REPORT OF ENERGY AUDIT

Submitted to

M.A.M. SCHOOL OF ENGINEERING, SIRUGANUR, TIRUCHIRAPPALLI – 621 105, TAMIL NADU

Date of Audit: 22.04.2020

Submitted by

NATURE SCIENCE FOUNDATION
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Contents

1. Introduction

An energy audit is a survey in which the study of energy flows for the purpose of conservation is examined at an Organization. It refers to a technique or system that seeks to reduce the amount of energy used in the Organization without impacting the output. The audit includes suggestions of alternative means and methods for achieving energy savings to a greater extend. Conventionally, electrical energy is generated by means of fossil fuels, hydraulic and wind. The availability of fossil fuels and their depletion rate, insist the need for alternate energy systems and conservation of electric energy. In general, the primary objective of an energy auditing and management of energy consumption is to offer goods or services at the lowest possible cost and with the least amount of environmental impact (Backlund and Thollander, 2015). The need for an energy audit is to identify the savings potential and cost reducing methods, understand the ways in which fuel is used, where, the waste occurs and find the scope for improvement.

An energy audit is proposed and conducted to ensure that energy saving practices are implemented and followed in Educational Institutions and Industrial sectors in a sustainable way. Preparation and completion of a questionnaire, physical examination of the campus, observation and examination of documentation, key person interviews, data analysis, measurements and suggestions are all part of the audit process. Energy audit involves several facts including energy savings potential, energy management, finding alternatives, etc. (Cabrera *et al*., 2010) With these facts in mind, the audit's specific objectives are to assess the competence of the sustainability management and control system, as well as the departments' compliance with applicable rules, policies, and standards. It has the potential to have a significant influence on the organization's operational cost as well as the environmental impact (Singh *et al*., 2012).

Energy Conservation Building Code (ECBC) is established in the year 2017 which provides minimum requirements for the energy-efficient design and construction of buildings across India. It also provides two additional sets of incremental requirements for buildings to achieve enhanced levels of energy efficiency that go beyond the minimum requirements (Gnanamangai *et al*., 2021). Bureau of Energy Efficiency (BEE) came into force in 2002 towards implementation of energy saving practices in an Organization. Energy-efficiency labels are information affixed to manufactured products and usually communicate the product energy performance (Ingle, 2014). BEE has developed a scheme for energy efficiency labelling of buildings coinciding with the star ratings of the building at accelerating energy efficiency activities. BEE Star Rating Scheme is based on actual performance of the building as well as equipment in terms of specific energy usage termed as 'Energy Performance Indicator' by means of star ratings labelled items used which will be useful for energy savings in a sustainable manner (Mishraand and Patel, 2016).

Energy audit programme provide aid in maintaining a focus on energy price variations, energy supply availability and efficiency, determining an appropriate energy mix, identifying energy-saving technology, retrofitting for energy-saving equipment and so on. In general, an energy audit process dealt with the driving conservation concepts into reality by giving technically possible solutions within a specified time

limit while also considering the economic and other organizational issues (Asnani and Bhawana, 2015). It also dealt with the uncover ways to cut operating expenses or reduce energy use per unit of production in terms of savings. It serves as a "benchmark" (reference point) for managing energy in the organization for planning more energy-efficient use across the board (Cabrera *et al*., 2010).

2. Need for an Energy Audit

In an organization, the top three operating expenses are energy labour and materials. Relating the manageability of the cost or potential cost savings in each of the above components, energy management is found to be the top ranker, and thus energy management constitutes the essential part in reducing the cost. Energy Audit helps in understanding the ways energy and fuel are being used in any organization, and identifies the areas where wastes occur and the scope for improvement exists. The Energy Audit gives a positive orientation to the energy cost reduction, preventive maintenance quality control programmes and will help to keep focus on variations which occur in the energy costs, availability, and reliability of supply of energy. The main objective of Energy Audit is to find ways to reduce energy consumption per unit of product output. The Energy Audit provides a "bench-mark" (Reference point) and a basic planning for managing energy and for more effective use of energy throughout the organization.

The Ecofriendly-campus concept essentially focuses on the efficient use of energy conservation and its savings opportunities in a sustainable way. It also gives importance for reduction of contribution to carbon emissions, carbon footprint calculation, use of star rated equipment, encouraging energy use conservation practices in all buildings, reduce the organization's energy consumption, reduce wastes to landfill, and integrating environmental considerations into all contracts and services considered to have significant environmental impacts.

Auditing for Energy Management may be studied in terms of energy savings and opportunities. In general, energy cannot be seen, but we know it is there in wire, pipes and other non-living materials because it shows visible effects in the forms of heat, light and power. The energy consumption, energy sources, energy monitoring, lighting, vehicle movement, electrical and electronics appliances, and transportation are addressed by this indicator. Energy usage is an important aspect of campus sustainability and requires no explanation for its inclusion in the assessment. However, energy saving, and opportunities may be taken into consideration while energy is extensively used. An old incandescent bulb uses approximately 50W to 100W while an energy efficient LED uses only less than 10W which shows the positive indication on energy savings. Energy auditing deals with the conservation methods to reduce its consumption related to environmental degradation. In addition, suggestions and recommendations might be given after auditing which in turn useful for energy savings. Thus it is essential for any environmentally responsible institution to examine its energy use practices at least once in two or three years using internal and external auditors.

The conduct of energy audit using internal and external energy auditors is playing important role in any organization in terms of energy management. The Energy

audit is able to measure the impact of energy potential in an organization so that it helps in determining the better ways to manage the impact on environment. In addition to liquid and solid wastes, biomedical and electronic wastes energy potential and biodiversity audits, attempts may be made to measure the carbon footprint in the organization based on the amount of carbon emissions created by the electrical appliances, vehicles, and human population. It takes into consideration the measure of bulk of CO_2 equivalents exhaled by the organization by which the carbon footprint accounting is done. It is necessary to know how much the organization is contributing towards sustainable development in terms of energy management is being done. It is therefore recommended to measure the carbon footprint in each organization which may be useful for maintaining the ecofriendly campus to the stakeholders.

3. Aims and Objectives of an Energy Audit

An energy audit is a useful tool for developing and implementing comprehensive energy management plans of an organization. The aim of an energy audit is to identify the energy efficiency, conservation, and savings opportunities at the premises of the audit sites in a systematic manner. The audit process is carried out as per the following.

