TECHNICAL AUDIT REPORT

[Green, Environment, Energy, Waste Management and Gender Audits]

Submitted to

SOKA IKEDA COLLEGE OF ARTS AND SCIENCE FOR WOMEN
MADHANANGKUPPAM, CHENNAI- 600 099
TAMIL NADU, INDIA

Date of Audit: 28.03.2023

Regd. No. 114 / 2017

Submitted by

NATURE SCIENCE FOUNDATION
(A Unique Research and Development Centre for Society Improvement)
[ISO Certified and Ministry of MSME Registered Organization]
No. 2669, LIG-II, Gandhi Managar, Peelamedu
Coimbatore 641 004, Tamil Nadu, India
Phone: 0422 2510006, Mobile: 9566777255, 9566777258
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SOKA IKEDA COLLEGE FOR WOMEN CHENNAI-99

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(A Unique Research and Development Centre for Society Improvement)
ISO 9001:2015, 14001:2015, 45001:2018 & 50001:2018 Certified and Ministry of MSME Registered Organization
No. 2669, LIG - II, Gandhi Managar, Peelamedu, Coimbatore - 641 004, Tamil Nadu, India.
Email : directornsf@gmail.com, director@nsfonline.org.in, Website : www.nsfonline.org.in
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Dr. S. RAJALAKSHMI, M.B.A., Ph.D., FNSF.,
Chairman

Mr. P. KANAGARAJ, FNSF.,
Secretary

Certificate of Declaration

The **Office of Nature Science Foundation**, Coimbatore, Tamil Nadu declare that

1. Nature Science Foundation has conducted onsite green audit at ***Soka Ikeda College of Arts and Science for Women, Madhanangkuppam, Chennai - 600 099, Tamil Nadu, India*** by deputing certified Lead Auditors and Technical Experts.
2. On the basis of audit observations by the auditors and pertinent data collected from the Auditee, the Technical Report has been prepared and being submitted.
3. Data presented in the Technical Report are verified and to best of our knowledge, the data are authentic and reliable.
4. Nature Science Foundation declares that data generated were not shared with any third parties and the soft copy of the report is available with Nature Science Foundation's Office till its validity.
5. Provided the Auditee desired to publish or share the data with other agencies, Nature Science Foundation has no conflict of interest.
6. We at Nature Science Foundation express our deep sense of gratitude to the Management for given an opportunity to conduct green audit at their premises in compliance with NAAC criteria and for whole hearted support extended at the time of onsite audit. Our sincere thanks to NAAC, IQAC Coordinator and Head of the Departments of the Organization for their intangible assistance and cooperation extended to the audit team at the time of physical facility verification.

Date:
Place: Coimbatore

Authorized signatory
Nature Science Foundation

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CONTENTS

1. GENERAL INTRODUCTION

1.1. Introduction

Green campus is an area of the Organization or the Organization as a whole itself contributing to have an infrastructure or development that is structured/planned to incur less energy, less water, less or no CO_2 emission and less or pollution free environment (Aparajita, 1995). Green Campus Audit is a tool to evaluate environment management system which is systematically executed to protect and preserve the environment. Green campus audit constitutes the environmental friendly practices and education combined to promote sustenance of green environment by adopting user-friendly technology within the campus. It creates awareness on environmental ethics, resolves environmental issues and offers solutions to various social and economic needs (APHA, 2017). It strengthens the concept of "Green Building" and "Oxygenated Building" which in turn provides a healthy atmosphere to the stakeholders.

1.2. Importance of National Building Code

National Building Code of India has a set of rules and guidelines that regulates construction and as well as ecofriendly activities of the campus. In order to achieve the minimum standards of welfare and safety of stakeholders of a campus, the Governing body lays down a set of guidelines to offer sustainable environment. In 1970, the National Building Code (NBC) was first published in India and the significant provisions of the Indian Building Code involve: 1. Structural safety of the building, 2. Earthquake-resistant building design, 3. Fire and life safety, 4. Solid waste management, 5. Accessibility for differently-abled and senior citizens, 6. Use of alternative building techniques and 7. Environmentally compatible building construction techniques like the use of solar power, rainwater harvesting, etc.

