tonnes per year, these variables are multiplied by the overall number of trips made each day and the approximate distance travelled by vehicles each day with a coefficient of (0.01).

The burning of fossil fuels, deforestation, and the production of cement are all human-related factors that increase carbon dioxide emissions. The industries that use coal, oil, and natural gas release the most methane (CH4). Almost all of the rise in greenhouse gases in the atmosphere over the past 150 years can be attributed to human activity. Burning fossil fuels for transportation, heat, and electricity is the main cause of human-related greenhouse gas emissions.

The Methodology of the Audit is presented in the following chart:



Flow chart of Energy Audit Methodology

Calculating Carbon footprint

Energy Audit Process

Energy audit is a sequence of tasks performed in a planned manner. It requires discussion, survey, collection of data, analysis, and reporting.

8.1 Steps involved in an Energy Audit

Step 1: Opening meeting among the audit team and auditees
Step 2: Planning and organizing the energy audit
Step 3: Conduct a walk-through audit at different sites
Step 4: Macro data collection and observation
Step 5: Analysis of data collected from the Organization
Step 6: Best practices followed in the Organization towards energy savings
Step 7: Recommendations for further improvement
Step 8: Exit meeting after the audit to discuss about the audit findings

8.2 Systems studied during the Energy Audit

- Physical verification of lighting, fan a/c machines, ventilators load fixtures.
- Verification of installed energy efficient systems.
- Inspection of Solar panel, Generators, Uninterrupted power supply machines.
- Inspect and verify the maintenance aspects of installed Generators and additional backup power sources.
- Analyse the electricity consumption through the supply utility company (Example: Tamil Nadu Electric Generation and Distribution Corporation Limited, Chennai).

- Review the potential usage of alternative energy resources.
- Review the energy conservation awareness among the stakeholders for optimum use of electricity and its savings.

8.3 Planning and organizing the Energy Audit

Planning and organizing are the integral part of the energy audit. An initial visit to the audit sites is organized and the areas to be inspected are listed. Following the listing, information on the energy consumption of various blocks in the recent past is obtained, and a planned analysis is carried out.

8.4 Walk-through Audit Process

Simple audit, screening audit or visual audit are the other names, by which walk-through audits are addressed. The main purpose of the walk-through audit is to obtain general information about the sites in which electrical energy is being used at the maximum. More specific information have been obtained from the maintenance and operational people during the time walk-through audit. It also included a walk-through of the facility to become familiar with the building's operation and a brief evaluation of facility utility bills (amount paid for electricity) and other operating data. During the audit the primary problem areas are discovered.

8.5 Macro Data collection and observation

Current level operation and practices within the campus are assessed and then the data regarding the number of electrical loads connected in each section are collected. The power ratings of each component and their respective hours of operation are also observed and documented for preparing the recommendations to the Organization.

8.6 Measurements in the Energy Audit process

An energy audit required measurements, such as the energy identification and quantification, and these quantities necessitate the instruments used in a consistent way. Some of the basic electrical parameters are monitored during the energy audit such as Voltage (V), Current (I), Power factor, active power (Kw), apparent power (demand in Kva), reactive power (Kvar), energy consumption (Kwh), frequency (Hz), harmonics, illumination level, etc. Temperature and heat flow, radiation, air and gas flow, liquid flow, speed, air velocity, noise and vibration, dust concentration, TDS, Ph, moisture content, relative humidity, flue gas analysis – CO_2, O_2, CO, SO_x, NO_x, combustion efficiency are the mechanical, thermal and other parameters that are analysed during the audit depending upon the requirements.

9. About the Institution

Unity college is established in 2007 and run by Samaikya Education Society. Campus is surrounded with a serene ambience with play ground and well built infrastructure with 50,000 Square feet area at main campus and Unity Corporate at city campus. Unity College emerged with the need of emerging Indian economy, the best practices of management would be rendered to future leaders. Unity College aims to provide the best global exposure to its future students with cost effective investments.Our aim ideology is to reach million students who have hidden talent to grow but cannot afford high investment global exposure education.