- Review of energy saving opportunities and measures implemented in the audit sites.
- Identification of additional various energy conservation measures and saving opportunities.
- Implementation of alternative energy resources for energy saving opportunities and decision making in the field of energy management.
- Providing a technical information on how to build an energy balance as well as guidance to be sought for particular applications.
- Detailed analysis on the calculation of energy consumption, analysis of latest electricity bill of the campus, understanding the tariff plan provided by the central and State Electricity Board.
- List ways that the use of energy in terms of electricity, electric stove, kettle, microwave, LPG, firewood, Petrol, diesel and others.
- Analysis of electricity bill amount for the last two to three years, amount paid for LPG cylinders for last one year and amount paid for water consumption for human beings and watering to the plants.
- Use of incandescent (tungsten) bulb and CFL bulbs, fans, air conditioners, cooling apparatus, heaters, computers, photo copiers, inverter, generators and laboratory equipment and instruments installed in the organization (for example- 60 watt bulb x 6hours x number of bulbs = kwh).
- Alternative energy sources / nonconventional energy sources are employed / installed in the organization (photovoltaic cells for solar energy, windmill, energy efficient stoves, Biogas, etc.).
- Creating awareness among the stakeholders on energy conservation and utilization.

4. Benefits of an Energy Audit

- **Reduced Energy Expenses:** The most obvious benefit is that the less energy the Organization uses, the less money that the Organization will have to spend on energy costs.
- **Identify Problems:** An energy audit can also help to identify any issues that the equipment might have. For example, the auditor could find small leaks in the compressed air system. These leaks would cost a significant amount of money if it is not noticed. Auditors can also detect dangerous health risks like the carbon monoxide that's emitted from equipment that hasn't been vented properly. With a regular energy audit, the organization will be able to address these kinds of issues promptly to help ensure the health and safety of the staff members.
- **Increased Employee Comfort:** During the audit, the Organization might learn about changes that have been made regarding insulation and air sealing. Completing these enhancements will help create a more reliable and more efficiently cooled or heated space for the employees. In turn, more comfortable employees tend to be more productive, so not only will the Organization save on energy costs, but may also improve overall well-being.
- **Personalized Recommendations:** Working with an energy expert can help learn about new energy-efficient technologies. The professional will customize a plan, recommending which upgrades will give the most return on investment. These might include updated lighting systems, a new HVAC system, weatherization measures like insulation and air sealing, and more. While some of the recommendations might have a substantial up-front cost that many of them will pay for themselves in a short period of time with significantly reduced energy expenses.
- **Show Environmental Concern:** By taking steps to be more energy efficient, the Organization will be showing the employees and clients that the organization cares about the impact on the environment.
- **Increased Property Value:** Using the recommendations of an energy auditor to make facility more energy efficient could also help to increase its overall worth. Things like solar panels, high-efficiency LED lighting, and weatherization procedures are all things that contribute to a higher property value.
- **Longer Equipment Lifespan:** An energy auditor might recommend to update some of the equipment for maximum energy savings. If the Organization decide to upgrade, it will not only save on energy costs, but also expect the equipment to last a long time. This is because newer, more energy-efficient equipment doesn't have to work as hard as older, outdated units to provide the same level of performance.
- **Energy audit evaluation:** Energy audits will evaluate the Organization "as a whole", the aim is to consider a wide range of available alternatives (Electrical, Mechanical, Thermal Water and Transportation).

- **Energy audit Opportunities:** The audit will not only inform about the opportunities but also provide information with financial analysis. This will enable prioritization based on financial benefit and return on investment. It provides technical information regarding the proposed energy conservation measures.

- **Analysing the quality of Energy Audit:** A good quality audit will investigate the historical energy usage and find the essential issues using statistical methods. It Provides information with emissions analysis to help understand the benefits of the decisions from an environmental standpoint. The audit provides benchmark information to help compare the energy use performance with others.

5. Procedures followed in an Energy Audit

In order to conduct an energy audit, several methods are adopted in the audit sites in which walk-through audit is conducted. The balance of total energy inputs with total energy outputs and identification of all energy streams in a facility are taken into account. The amount of energy used by each of its energy streams are calculated as per the methodology mentioned in the Manual of Gnanamangai *et al*. (2021). The top three operating expenses of the Organization are typically observed to be energy (both electrical and thermal), labour and materials. During the audit, physical verification of Lighting, Ceiling, Table and Exhaust Fans, A/C machines, Solar panels, Heaters, Generators, Uninterrupted power supply machines and ventilators load fixtures and verification of installed energy efficient system's capacities are carried out. Inspection of when the cost or prospective cost savings in each of the above components are considered, energy always wins, and the energy management task becomes a key cost reduction area. The energy audit assisted in better understanding how energy and fuel are used in the Organization as well as identifying waste factors and development potential towards energy savings opportunities. Finally after the audit process, the energy audit included suggestions for energy cost reduction, preventive maintenance and quality control activities, all of which are critical for the utility operations in the auditee (Organization).

The audit involved visiting the campus and physical verification of the loads and sources installed. The entire campus is divided into different sections and those sections are audited in which electrical fittings and energy supply are monitored. The production process flow is studied and electricity consumption are measured. Location of the electrical machines, conditions of them and their accessories are inspected through physical verification is observed as per the regulation of Indian Green Building Council (IGBC, 2021) and World Green Building Council (WGBC, 2021). The energy bill from the supply utility company (Example: Tamil Nadu Electric Generation and Distribution Corporation Limited, Chennai) is audited and assessed for the load demand requirement and efficient consumption of energy. Stakeholders are interacted with the scope for improvement and energy management during the audit. Potential areas in which the scope of energy conservation and saving opportunities available in the current context have been identified and suggested for implementation to the Organization. The level of carbon dioxide might be measured in different places across the Organization campus using a portable CO_2 Analyzer to calculate the carbon footprint. It may be useful to check where carbon emission is prominent which could be taken into account to reduce.

The audit involves visiting physical position of load & carry out inventory of load. Due measurement of electrical load of equipment & circuit is carried out. Energy bill received from TNEB is audited & studied for KWH requirement & how efficiently energy is used. Various positions are interacted, familiarized with energy audit & involved for successful & result oriented energy audit. Energy conservation & saving

opportunities are identified during round & measurement for implementation.

6. Types of Energy Audit

The Energy Audit types depends on the following factors:

- Industry/ Organization type and its function
- Intense and the extent to which final audit is required, and
- The magnitude of cost reduction

Thus Energy Audit can be classified into the following types.

1) Preliminary Energy Audit
2) Detailed Energy Audit
3) Potential and magnitude of Energy Audit
4) Comprehensive Energy Audit

6.1. Preliminary Energy Audit Methodology

Preliminary energy audit gives a quick access to:

- Estimating and establishing energy consumption in the organization
- Estimate the scope of audit
- Identify the areas of maximum energy consumption
- Identify the areas of improvement
- Setting benchmark
- Performing Preliminary energy audit uses existing data.

6.2. Detailed Energy Audit Methodology

The detailed Energy audit offers the most accurate estimation of energy savings and cost. A comprehensive audit provides a detailed energy implementation plans for a facility, as it evaluates all major energy consumption systems.. It considers the effects of all projects, accounts for the energy use of all major equipment, and includes detailed energy cost saving calculations and project cost. Energy Balance is the key element in detailed energy audit. The estimated use is compared to utility bill charges. There are three phases in detailed energy audit

Phase I - Pre -Audit Phase
Phase II - Audit Phase
Phase III - Post Audit Phase

6.3. Potential and Magnitude of Energy Audit

A systematic and structured method is necessary for an efficient working of energy audit process. An initial site study is carried out for planning the procedures necessary for an audit.