National building codes not only offer a standard benchmark that constructors must meet, but they also establish safety standards along with ecofriendly atmosphere of a campus for years to come. As extreme weather conditions and fires are growing rapidly in the country, it becomes vital that buildings and structures be built and designed using the current building codes to allow for maximum safety sustainability and resilience. For instance, new and updated building codes put much emphasis on conservation as energy and the waste is the most expensive byproduct of older regions. This will not only offer environmental benefits to future generations but will also regulate indoor air pollution to protect the health.

Before the introduction of National Building Codes of India in the construction industry, building commercial and residential properties used a lot of energy which adversely affected the environment. Thus, enforcing building codes to create low-energy buildings offers a tangible way for the company to help decrease the greenhouse gas emissions of the nation and in this way National building code offers multiple environmental benefits to various stakeholders. While safety is the primary objective, new building codes are making significant contributions toward solving energy issues. National building codes contain provisions relating to the use of environmentally compatible construction techniques like planting trees, landscaping, rainwater harvesting and renewable and non-renewable energy sources. These provisions allow the constructors to use natural energy sources which in turn reduces the energy bills to a greater extent

1.3. Role of Educational Institutions in natural resource conservation

In view of providing eco-friendly atmosphere to the stakeholders, educational institutions are focused on establishing and maintenance of green and eco-friendly campus without harming the environment. A clean and healthy surrounding in an organization determine the effective learning/teaching and provides a favorable learning environment to the students. Educational institutions are insisted by both Central and State Governments toprovide green, healthier and eco-friendly atmosphere to the stakeholders. In addition, all the educational institutions are asked to save the environment for future generations and to solve the problems associated with environment through Environmental Education. Implementation of Swachh Bharath Abhiyan Scheme by the Indian Government through Educational Institutions imparted neat and clean environment at tribal, rural and urban areas across the country. Seminar, Conference, Workshop, training and awareness programmes on biodiversity conservation education, environmental awareness programmes, etc., may be conducted periodically by the Management and Administrative people of an organization for the benefit of the stakeholders.

1.4. Green Campus and Environment Policies

Green Campus Policy dealt with cleanliness of the campus maintained through proper disposal of wastes and steps to be followed to recycle the biodegradable wastes and utilization of eco-friendly supplies to maintain the campus free from hazardous wastes/pollutants. The concept of eco-friendly culture is disseminated among the students as well as rural community through various awareness programmes. Attempts are made to minimize the energy usage and substitute the non-renewable energy sources with renewable energy sources. Head of the Organization, Departmental Heads and Senior Managers/ Management Representatives are responsible for monitoring the "Go Green" initiatives of the Organisation and maintain a clean/green campus while each and every individual of the organization should adhere to the policy.

1.5. Environment Friendly Campus

As stated earlier, Organization is liable to provide an eco-friendly atmosphere along with good drinking water facility to all the stakeholders. Manuring the cultivated plants/grown within the campus may applied with organic manure, cow dung, farmyard manure and vermicompost instead of using chemical fertilizers. All non-compostable and single-use disposable plastic items, plastic utensils, plastic straws and stirrers should be avoided. Demonstration / awareness programme on establishing plastic-free environment and utility of organic alternatives for all incoming and current students, staff and faculty should be organized. Reduction of use of papers alternated with e-services, e-circulars, etc., and proper disposal of wastes, recycling and suitable waste management system should be considered to establish environment friendly campus.

The term 'auditing' is to examine the management practices and to evaluate performance of an organization in relation to environmental issues. World along with Associated Chambers of Commerce and Industry of India (ASSOCHAM), Green Building Code and Green Ratings Systems (GBCRS), Green Rating for Integrated Habitat Assessment (GRIHA), Bureau of Energy Efficiency(BEE), Leadership in

Energy and Environmental Design (LEED), CII-GreenCo –GreenCo Rating System (CII-GRS), Food Safety Management System & Occupational Safety & Health (FSMS), Swatch Bharath under India Clean Mission (SBICM) and International Standard Organization (ISO 2021) have formulated a series of standards in the field of environmental auditing. These standards are basically intended to guide organizations and auditors on the general principles common to the execution of environmental audits.