The college is housed in magnificently built buildings with all infrastructural facilities within a lush green campus. Since its inception, it has slowly established itself as a prime destination for high-quality education.The strength of the institute lies in its modern classrooms, well-equipped laboratories and trained faculty. It is affiliated to JNTU Hyderabad. It believes in all-round development of its students and faculty members and leaves no stone unturned to ensure that the best of facilities is provided for the same.

The campus boasts of the following unique facilities to make Happen:

- Spacious playgrounds
- Canteen for the use of day scholars and staff
- Transport facilities for students and staff
- Secure campus with widespread CCTV coverage
- Medical facilities for boarders
- A 200+ seater auditorium
- Excellent computing facilities with Internet and Wi-Fi

Vision of the Institute

To emerge as a global leader in imparting quality technical education emphasizing ethical values for the betterment of the society.

Mission of the Institute

- To create an excellent teaching learning environment and inculcate the aptitude for research.
- To establish centers of excellence through collaborative initiatives.
- To empower the student community by developing creativity and innovation.

Quality Policy:

We are committed to provide uncompromising quality education in a conducive environment through effective teaching learning process transforming students into competentprofessionals.

Accreditations & Affiliation

10.Audit Details

Date/Day of Audit	:	19.07.2021 (Monday)
Venue of Audit	:	Unity College of |Pharmacy
Audited by	:	Mr.Shivam Sharma.
Audit type	:	Energy Audit
Name of Lead Auditor	:	Mr. Pramod Yadav


GPS Map Camera
Rayagiri Rural, Telangana, India
Unnamed Road, Rayagiri Rural, Telangana 508116, India
Lat 17.534707°
Long 78.945941°
Google


GPS Map Camera
Rayagiri Rural, Telangana, India
Unnamed Road, Rayagiri Rural, Telangana 508116, India
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02/12/23 11:47 AM GMT +05:30
Google


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Long 78.946147°
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Long 78.946065°
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11. Observations of the Energy Audit

11.1 Facilities visited during the Energy Audit

Date	Section where Energy Audit is conducted
19.07.2021	Administrative Block
	Faculty Rooms
	Classrooms
	Seminar Halls
	Auditorium
	Laboratories
	Computer Centers
	Well, Sump and pumps.
	Library

In the sections, the services offered are monitored, verified and analyzed on the aspects of energy consumption. In all these areas lighting systems forms the major consumer of electrical energy. Three phase electricity service connections available in the campus are provided by Telangana State Southern Power Distribution Corporation Limited. The electricity consumption charges are audited and studied for the load demand requirement and efficient consumption of energy. Stakeholders are interacted and the scope for improvement has been discussed. Potential areas in which scope of energy conservation and saving opportunities available have been identified and suggested for implementation.

11.2 Systems Studied during the Energy Audit

1. Lighting fixtures were verified physically.
2. Installation of energy efficient lighting systems were verified.
3. Installation of safety systems were verified
4. Installation of power backup systems (generators and UPS) were verified on the aspect of maintenance and consumption.
5. Electricity consumption through the TSSPDCL bills was analyzed.
6. The energy conservation awareness among the stakeholders for optimum use of electricity and its savings were reviewed.

11.3 Energy cost profile

Average energy consumption per stakeholder per month: 1.56 kWh.