Initial Site Study and Preparation for Detailed Auditing

An initial site study visit might take one or two days and gives the Energy Auditor an opportunity to meet the concerned person (Auditee), to familiarize with the site and to assess the procedures necessary to carry out the energy audit.
During the initial site visit the Energy Auditor carries out the following actions: -

- Discussing the aims of the energy audit with the audit study site's management.
- Discussing the economic factors associated with the recommendations of the audit.
- Analysing the major energy consumption data with the concerned person.
- Obtaining the available audit site drawings – building layout, electricity distribution, steam distribution, compressed air distribution, etc.
- Conducting Walk-through audit around site.

The main aims of this visit are:

- Finalising the Audit team members
- Identifying and analysing the main energy consuming areas during the audit.
- Identifying existing instrumentation/ additional metering required.
- To decide if any meters will have to be installed prior to the audit eg. kWh, steam, oil or gas meters.
- Identifying the instruments required for carrying out the audit.
- Planning the time management
- Collecting the macro data on major energy consuming areas.
- Conducting awareness meetings/ programmes.

6.4. Comprehensive Energy Audit

A comprehensive audit can take from several weeks to several months depending on the nature and complexity of the site to complete the audit process. Detailed study is carried out to establish, and investigate, energy and material balances for specific departments. Possible checks of plant operations were carried out over extended periods of time, at nights and at weekends as well as during normal daytime working hours, to ensure that nothing is overlooked.

The audit report includes list of energy inputs and product outputs by major department or by major processing function and estimates the efficiency of each step of the Organization. The methods for improving the efficiency will be listed, and it also includes preliminary assessment of the cost of the improvements and expected payback on any capital investment needed. The audit report concludes with specific recommendations for detailed engineering studies and feasibility analysis. The comprehensive energy audit is useful in identifying the major energy consuming areas to be surveyed during the audit and to identify any existing instrumentation/ additional metering required. Proper care should be taken while identifying the instrumentation required for carrying out the audit and to plan the time management for collecting the macro data from energy consuming areas. The audit report is definitely useful for energy management.

The information to be collected during the detailed audit includes:

1. Energy consumption by type of energy, by department/area, by type of process equipment, by end-use
2. Energy cost and tariff data
3. The distribution and generation of site services (eg. Electricity, Compressed air, steam).

4. Sources of energy and its supply (e.g. electricity from the grid or self-generation)
5. Potential alternative for fuel substitution, process modifications, and the use of co-generation systems (combined heat and power generation).
6. Energy conservation and management awareness training programs within the Organization.

   The audit team collects the following baseline data:

   - Major Equipment details, process/technology used
   - Water consumption
   - Fuel usage
   - Capacity utilisation
   - Electrical energy consumption
   - Steam consumption
   - Yield/ Efficiency

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

The level of Carbon dioxide is measured in different places across the Organization campus using a portable CO_2 Analyzer (Non dispersive infra-red meter). In addition, CO_2 meter is also displayed the readings of atmospheric temperature, relative humidity, and dew point in the places, where the level CO_2 is measured. The meter started measurements of CO_2 level in the atmosphere after powered ON and updated the readings every second in the display screen. If the operating environment is changed (example from high to low temperature) which took 30 seconds for CO_2 sensor to respond and 30 minutes for flexibility in relative humidity. The meter features an audible alarm to give warnings when CO_2 concentration exceeds the set limit. It emits beeps (Abt.80Db) when CO_2 level goes over the set value and stops when any key (except SET) is pressed, or the readings fall below the set values.

The Carbon footprint per year is calculated (www.carbonfootprint.com) based on electricity usage per year in which CO_2 emission from electricity and the sum of transportation per year in terms of number of the shuttle buses service operated by the Organization and number of cars, motorcycles and trucks entering in the Organization campus. These factors are multiplied with total number of trips in each day and approximate travel distance of vehicles covered in each day with a coefficient (0.01) to calculate the emission of CO_2 in metric tons per year.

Humans contribute to a massive increase of carbon dioxide emissions by burning fossil fuels, deforestation, and other industrial activities. Methane (CH_4) is largely released by coal, oil, and natural gas industries. Anthropogenic activities are responsible for almost all of the increase in greenhouse gases in the atmosphere over the last 150 years. The largest source of greenhouse gas emissions from human activities is from burning fossil fuels for electricity, heat, and transportation.

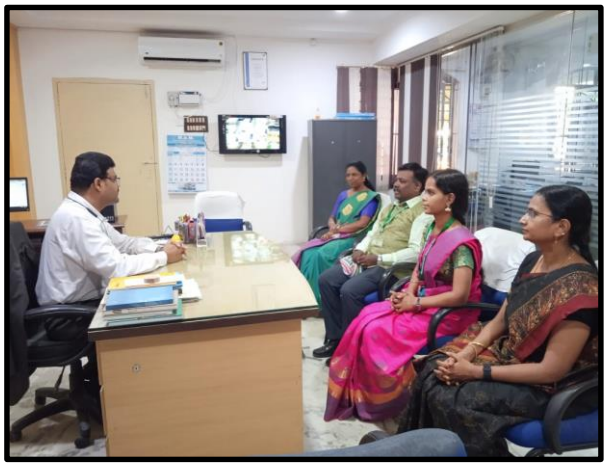
The Methodology of the Audit is presented in the following chart

Flow chart of Energy Audit Methodology

Calculating Carbon footprint

8. 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.



Opening Meeting for the conduct of Energy audit

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_2, NO_2, combustion efficiency are the mechanical, thermal and other parameters that are analysed during the audit depending upon the requirements

9. About the Institution

9.1. About M.A.M. School of Engineering

M.A.M. School of Engineering was founded in the year 2010 and was Affiliated to the Anna University, Chennai and approved by the All-India Council of Technical Education (AICTE) in the same year. The college secured its ISO 9001 certification in the year 2012, and continues to hold the same, till date of 31 August 2018, with the award of ISO 9001:2008.

M.A.M. School of Engineering, founded by the lofty mission and vision of its founder, Janab M. Abdul Majedu under the guidance of a noted engineer, academician and an administrator, Dr. S. Sathikh, the former Vice Chancellor of the University of Madras, is led by Mr. M.A. Peer Mohamed, its Correspondent. Dr P Ranjith Kumar assumes office as Principal and led the organization to get NAAC accreditation by the year 2017. The administration is backed up by the well experienced person Prof C. Rajagopalan, who is also an accomplished academician and an administrator, with a number of laurels and achievements to his credit.

M.A.M. School of Engineering which began to admit students in the academic year, 2010-2011 is currently in the 10th year of its relentless service to the cause of the

muslim minority, the economically weaker, socially marginalized and the underprivileged sections of the nation. Since the time of its humble student strength, the college has grown enormously to have about thousand students across the UG and the PG departments, all of which are proudly accredited by the National Assessment and Accreditation Council NAAC, New Delhi.