Environmental auditing concerned with following aspects:

- ✓ Assessing compliance with pertinent constitutional and internal requirements
- ✓ Providing management control over environmental activities
- ✓ Endorsing good environmental management
- ✓ Maintaining credibility with the public
- ✓ Creating awareness among the staff on their commitment towards environmental policy
- ✓ Enduring improved opportunities and
- ✓ Establishing the performance baseline for developing an Environmental Management System (EMS).

1.6. About Nature Science Foundation (NSF)

NSF is an ISO QMS (9001:2015), EMS (14001:2015), OHSMS (45001:2018) & EnMS (50001:2018) Certified and registered with Ministry of Micro, Small and Medium Enterprise (MSME), Government of India Organization functioning energetically towards the noble cause of nature conservation and environmental protection. NSF is managed by a Board of Trustees which is a Public Charitable Trust registered 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 12AA, 80G and Form 10AC certificates for income tax exemption and implanting various Government schemes. The main motto of the NSF is "Save the Nature to Save the Future" and "Go Green to Save the Planet". NSF family iswide spread across India with over 115 State wise Lead Auditors to conduct Green Audit (Table 1).

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 pertinent to biodiversity and natural resource conservation. NSF is being released "Magazine" and "Quarterly Newsletter" to share the information about Environmental awareness programmes on biodiversity conservation in Western Ghats

of Southern India. In order to encourage the students, faculty members, academicians, scientists, entrepreneurs and industrial experts those who are involving in nature protection and biodiversity conservation activities across the world, NSF tributes the deserved meritorious candidates with various awards/honours and these awards will be conferred to them during the Annual Meet and Award Distribution Ceremony which will be conducted every year.

Apart from the "Green Audit", NSF has introduced various types of audits such as Hygienic Audit Water & Soil Audit, Plastic Waste Management Audit, Biomedical Waste Audit, Solid Waste Management Audit, E-Waste Management Audit, Academic & Administrative Audits including ISO certification process 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 in compliance with ISO 17020 Criteria and Government Law and Environmental Legislations including World / Indian Green Building Council and the concept of Swachh Bharath Abhiyan under Clean India Mission.

Table 1. Audit processes are being conducted through the certified Auditors as per the following list

Audit	Certified Course	Lead Auditors/ Technical Experts/ Observers
Green Audit	• GBCRS - Green Building Code and Green Ratings Systems • GRIHA - Green Rating for Integrated Habitat Assessment • ISO Green Audit (17020:2012) • ISO QMS (9001:2015) • IGBC – Indian Green Building Council	Dr. S. Rajalakshmi (ILA) Dr. R. Mary Josephine (ILA) Dr. K. Suresh Babu (ELA) Dr. B. Mythili Gnanamangai (ILA) Er. N. Shanmugapriyan (ELA) Ms. V. Sri Santhya (ILA) Dr. Amzad Basha Kolar (ETE) Mr. B.S.C. Naveen Kumar (ETE) Mr. K. Sampath Kumar (ELA) Dr. Sreekala K Nair (Observer)
Environment Audit	• ASSOCHAM - Associated Chambers of Commerce and Industry • FSRS – Fire Safety & Rescue Services • ISO EMS (14001:2015)	Ar. N.M. Pradeep Kumar (ELA) Er. S. Srinivash (ELA) Er. A. Karthik (ELA) Dr. Helen Roselene Thomes (ETE) Dr. S.J. Veeresh (ETE) Dr. D. Vinoth Kumar (ILA) Dr. P.V. Sreenivasan (Observer)
Energy Audit	• BEE - Bureau of Energy Efficiency • LEED - Leadership in Energy and Environmental Design	Er. D. Dinesh Kumar (ELA) Er. P. Shanmugapriyan (ELA) Dr. D. Vinoth Kumar (ILA) Dr. N. Balasubramaniam (ELA) Ms. V. Sri Santhya (ILA) Dr. P. Thirumoorthi (ETE)
	• CII-GreenCo – GreenCo Rating System Felicitator • ISO EnMS (50001:2018)	Dr. G. Murugananth (ETE) Ms. T. Joys Ememmal (ITE) Dr. R. Raj Kumar (Observer)