11.4 Power supply Equipment and Major Loads

Sanctioned MD : 100 kW
Transformer : 125 kVA
Generator : 100 kVA + 63.11 kVA

Table 1. Major Equipment related to Electrical energy utilization

S.No	Equipment/ Utility	Rating/ Capacity	Quantity
1.	Tube Lights	42W	32
2.	LED Bulbs	25W	496
3.	Fan (Ceiling, Pedestal and Table fan)	1200W	357
4.			
5.	UPS	12KVA	12
6.			
7.	LCD projector	20W	120
8.	Refrigerators	(1-5Star rated)	1
9.	AC (Split, Window and Centralized AC)		10
	Principal room	2T	1
	Server	2T	1
	Computer lab	4T	6
10.	RO Water Facility	1200Lit	1

11.4 Measurement of Carbon dioxide level in the Campus

Despite a massive increase in global warming, environmental changes and human population including many commercial activities now-a-days, the amount of carbon in Earth's atmosphere is playing an important role which act as a global indicator for checking the purity of the atmosphere. Using a portable CO_2 Analyzer, the level of carbon dioxide was measured in different places across Princeton Institute of Engineering and Technology for Womencampus. The observation showed that the concentration of CO_2 in the atmosphere is found to be low which did not exceeds the critical limit of CO_2. It is further revealed that all the selected locations are having pure air with good airexchange which are free from pollutants (Table 6).

Carbon footprint, amount of CO_2 emissions associated with all the activities of the College or other entities like building construction and anthropogenic activity by human beings includes direct emissions, such as those that result from fossil-fuel combustion in manufacturing, heating, and transportation, as well as emissions required to produce the electricity associated with goods and services consumed. In addition, the carbon footprint concept also often included the emissions of other greenhouse gases.

11.5

Table Measurement of CO_2 Concentration in the Campus

S.No.	Different locations of the Organization's campus	Carbon dioxide level (ppm)	Remarks
1.	Class Room 1	560	CO_2 level is low
2.	Smart Classroom	480	CO_2 level is low
3.	Ladies Staff Room	620	CO_2 level is low
4.	Library	350	CO_2 level is low
5.	Computer Science Lab	750	CO_2 level is low
6.	Bio-Chemistry Lab	452	CO_2 level is low
7.	Office	534	CO_2 level is low
8.	Conference Hall	630	CO_2 level is low
9.	Chemistry Lab	525	CO_2 level is low
10.	Class Room 2	354	CO_2 level is low
11.	Catering Lab	600	CO_2 level is low
12.	Parking	625	CO_2 level is low

Reference of Set values of CO_2 level

- 350-1000 ppm: Typical level found in occupied spaces with good air exchange along with pure air.
- 1000-2000 ppm: Moderate level associated with complaints of drowsiness and poor air quality.
- 2000-5000 ppm: Critical level associated with headaches, sleepiness, and stagnant, stale, stuffy air. Poor concentration, loss of attention, increased heart rate and slight nausea may present.

Calculation of Carbon Footprint in the college with respect to electricity usage

The Carbon footprint calculation can be conducted based on the stage of calculation as stated in www.carbonfootprint.com, which is the sum of electricity usage per year.

The CO_2 emission from electricity
= (electricity usage per year in kWh/1000) x 0.84
= (4304668.8kWh/1000) x 0.84
= 3615.92 metric tons

Notes:

Electricity usage per year = 4304668.8 kWh
0.84 is the coefficient to convert kWh to metric tons.

11.6 Ways to reduce Carbon Footprint

Understanding the carbon footprint can help limit the impact of your consumptionon the environment. Small changes can make a big difference in the long run, for example when it comes to transportation, food, clothing, waste, etc. Here are some tips:

Food

- Consume local and seasonal products.
- Limit meat consumption, espceially beef.
- Select fish from sustainable fishing.
- Bring reusable shopping bags and avoid products with excessive plastic packaging
- Make sure to buy only what you need, to avoid waste

Clothing

- Take good care of your clothes
- Try swapping, borrowing, renting or buying second-hand
- Buy responsibly-made clothes, e.g. made from recycled material or with an eco-label

Transport

- Cycle or use public transport
- Be smart about when and how you drive

Energy and waste

- Turn down the heating by 1°, it will already make a difference
- Take short showers
- Turn off the water while you brush your teeth or clean the dishes
- Unplug your electronic equipment and don't leave your phone on charge when the battery is already full
- Select energy efficient products with an "A" label (EU Energy label)
- Limit and recycle your waste.