The able faculty members of the M.A.M. School of Engineering are most proficient with the many teaching methodologies, as applicable in engineering education and are nobly devoted to their profession. These faculty members of the college, upon whom the pride and the pillars of the college rest, are most consistent at their efforts in educating their students and helping them with the achievement of the dreams of themselves and those of their parents.

The facilities at the M.A.M. School of Engineering are fast expanding and are continuously updated to reflect the change and trends in the engineering sector. The Labs, Libraries, and the wi-fi internet facilities are all part of the expanding infrastructure of the college, that aim at helping the students to secure hands on experience along with the knowing and understanding of the advanced concepts and techniques in the realms of their pursuits.

M.A.M. School of Engineering offers Undergraduate B.E., degree programmes in Aeronautical Engineering, Computer Science and Engineering, Electrical & Electronics Engineering, Electronics & Communication Engineering, Mechatronics Engineering, Mechanical Engineering. In addition, the M.A.M. School of Engineering also offers Post Graduate programmes leading to an M.E in Power Electronics and Drives and M.E in Computer Integrated Manufacturing.

9.2. About Nature Science Foundation (NSF)

NSF is a Non-Profit ISO 9001:2015 certified Organization and registered with NGO Darpan NITI Aayog and Ministry of Micro, Small and Medium Enterprise, Government of India functioning energetically towards the noble cause of nature conservation and environmental protection. NSF is managed by a board of trustees of NSF Public Charitable Trust under the TN Societies registration Act 1975 (TN Act 27 of 1975) on 29th November, 2017 at Peelamedu, Coimbatore- 641 004, Tamil Nadu, India with Certificate of Registration No. 114 / 2017. In addition, NSF has 12A, 80G and Form 10AC certificates for income tax exemption. The main motto of the NSF is to “Save the Nature to Save the Future” and “Go Green to Save the Planet”. NSF Branch Offices are also functioning effectively at Gorakhpur, Uttar Pradesh and Faridabad, Haryana, India to adopt the ‘Go Green Concept’. NSF family is wide spread across India with over 70 state-wise Lead auditors to conduct Green and Environment Audits.

NSF is functioning strenuously to conduct different awareness programmes and implement various schemes to public and school / college students towards the noble cause of nature protection. Some of the programmes are also being organized for the benefit of tribal communities to create the supply chain for biodiversity conservation studies. The objectives along with vision and mission are illustrated to promote educational and environmental awareness programmes through social activities for

enhancing the quality of life and to conserve nature from environmental pollutants using traditional and modern technologies for sustainable land management. NSF is educating the tribal community children through social service and towards the upliftment of tribes as a whole and make them as entrepreneurs.

International Eco Club Student Chapter (IECSC) has been established for Student volunteers and faculty members are encouraged to conduct National and International events, Student Technical Symposium, Distinguished lecture programme, Environment day celebration, Ozone day celebration, Project model exhibition, Awareness programmes on Environmental pollution, Biodiversity and Natural resources conservation and etc. with the financial support of the Foundation. NSF is being released 'Magazine' and 'Newsletter' biannually to share the information about Environmental awareness programmes on biodiversity conservation, seminar on soil conservation, water management and solid waste management, restoration and afforestation programmes in Western Ghats of southern India.

In order to encourage the students, members of faculty, academicians, scientists, entrepreneurs and industrial experts those who are involving in nature protection and biodiversity conservation studies, NSF tributes the deserved meritorious candidates with various awards and honours such as 'Best Faculty Award', 'Best Women Faculty', 'Best Scientist Award', 'Best Student Award', 'Best Research Scholar Award', 'Best Social Worker Award', 'Young Scientist Award', 'Life-Time Achievement Award' and 'Fellow of NSF' will be given.

NSF has introduced various types of Audits such as 'Eco Audit', 'Green Audit', 'Energy Audit' and 'Hygienic Audit' to academic Institutions, R&D Organizations and Industries towards the accreditation process as well as maintaining a hygienic eco-friendly environment to the stakeholders in their campus. All audits will be conducted as per the Checklist prepared by the NSF ISO EMS 14001:2015 criteria and in compliance with Government Law and Environmental Legislations including World / Indian Green Building Council and the concept of Swachh Bharath Abhiyan under Clean India Mission. Green campus and Environment Policy, Purchase Policy, MoU, International Eco Club student Chapter Certificate will be given to get the maximum mark weightage in NAAC. Audit processes are being conducted through the certified Auditors as per the following

Audit	Certified Auditors	Certified Auditors
Green Audit	• IGBC - Indian Green Building Council • GBCRS - Green Building Code and Green Ratings Systems • GRIHA – Green Rating for Integrated Habitat Assessment	➢ Mrs. S. Rajalakshmi ➢ Dr. R. Mary Josephine ➢ Dr. B. Mythili Gnanamangai ➢ Er. Ashutosh Kumar Srivastava ➢ Er. N. Shanmugapriyan
Energy Audit	• BEE - Bureau of Energy Efficiency • LEED - Leadership in Energy and Environmental Design • CII-GreenCo – GreenCo Rating System Felicitator	➢ Er. D. Dinesh kumar ➢ Er. N. Shanmugapriyan ➢ Dr. N. Balasubramaniam ➢ Dr. P. Thirumoorthi ➢ Dr. G. Murugananth
Environment Audit	• IGBC -Indian Green Building Council • ASSOCHAM - Associated Chambers of Commerce and Industry of India • FSRS – Fire Safety & Rescue Services	➢ Mrs. S. Rajalakshmi ➢ Dr. A. Geetha Karthi ➢ Dr. R. Mary Josephine ➢ Dr. B. Mythili Gnanamangai ➢ Er. Ashutosh Kumar Srivastava ➢ Er. N. Shanmugapriyan
Hygiene Audit	• FSMS – Food Safety Management System & • Occupational Safety & Health (ISO 22000:2018) • SBICM - Swatch Bharath under India Clean Mission	➢ Mrs. Gaanaappriya Mohan ➢ Er. Ashutosh Kumar Srivastava ➢ Dr. R, Sudhakaran ➢ Dr. N. Saranya
Waste Management Audits	• Water Audit, Soil Audit, Biomedical Waste Audit, Solid Waste Management Audit as per the IGBC, GRIHA and BEE	➢ Mrs. Gaanaappriya Mohan ➢ Er. Ashutosh Kumar Srivastava ➢ Dr. R, Sudhakaran ➢ Er. N. Shanmugapriyan ➢
Academic & Administrative Audits	• Academic & Administrative Audits as per the NAAC Criteria	➢ Dr. B. Anirudhan ➢ Dr. B. Shreeram

10. Audit Details

Date/Day of Audit : **22.04.2020**

Venue of Audit : **M.A.M. School of Engineering, Siruganur, Tiruchirappalli – 621 105, Tamil Nadu, India**

Audited by : **Nature Science Foundation,** Coimbatore, Tamil Nadu, India.