Waste Management Audit	• Water & Soil Audit, Plastic Waste Management Audit, Biomedical Waste Audit, Solid Waste Management Audit, E- Waste Management Audit	Mrs. Gaanappriya Mohan (ELA) Ms. B. Vijayalakshmi (ELA) Dr. D. Vinoth Kumar (ILA) Er. A. Karthik (ELA) Ms. V. Sri Santhya (ILA) Dr. K.S. Vinayaka (ETE)
Hygiene Audit	• ISO FSMS (22000:2018) • SBICM - Swatch Bharath under India Clean Mission • ISO OHSMS (45001:2018)	Mrs. Gaanappriya Mohan (ELA) Ms. M. Nithya (ILA) Ms. R.S. Thulaja (ILA) Dr. N. Saranya (ETE)

Note:
ILA: Internal Lead Auditor, **ELA:** External Lead Auditor
ITE: Internal Technical Expert, **ETE:** External Technical Expert

1.7. About the Organization

Soka Ikeda College of Arts and Science for Women is named after a renowned Japanese poet and Buddhist philosopher Dr. Daisaku Ikeda and Soka Education System, which stresses on moral building. Dr. Daisaku Ikeda is the Honorary Founder and Mrs. Kaneko Ikeda is the Honorary Principal of the college.

Soka Ikeda College of Arts and Science for Women has gloriously embarked on the twenty fourth year with many accolades and achievements since its inception in the year 2000. Having emerged as a pioneer institution, in its neighbourhood, the college offers humanistic education. "The Institution of Excellence' award given by the Indian Council of Gandhian Studies, New Delhi adds glory to the success saga of the institution.

The college is an ISO 9001:2015 Certified Institution and is affiliated to the University of Madras and recognized by the Government of Tamilnadu (G.O.281). The college offers 12 courses at the U.G. level, 4 courses at P.G Level in Shift-I and 5 U.G. Courses, 3 P.G. courses in Shift-II

Vision

Soka Ikeda College of Arts and Science for Women aims to deliver university education to benefit and uplift the students and society through systematic knowledge assimilation and delivery, at all levels.

Mission

Soka Ikeda College of Arts and Science for Women aims to produce knowledgeable and competent graduates, postgraduates and researchers with wholesome leadership qualities, by systematic teaching and training with regular and path breaking programmes and strategies.

Quality Policy

We at Soka Ikeda College of Arts and Science for Women are committed to nurture and deliver continually enhanced, global quality education with leadership qualities.

Geographical location: The Soka Ikeda College of Arts and Science for Women located at Madhanangkuppam, Chennai, Tamil Nadu, India. At present, the campus is

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quite clean, green and with much less pollution when compared to the rest of the city. Dicot and monocot plants can be found on the campus considerably. In contrast, the campus is harboured a wide variety of birds and animals.

The campus occupies a total area of 9.154 acres in which total build area is estimated about 72426.14 Sq ft. (Table 2). Among the total built area, one sixth area has been installed with AC's. With regard to vegetation availability within the campus, 40% accounts for forest/natural vegetation while remaining 60% represents manmade, artificial vegetation (Table 2).

Table 2. Soka Ikeda College of Arts and Science for Women facility details

S.No.	Details of Area	Total area
1.	Total Campus area	9.154 acres
2.	Total Built up area	72426.14 Sq ft
3.	Forest vegetation	40%
4.	Planted vegetation	60%