12 . Best Practices followed in the Organization

- Transformer, Generators and UPS are protected properly with fencing and kept awareness boards on 'Dangers' and 'Warnings'.
- Most of places, sign board of 'Switch ON' and 'Switch OFF' are kept towards saving energy measures to the stakeholders.
- Electrical wires, switch boxes and stabilizers are properly covered without any damage which will cause any problems to the staff and student members.
- Installed roof top solar power plant.
- Solar Water heaters are installed and they are functioning well.
- LED lights and Solar street lights are used.
- Installed automatic switches with sensors.
- Water level controllers are used.
- Power factor is maintained near to unity with APFC.
- STP is used for water recycling which is functioning well.
- VFDs based Lift and ACs.
- Replaced old generation computers and TVs with LED monitors.
- Availability of e-vehicle inside the campus.
- Adopted Sprinkler Irrigation.
- Use of few star rated equipment

13.Recommendations for improving the energy efficiency and energy conservation in the Organization

The energy audit included suggestions for energy cost reduction, preventive maintenance and quality control activities, all of which are critical for utility operation in the audit sites.

- Procurement of equipment with energy efficiency (4-5 star rated equipment) during replacement may be considered.
- Sub meters in all the buildings for energy monitoring is recommended so that energy load required and energy consumption in each building may be noted.
- Optimal water usage and temperature settings may be used which are coming under automatic process towards energy savings.
- Continuous monitoring and analysis of energy consumption by dedicated team may be planned within the campus.
- Promoting ECON awareness and practice among the stakeholders may be conducted periodical through Association, Clubs, Forums and Chapters.
- Turn off electrical equipment when not in use
- Maintain appliances and replace old appliances in all laboratories.
- Use computers and electronic equipment in power saving mode.
- Installation of Biogas plant for hostel kitchen as well canteen.
- Automatic switches with occupancy sensors in common areas

- Monthly use of electricity in the College is very high which may be reduce to a greater extent by means of undertaking a periodical energy audit.
- There are fans of older generation and non-energy efficient which can be phase out by replacing with new energy efficient fans.
- Regular monitoring of equipment in all laboratories and immediate rectification of any problems.
- Value added / Non-formal / Certificate / Diploma course on 'Energy and Environment Management Audits' may be conducted for the benefit of students andresearch scholars to become a certified Lead Auditor.

14 Recommendations on Carbon Footprint in the Organization

- Establish a more efficient cooking system to save gas in hostel kitchen and canteen.
- More use of generators, inverters and UPS every day should be discouraged.
- Switch off the lights, fan, air conditioners, equipment and instruments when they are not in use.
- Large number of ventilation and exhaust systems may be placed in auditorium, seminar and conference halls to reduce the carbon dioxide level among the participating students, scholars and staff members.

15.Conclusions

Given that the organisation has been around for a while and has a good reputation, there is a lot of room to save energy and make the campus as self-sufficient as possible. The institution has implemented significant energy conservation measures. The institution employs energy-efficient lighting designs, raises stakeholder awareness, and uses necessary power backups. The company adheres to some best practises for energy auditing, such as properly securing transformers, generators, and UPS units with fencing and maintaining warning and cautionary signs. It has been noted that most locations have signs that read "Switch ON" and "Switch OFF" to encourage stakeholders to conserve energy. Electrical wires, switch boxes, and stabilisers are all properly covered and free from any damage that might endanger staff or students. Sprinkler irrigation modifications on campus that reduce energy potential are greatly appreciated. A few additional suggestions can help the Organization save even more energy. The stakeholders may benefit from a prosperous future in terms of an energy-efficient campus, as well as a sustainable environment and community development, in the years to come.