Audit type : **Energy Audit**

Name of ISO EMS Auditor : **Mrs. S. Rajalakshmi,** Chairman & ISO EMS Auditor, NSF.

Name of Lead Auditors : **Dr. R. Mary Josephine,** Board of Directors, NSF.

Name of Energy Auditors : **Dr. R. Sudhakaran** BEE Certified Energy Auditor, NSF

Mrs. S. Pirathiba Programme Officer

Name of IGBC AP Auditor : **Dr. B. Mythili Gnanamangai,** IGBC AP, Indian Green Building Council.

11. Observations of the Energy Audit

11.1. Facilities visited during the Energy Audit

Date	Section where Energy Audit is conducted
22.04.2020	Administrative Block
	Power House
	Faculty Rooms
	Classrooms
	Seminar Halls
	Auditorium
	Laboratories
	Computer Centres
	Well, Sump and pumps.
	Sewage Treatment Plant
	Hostel
	Library

In the sections, the services offered are monitored, verified, and analysed 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 TNEB. The electricity consumption charges are audited and studied for the load demand requirement and efficient consumption of energy. Stake holders are

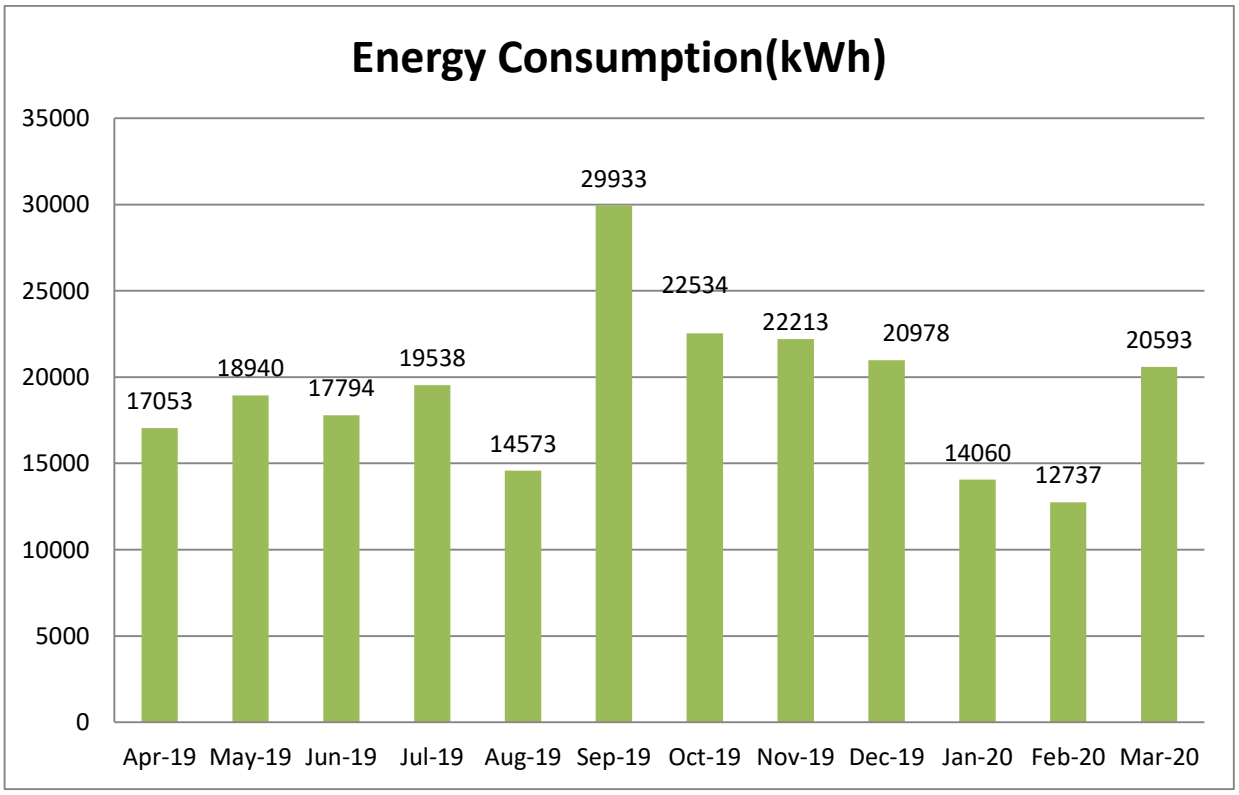
interacted and the scope for improvement has been discussed. Potential areas in which scope of energy conservation and saving opportunities available have been identified and suggested for implementation.

11.2. Systems Studied during the Energy Audit

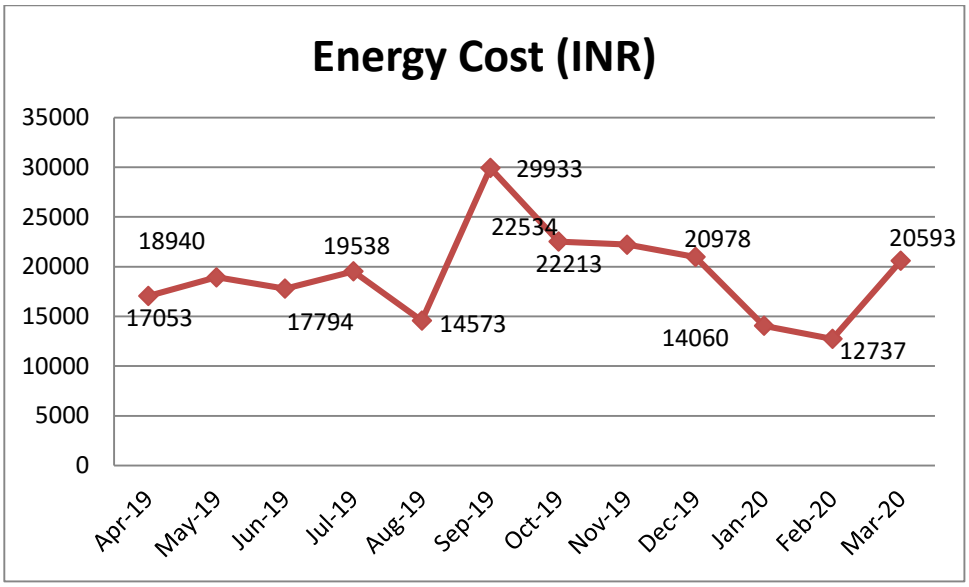
1. Lighting fixtures are verified physically.
2. Installation of energy efficient lighting systems are verified.
3. Installation of safety systems are verified
4. Installation of power backup systems (generators and UPS) are verified on the aspect of maintenance and consumption.
5. Electricity consumption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

11.3. Energy Consumption and Cost Profile

The following chart shows the profile of energy consumed and the cost for one year by the stakeholders.