1.8. Audit Team Details

Date / Day of Audit	:	**28.03.2023**
Venue of Audit	:	**Soka Ikeda College of Arts and Science for Women,** Madhanangkuppam, Chennai - 600 099, Tamil Nadu, India.
Audited by	:	**Nature Science Foundation** Coimbatore, Tamil Nadu, India
Audit type	:	**Green, Environment and Energy Audits**
Name of the Auditing Chairman	:	**Dr. S. Rajalakshmi** ISO QMS, EMS, OHSMS and EnMS Auditor Founder & Chairman of NSF
Name of the Auditing Team Leader	:	**Dr. D. Vinoth Kumar** ISO QMS, EMS and EnMS Auditor Joint Director, NSF.
Name of the Lead Auditor	:	**Er. D. Dinesh Kumar** Certified BEE, IGBC, ASSOCHEM, GRIHA & LEED Auditor
Name of the Green Auditor	:	**Dr. B. Mythili Gnanamangai** Indian Green Building Council Auditor
Name of the Environment Auditor	:	**Er. S. Srinivash** Tamil Nadu Fire and Rescue Services
Name of the Energy Auditor	:	**Dr. N. Balasubramanian** Bureau of Energy Efficiency Auditor
Name of the Waste Management Auditor		**Er. A. Karthick** Bureau of Energy Efficiency Auditor
Name of Technical Expert	:	**Mr. B.S.C. Naveen Kumar** Senior Faculty, Mahatma Gandhi National Council of Rural Education, Hyderabad Ministry of Higher Education, New Delhi
Name of the Green Audit Observer	:	**Dr. Sreekala K Nair** Research & Development, NSF
Name of the Environment Audit Observer	:	**Dr. R. Raj Kumar** Advisor, NSF
Name of the Energy Audit Observer	:	**Dr. P.V. Sreenivasan** Director, NSF
Name of the Waste Management Audit Observer		**Dr. B. Anirudhan** Executive member, NSF

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1.9. Procedures followed in auditing

Green audit is a structured process of documenting the credentials in terms of number of trees, herbs, shrubs, lawns, climbers and lianas reflected in reducingthe environmental pollution and soil erosion and useful for biodiversity conservation, landscape management, natural topography and vegetation. Green audit projects the best environmentalpractices and initiatives taken in the organization at the prescribed site of audit that brings added value to the organization in maintaining the eco-friendly campus to the stakeholders. First step of the audit is ensuring that the organization has a central role in building the green campus in order to validate the same (Adeniji, 2018).

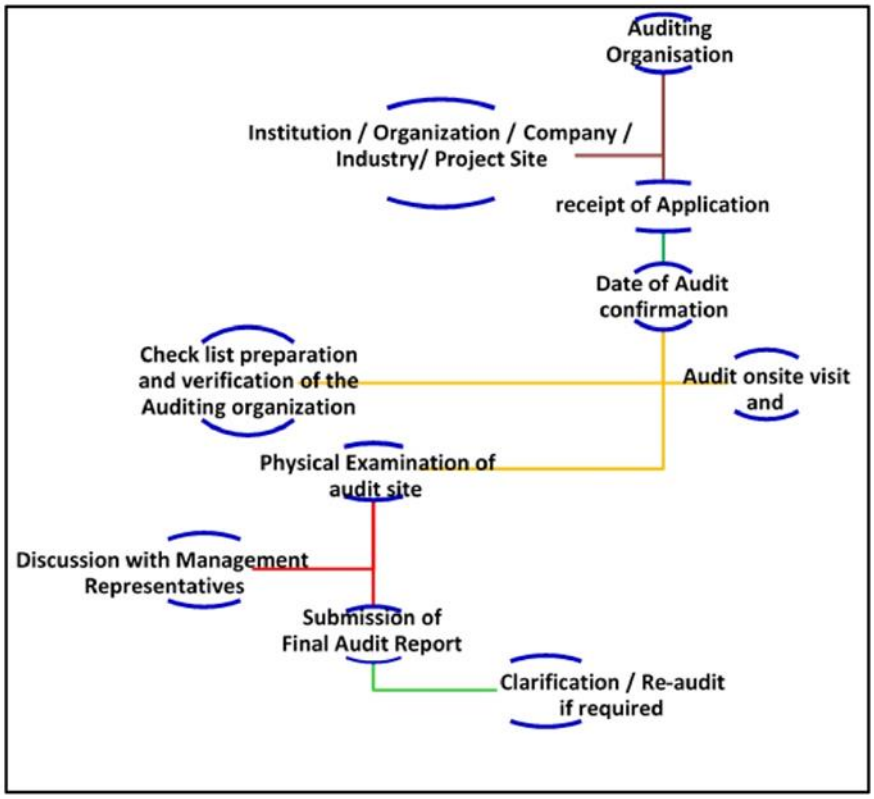
Green campus is not intended for the self-sustainability of the building alone, it also involves in propagation of the green campus initiatives so as to be adopted by any individuals and organization at a minimum cost. Green audit has been conducted as per the checklist based on National Building Code (NBC) Part 11 - Approach to Sustainability through the authenticated Professionals who have qualified to investigate and evaluate the campus for validating the best environmental practices.

During the audit, the nature of plants and animals / birds species thriving within the campus were recorded. Establishment of lawns, trees, herbs, shrubs and climbers and establishment of terrace / kitchen / herbal / zodiac / ornamental / medicinal gardens / aquarium and aquatic (hydrophytes) plants in the campus were documented. Labelling of common and botanical names of plants were observed. The operation of irrigation system, drip and sprinkler irrigation methods and utility of recycled water in the campus area were noted.

Attempts made for water scarcity during summer season towards the maintenance of plants and frequency of watering of plantations in the campus were recorded. Biodiversity conservation education, projects, awareness programmes, etc., through Indian Biodiversity Act and Ministry of Environment, Forests and Climate Change, Government of India and the conduct of outreach programmes for dissemination of Green campus motto among the students and staff members including public domain were gathered (Venkataraman, 2009) besides signing of MoU with Government and Non-Governmental Organizations to ensure green campus activities.

Projects, dissertations and thesis are the academic effort credentials that always fosters the innovative ideas on thinking and implementation of new approaches towards the green campus through presentations and publications in social media. These efforts taken by the students and staff were deliberated while conducting the green audit. Green audit processes are taking place as per the following flow-chart starting from the scrutinyof application forms from the auditee (organization) and ending upon the submission official report to the concerned organization (Leal Filho *et al.*, 2015). In addition, supporting activities of the scholars and staff with regard to "Vision and Mission" of the greenery activities of the Organization is also evaluated and reported.

Flow-chart of Audit Procedures



1.9.1. Pre-Audit stage activities

A pre-audit meeting (opening meeting) is conducted with Management and Administrative people along with staff coordinators with regard to green audit process, wherein audit protocol and audit plan were discussed in brief. The purpose of this meeting is to provide a chance to emphasize the scope and objectives of the audit and discussions held on the feasibilities associated with the audit (Marrone *et al.*, 2018). Pre-audit stage activities are an essential prerequisite for the green audit to meet the auditee and to gather information about the campus and required documents were collected directly from the Organization before the start of the audit processes (Fachrudin *et al.* 2019).

1.9.2. Onsite audit activities

- Followed by opening meeting, onsite inspection will be conducted which is the second step in the audit where the audit team members visit different sites in the campus and required photographs were taken then and there for preparing the audit report.
- During the onsite visit, it is vivid how the various facilities made by the Management to the stakeholders without disturbing the landscape, natural topography and vegetation to ensure the green campus.

- It is also observe how the environment is protected in the campus and by what meansan eco-friendly atmosphere is being given to the stakeholders. Assessment reveals the strengths and weaknesses of the Auditees Management controls and risks associated with their failure in creating green campus facilities.
- Collecting audit proofs i.e. data collection and information from the auditee as per the audit protocol were carried out.
- An exit meeting was conducted to describe the findings of the audit. Representatives and staff members.

1.10. List of Instruments used in the Inspection Process

Nature Science Foundation conducts audits by using the listed instruments

- Oxygen Meter
- Carbon Dioxide Meter
- Light (LUX) Meter
- Sound Level Meter
- pH Meter
- TDS Meter
- GPS Meter
- Deluxe Water and Soil Analysis Kit

1.10.1. Oxygen Meter

Oxygen meter is used in the audit process to measure the oxygen level in the organization. The instrument is calibrated after using 20 times. Suitability of the instrument are range between 0 to 30 % O_2, resolution of 0.1%, accuracy is ± (1% reading + 0.2 % O2), response time is ≤ 15 seconds, environment pressure range is 0.9 to 1.1 atmosphere, temperature range is 0 °C to 50 °C, 32 °F t 122 °F, temperature resolution is 0.1-degree, temperature accuracy is °C - ± 0.8 °C & °F –

1.10.2. Carbon dioxide meter

Carbon dioxide meter is to measure the carbon level in the organization. The instrument is calibrated after using 20 times. Suitability of the instrument are range between 0 ~ 4000 ppm, resolution of CO2 Meter is 1 ppm, accuracy is ≤ 1,000 ppm, repeatability is ± 20 ppm, temperature range between 0°C to 50°C, 32°F to 122°F, temperature Resolution is 0.1-degree, temperature accuracy is °C – 0.8°C, °F – 1.5°F.