Energy Consumption Profile



Energy cost profile

Average energy consumption per stakeholder per month: 1.84 kWh.

11.4. Power supply Equipment and Major Loads

Table 1. Major Equipment related to Electrical energy utilization

S.No	Equipment/ Utility	Rating/ Capacity	Quantity
1	LED Tube Lights	22w	460
2	Fluorescent Lamps	40w	40
3-a	CFL		30
3-b	CFL		-
4	LED Focusing Light		10
5	LED Bulb		120
6	Solar Water Heater		0
7	Solar Panel		6
8	UPS		4
9	LCD Projectors		9
10	Refrigerators		1
11	Varanda Light load		60
12	Lift		1
13	Water Doctors		5
14	Water Purification System		3
15	AC (Split, Window and Centralized AC)		27
16	Air Cooler		1
17	Celling Fans	80w	510
18	Generators	160KVA	1

19	Pumps		5
20	Motors		5
21	Vacuum Cleaner		0
22	Drip & Sprinklers Irrigation		1
23	Ventilators		0
24	Exhaust Fans		15
25	Automatic Lights		0
26	Internet Connectivity	150Mbps	360
27-1	Podium containing Mike,		1
27-2	Speakers		12
27-3	Amplifiers		3
27-4	Camera,		60
27-5	Sensors		0
28	Computers		367
	Dot-matrix Printer		5
	Laser printers		27
	Xerox Machines		4
	Scanners		3

Table 2. Annual Energy Consumption of Fuels

S.No	Month	Units Consumed (kWh)	Diesel Consumption (Litres)	Petrol Consumption (Litres)	LPG Consumption (kg)
1	April-2019	17053	6480	-	**760**
2	May-2019	18940	6300	-	**750**
3	June-2019	17794	6328	-	**780**
4	July-2019	19538	6260	-	**770**
5	August-2019	14573	6544	-	**750**
6	September-2019	29933	6420	-	**720**
7	October-2019	22534	6789	-	**710**
8	November-2019	22213	7099	-	**725**
9	December-2019	20978	7120	-	**740**
10	January-2020	14060	6848	-	**750**
11	February-2020	12737	6750	-	**755**
12	March-2020	20593	6670	-	**670**

Table 2: Energy Consumption and Cost Profile

SL.No	Months	Cost in Rs.	Rating / Capacity units in kWh
1.	April-2019	1,53,473	17053
2.	May-2019	1,70,456	18940
3.	June-2019	1,60,142	17794
4.	July-2019	1,75,846	19538
5.	August-2019	1,31,155	14573
6.	September-2019	2,69,395	29933
7.	October-2019	2,02,802	22534
8.	November-2019	1,99,919	22213
9.	December-2019	1,88,800	20978
10.	January-2020	1,26,544	14060
11.	February-2020	1,14,631	12737
12.	March-2020	1,85,339	20593

The sum of electricity usage per year = 49,67,510

The CO_2 emission from electricity = (Electricity usage per year in kWh/1000) x 0.84 = (49,67,510/1000) x 0.84 = 4172.71

Table 3. Transportation Facilities available in the campus

S.No	Type of Vehicle	Fuel Used	No. of Vehicles	Non Pollution Certified (Y/N)
1.	Bus	Diesel	8	Yes, all busses have pollution certificate
2.	Van	Diesel	3	
3.	Cars	Diesel	2	
4.	Auto	Diesel	1	

11.5 Quantitative and Qualitative Measurement

S.No.	Requirements and checklists of the audit	Conformity		
		Yes	No	NA
1.	Have internal Energy audit procedures been developed and implemented in the Organization?	✓		
2.	Have programmes for the achievement of energy efficiency and conservation objectives been established and implemented as on today in the campus?	✓		
3.	Has a Management Representative, Electrical Engineer, Staff in charge been assigned for energy savings on power consumptions?	✓		
4.	Have programmes for the achievement of prescribed financial outlay for current bills for each building in the campus towards power consumptions?		✓	
5.	Has the organization ensured that personnel performing environmental specific tasks have the required knowledge on energy audit (e.g. education, training programme, seminar, workshop, camp, etc.)?	✓		
6.	Are objectives and targets documented towards energy audit periodically and any Register is made?	✓		
7.	Any analysis of energy flows for energy conservation in terms of the amount of energy input into the system without negatively affecting the output in buildings	✓		
8.	Implications of alternative energy efficiency measures sufficient to satisfy the financial criteria of sophisticated investors	✓		
9.	Identification of the most efficient and cost-effective Energy Conservation Opportunities (ECOs) or Measures (ECMs) taken by the Management	✓		
10.	Are the following energy efficiency and conservation aspects considered in sufficient detail?	✓		
	a. Fluorescent (tube) lights, Incandescent lamp and sodium vapour lights are replaced with CFL / LED	✓		
	b. Number of Uninterruptible power supply (UPS) and Power generators for power back-up to alternative current supply facility in each building	✓ 2+2		
	c. Number of solar panels, solar lights, solar water heaters, electric water heater installed	6		
	d. Automatic sprinkler system used for irrigation purpose	✓		

	e. Ultra-violet lights and any other harmful lights used with safety precautions	✓		
	f. Attempt in reducing the energy expense and carbon footprint	✓		
	g. Disposal facility for hazardous arise from electrical gadgets, equipment and installation	✓		
	h. Renewable energy utilization (solar panel, wind mill)	✓		
	i. Natural / Mechanical air ventilation at Indoor / Outdoor auditorium, stadium, seminar halls, etc.	✓		
	j. Sign boards indicating Switch OFF / ON, Danger at Electrical equipment and Power transformers in the campus	✓		
11.	Signing of MoU with Govt. and NGOs to ensure about the energy conservation and efficiency in the campus		✓	
12.	Conduction of awareness programmes and outreach programmes on the energy conservation and efficiency	✓		
13.	The details of public transport, battery operated / electric vehicles, biofuel use, exhaust fans, boiling water system, chillers and geysers on energy savings mode	✓		
14.	Projects and Dissertation works on the energy conservation and efficiency carried out by students and staff members	✓		
15.	Steps taken to take care of daylighting, AC machines heat emission and ecofriendly Refrigerators, etc.	✓		
16.	Use of water metering, IoT based energy efficiency practices, remote waterlines, automation of electrical fittings and gadgets to save energy		✓	
17.	Are all monitoring electrical equipment appropriately maintained and calibrated?	✓		
18.	Are any energy conservation technologies and retrofit for energy conservation equipment being implemented?	✓		
19.	Skylight roof ratio, fenestration plan and Daylight illuminance in building construction towards energy efficiency*	✓		
20.	Any Automatic Lighting Shutoff with occupancy Sensors and Timers, Exterior / Interior lighting control facility*		✓	
21.	Have any rooms and guest suites a master control device at the main room entry that controls all permanently installed luminaires and switched receptacles*	✓		