1.10.3. Light (LUX) Meter

Light meter is to calculate the light intensity in the organization. Suitability of the instruments are, 5 ranges.ie.40.00, 400.0, 4,000, 40,000, 400,000 Lux, operating temperature is 0 to 50 °C (32 to 122 °F), Operating humidity is less than 80% RH, Power consumption is DC 8 mA approximately. This Instrument will be calibrated yearly once or during non-functioning.

1.10.4. Sound Level Meter

Sound level meter is to measure the noise level in the organization. This instrument is calibrated yearly once or after using 20 times. Suitability of the instruments are measurement range is 30 – 130 dB, resolution is 0.1 dB, accuracy is (23±5 °C), Frequency of the instrument is 31.5 to 8,000 Hz, Operating temperature is 0 to 50 °C (32 to 122 °F), Operating humidity is less than 80% RH, Power consumption is DC 6 mA approximately.

1.10.5. pH Meter

pH meter is generally used to measure the pH level in water. It is calibrated 6 months once or after 20 times of its use. Suitability of the instrument are range of the pH meter is 0 – 14, accuracy is ± 2%, resolution of the instrument is 0.1 pH, operating temperature is 0 to 50 °C (32 to 122 °F)

1.10.6. TDS Meter

TDS meter is generally used to measure the TDS level in water. Suitability of the meter are range of TDS meter is 0 – 9990 ppm (mg/L), operating temperature is 0 to 80 °C (32 to 176 °F) and accuracy is ± 2 %. This meter is calibrated six months once or 20 times after its use.

1.10.7. GPS Meter

GPS meter is subjected to know the latitude and altitude, location, etc., Suitability of the GPS meter are, dimension is 2.1" x 4.0" x 1.3" (5.4 x 10.3 x 3.3 cm), Display resolution is 128 x 160 pixels an GPS Map features included in Continental Europe. It is calibrated six months once or after 20 times of the usage.

1.10.8. Deluxe Water and Soil Analysis Kit

Deluxe water and soil analysis kit is used to analyze the pH, TDS, salinity, turbidity, alkalinity dissolved oxygen of water.

1.11. Use of Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) refers to protective clothing for the eyes, head, ears, hands, respiratory system, body, and feet. It is utilized to protect individuals from the risks of injury and infection while minimizing exposure to chemical, biological, and physical hazards. PPE serves as the final line of defense when engineering and administrative controls are insufficient in reducing risks. Nature Science Foundation safeguards all the auditors by supplying PPE during the conduct of audits. PPE used are safety jackets, ear plugs, googles, face shield, hand gloves, shoes, etc.,

1.11.1. Safety jackets:

PPE includes safety vests and suits that can be used for inspection process which will protect body injuries from extreme temperatures, flames and sparks, toxic chemicals, insect bites and radiation.

1.11.2. Goggles and Face shield:

Goggles and face shield are used in the inspection process while inspecting items which would cause eye damage or loss of vision, spray or toxic liquids especially in chemistry labs, nearing the electric and electronic item.

1.11.3. Helmet:

PPE includes hard hats and headgears which will be required for tasks that can cause any force or object falling to the head. It also helps to resist penetration.

1.11.4. Hand gloves:

PPE includes safety gloves and should be used for tasks that can cause hand and skin burns, absorption of harmful substances, cuts, fractures or amputations**.** Selection of hand gloves is based on the application of use.

1.11.5. Safety Boots:

Foot protection is one of the most commonly used PPE and can differ depending upon the environment. Safety boots are used for tasks that can cause serious foot and leg injuries from falling or rolling objects, hot substances, electrical hazards, and slippery surfaces.

1.11.6. Ear Plug:

Ear plugs are used for tasks that can cause hearing problems and loss of hearing. Hearing protection devices reduces the noise energy reducing reaching and causing damage to the inner ear. This ear plug is mostly used near sound producing devices like power motors, genets, generators, etc.,

1.12. Scope and Importance of National Building Code (Part -11 Approach to Sustainability)

The National Building Code of India (NBC), a comprehensive building code, is a national instrument providing guidelines for regulating the building construction activities across the country. It serves as a model code for the adoption of all agencies involved in building construction works. It includes Public Works Department, other Government construction departments, local bodies or private construction agencies. Scope 11 covers the parameter required to be considered for planning, design, construction, operation and maintenance of building and those relating to land development from sustainable point of view.