22.	Total electricity usage divided by total campus' population (kWh per person)	✓		
23.	The ratio of renewable energy production divided by total energy usage per year	✓		
24.	Total carbon footprint divided by total campus' population (metric tons per person)	✓		
25.	Elements of green building implementation as reflected in all construction and renovation policies		✓	
26.	Greenhouse gas emission reduction awareness programme to the stakeholders	✓		
27.	Computers, Lap tops, ipad, Dot matrix Printer, Laser printers, Xerox Machines, Scanners, Server, Fax machine, Inverter with UPS	✓		
28.	**Equipment, Instruments and Machineries related to Life Sciences and Biological Sciences including Biotechnology, Nanotechnology, Food Technology, etc** Electronic Balances, pH Meter, Hot-air-oven, Microwave oven, Laminar Air Flow, Autoclave, Microscopes, Electophonic, Apparatus, Chromatography devices, Grinders, Mixers, Deep Freezers, BOD incubators, COD digester, Extraction apparatus, Incubators, Co2 incubators, Heating Mantle, Vaccum pump, Vortes Mixer, Magnetic stirrer, Gel rocker, Somicator, Growth chambers, Air curtains, Acrators, Spectrophotometers, Calorimeters, Turbidity meter, Colony counter water bath, Dry bath, Thermocycler, Gene gun, Gel documentation system, Trans illuminator, Ice maker, ELISA reader & Water, Aquarium, zebra fish/animal house facility, Mechanical & Orbital Shakers, cyclo mixer, Lyophilizer, Incinerators, Fermenters, Reactors, Particle size Analyser, XRD, FTR, Muffle furnace	✓		
29.	**Chemical Sciences and Engineering Equipment/Machines** Distillation unit, Flow through straight pipe, packed bed distillation, Roll crusher, jaw crusher, sieve analysis machine, Shell and tube heat exchangers, plate and frame filter press, Fume hood, Fluorimeter, Venturimeter, Orifice meter, Nephelometer, Membrane Filtration Apparatus, Sieve set Machine, Jar test apparatus			
30.	**Electrical, Electronics and Communication Engineering Equipment/Machines**	✓		

	DC Shut motor, DC Series motor, DC Compound motor, DC Shunt motor, DC Compound generator, Dc series generator, Single phase & Three phase transformers, Loading rheostat, Single phase & three phase, inductive & capacitive load, Power electronics trainer kits, Three phase squirrel cage indication motor, Three phase slip ring induction motor, AC generator, Stabilizers, synchronizer, Half and fully controlled converters, Buck, Boost and buck-boost converters, Single phase and three phase inverters, synchros, CRO, DS, CRO.			

11.6. 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 the **M.A.M. School of Engineering, Trichy-Chennai Trunk Road, Siruganur, Tiruchirappalli – 621 105, Tamil Nadu, India.** The observation showed that the concentration of CO_2 in the atmosphere is found to be low which did not exceed the critical limit of CO_2. It is further revealed that all the selected locations are having pure air with good air exchange 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 from direct burning, transportation, industrial activities, as well as emissions from electricity generation. In addition, the carbon footprint also contributes to the greenhouse emission.

Table 6. Measurement of CO_2 Concentration M.A.M. School of Engineering, Trichy-Chennai Trunk Road, Siruganur, Tiruchirappalli – 621 105, Tamil Nadu, India

S.No.	Different locations of the Organization's campus	Carbon dioxide level (ppm)	Remarks
1.	Peter Norton Lab	410	CO_2 level is low
2.	Chemistry Lab	418	CO_2 level is low
3.	Canteen	413	CO_2 level is low
4.	Classroom	415	CO_2 level is low
5.	Auditorium	414	CO_2 level is low
6.	Parking	408	CO_2 level is low
7.	Open Place	389	CO_2 level is low
8.	Power House	410	CO_2 level is low

9.	Physics Lab	413	CO_2 level is low
10.	Garden Area	412	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 at M.A.M. School of Engineering, Trichy-Chennai Trunk Road, Siruganur, Tiruchirappalli – 621 105, Tamil Nadu, India 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

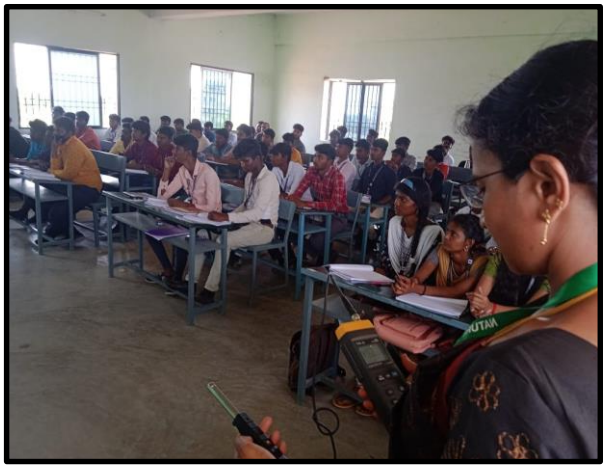
= (365736 kWh/1000) x 0.84

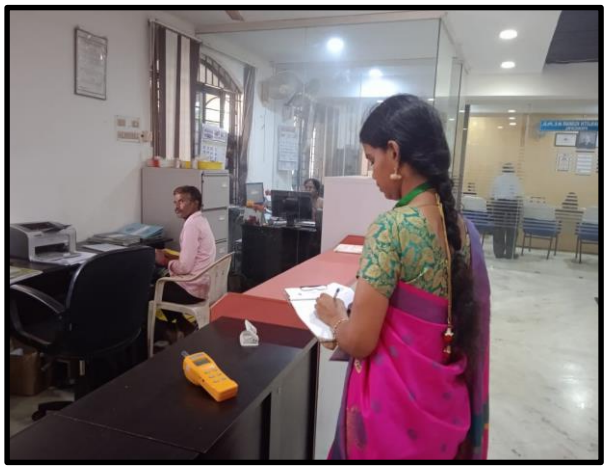
= 307.21 metric tons

Notes:

Electricity usage per year = 365736 kWh

0.84 is the coefficient to convert kWh to metric tons.





CO2 level measurement at various locations of M.A.M. School of Engineering, Trichy-Chennai Trunk Road, Siruganur, Tiruchirappalli – 621 105, Tamil Nadu, India

11.7. Ways to reduce Carbon Footprint

Evaluating and understanding the CO_2 emission can reduce the negative impact on the environment. Tiny changes can bring good impacts like when it comes to transportation, food, clothing, waste, etc., the following tips helps in reducing the carbon footprint.

Food

- Consumption of local and seasonal products.
- Limiting the consumption of meat and beef.
- Adopting sustainable fishing.
- Avoiding plastic packaging and practising the use of reusable bags.
- Sense of buying only necessary things.

Clothing

- Taking good care of clothes.
- Buying second hand products or borrowing
- Using the clothes made from recycled products with eco label

Transport

- Adopting carpooling practice, using cycles and public transport
- Usage of No Pollution certified vehicles.

Energy and waste

- Turning down the heating.
- Short showers
- Proper usage of water while brushing teeth or cleaning the dishes
- Proper care while charging the batteries.
- Selecting star rated equipment and EU Energy labelled products
- Reduce and recycle of wastes.

11.8. Light Intensity Measurement

Light intensity or light output is used to measure whether a particular light source provides enough light for an application needed. There is a well-established light level recommendation for a wide range of applications in lighting industry and also for the type of space. Understanding the light intensity helps to properly evaluate whether the space has adequate lighting conditions or not. Light intensity is measured in terms of lumens per square foot (foot-candles) or lumens per square meter (lux). Measuring the amount of light that falls on a surface allows to evaluate if the particular space has sufficient light to perform the tasks.

A light meter (lux meter) is used to measure the amount of light in a space/on a particular work surface. The light meter consists of a sensor that measures the light falling on it and provides the user with a measurable illuminance reading. Light meters are an especially useful tool for measuring light for safety or over-illumination. The light intensity is usually measured by taking initial reading, where the lightings are turned off (Baseline measurement) and the final reading is taken by turning on the lights in the particular space (illuminated level). Subtracting the baseline measurement from illuminated level gives the light intensity of the particular room/ space.

Light Intensity Measured at various locations of M.A.M. School of Engineering, Trichy-Chennai Trunk Road, Siruganur, Tiruchirappalli – 621 105, Tamil Nadu, India

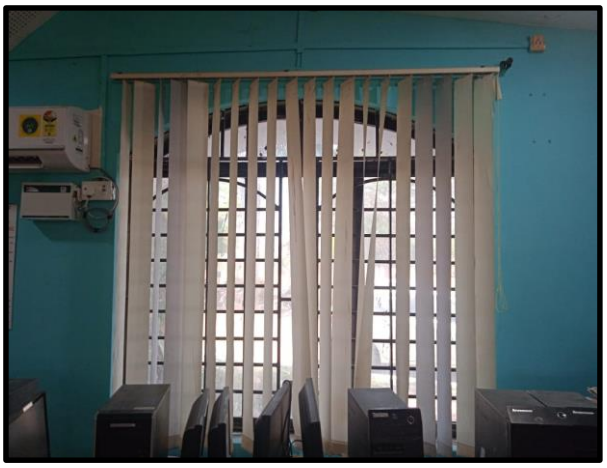
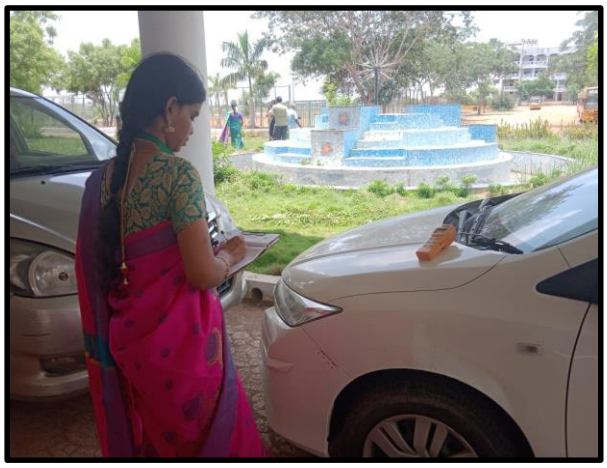
S.No	Location	Light Intensity (Lux)	Recommended Level (as per NBC 2016) (Lux)
1.	Principal office	295 – 310	200 – 500
2.	Reception area	58 – 70	150 – 300
3.	Faculty room	178 – 190	200 – 500
4.	Library	300 – 340	200 – 500
5.	Auditorium	450 – 500	200 – 500
6.	Class Room	320 – 360	300 – 750
7.	Peter Norton Lab	125 – 127	300 – 750

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.
- Installed automatic switches with sensors.
- HVLS Fans are fitted in the auditorium.
- Water level controllers are used.
- Power factor is maintained near to unity with APFC.
- STP is used for water recycling which is functioning well.
- Replaced old generation computers and TVs with LED monitors.

- Promoting ECON awareness and practice among the stakeholders are being conducted periodical through Association, Clubs, Forums and Chapters.
- Usage energy efficient light-emitting diode (LED) bulbs instead of incandescent and CFL bulbs.
- Maintenance of appliances and replaced old appliances in all laboratories
- Value added / Non-formal / Certificate / Diploma course on ‘Energy and Environment Management Audits’ are being conducted for the benefit of students and research scholars to become a certified Lead Auditor.
- Establishment of a system of carpooling among the staff members and students to reduce the number of four wheelers coming to the College.
- Discouraging the students and research scholars using two wheelers for their commutation in the campus.
- Switching off the lights, fan, air conditioners, equipment and instruments when they are not in use.



Walk-through Audit Conducted at various locations in M.A.M. College of Engineering, Trichy-Chennai Trunk Road, Siruganur, Tiruchirappalli – 621 105, Tamil Nadu, India and the Energy Equipment were inspected

Best Practices followed by the Institution

Best Practices followed by the Institution

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.
- 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.
- Turn off electrical equipment when not in use
- 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
- Inclusion of on campus e-vehicle.
- Monthly use of electricity in the College may be reduced 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.

14. Recommendations on Carbon Footprint in the Organization

- Encourage students and staff members to use bicycles and battery operated vehicles to reduce fuel consumption and carbon emission.
- Establish a more efficient cooking systems like biogas operated machineries to save fossil gas in hostel kitchen and canteen.
- More use of generators, inverters, and UPS every day should be discouraged which could save electrical energy.
- 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.

Closing meet of the conduct of Energy audit

15. Conclusions

Considering the fact that the organization is a well-established, long time run establishment with good reputation, there is significant scope for conserving energy and make the campus as self-sustained in it. The energy conservation initiatives taken up by the institution are substantial. Energy efficient lighting schemes, awareness created among stakeholders and necessary power backups are being practiced by the institution. There are some best Practices followed on Energy Audit in the Organization like Transformers, Generators and UPS are protected properly with fencing and kept awareness boards on ‘Dangers’ and ‘Warnings’. It is observed that the 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. Few recommendations, in addition, can further improve the energy savings of the Organization. This may lead to the prosperous future in context of Energy Efficiency Campus and thus sustainable environment and community development to the stakeholders in coming years to come.

16. Acknowledgement

Nature Science Foundation, Coimbatore, Tamil Nadu, India is grateful to the Management and Principal of **M.A.M. School of Engineering, Trichy-Chennai Trunk Road, Siruganur, Tiruchirappalli – 621 105, Tamil Nadu, India,** for providing us necessary facilities and co-operation during the energy audit process. This helped us in making the audit a success. Further, we hope that the best practices on sustainability followed by the Organization and recommendations and suggestions given by the NSF will boost the new generations to take care of the Electrical energy conservation, Energy saving measures and sustainability incompliance with the applicable regulations, policies and standards in the College Campus.

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