1.12.1. Campus Details

S.No.	Details / Descriptions	Quantity
1.	Total strength of Students	**1384**
2.	Total strength of Employees	**106**
3.	Total number of Buses in the campus	**07**
4.	Number of Cars entering in the campus	**05**
5.	Number of Motorcycles entering in the campus	**150**
6.	Number of other vehicles (Lorry, Ambulance, Jeep, Trucks, Cranes, Poclain, and etc. entering in the campus)	**01**
7.	Number of E-Vehicles	**02**
8.	Number of RO Water Plants	**01**
9.	Number of Borewells	**01**
10.	Number of Open wells	**Nil**
11.	Number of Percolation Ponds	**Nil**
12.	Number of Wastewater treatment facility	**Nil**
13.	Number of Solid waste management facility	**01**
14.	Number of Rain harvesting system	**01**
15.	Number of Water reservoirs in the campus	**04 Tanks**
16.	Number of Composting pits and Vermicompost units	**Nil**

SOKA IKEDA COLLEGE FOR WOMEN * CHENNAI-99 *

PRINCIPAL
SOKA IKEDA COLLEGE OF ARTS AND SCIENCE FOR WOMEN
CHENNAI - 600 099

4. ENERGY AUDIT

4.1. 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 energy. The availability of fossil fuels and their depletion rate, insist the need for alternate energy systems and conservation of conventional electricenergy. 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).

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. 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 *et. Al*., 2014).

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 (Mishra 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 (Gnanamangai *et al*., 2021, 2022; Rajalakshmi *et al*., 2019). In general, an energy audit process dealt with the driving energy conservation concepts into reality by giving technically possible solutions within a specified time limit while 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 interms of savings. It serves as a "benchmark" for managing energy in the organization for planning more energy-efficient use across the board (Cabrera *et al*., 2010).

4.2. 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 of energy and fuel are being used in any organization and identifies the areas where wastes occur and the scope for improvement exists. 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 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 in carbon emissions, carbon footprint calculation, use of star rated equipment, encouraging energy use conservation practices, reduce the organization's energy consumption, reduce wastes to landfill. of course, integrating environmental considerations into all contracts and services considered to have significant environmental impacts (Anirudhan *et al*.,2023). 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 (Shriberg, 2002), however, energy saving and opportunities may be taken into consideration while energy is extensively used (Choy and Karudan, 2016). 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 institutionto examine its energy use practices at least once in two years using internal and external auditors (Sri Santhya *et al*., 2022). 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 is therefore recommended to measure the carbon footprint in each organization which may be useful for maintaining the environmental friendly campus for the benefit of stakeholders (Sreekala *et al*., 2023).

4.2.1. 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. As mentioned earlier, aim of an energy audit is to identify the energy efficiency, conservation and savings opportunities at the audit sites in a systematic manner. The audit process involves following steps.

- Review of energy saving opportunities and measures implemented in an audit site.
- Identification of various energy conservation measures and saving opportunities.
- Implementation of alternative energy resources for energy saving opportunities and decision making.
- Providing a technical information on how to build an energy balance as well as guidance to be sought for particular application.
- Detailed analysis on energy consumption based on latest electricity bills and understanding the tariff plan provided by the Central and State Electricity Board.
- The utility of energy in terms of electricity, LPG, firewood, petrol, diesel and other resources to calculate carbon foot print analysis with in the campus.
- Utility of number if 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 to calculate the energy utilization.
- 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.

4.2.2. Benefits of an energy audit

- **Reduced energy expenses:** Less energy used by an organization, reduced the energy costs.
- **Identify problems:** Energy audit can help to identify any issues that the equipment might have.
- **Increased employee comfort:** Insulation and air sealing is an important criteria which enhances more reliable and more efficiently cooled or heated space for the employees. More comfortable employees tend to be more productive, in turn, it is not only savings on energy costs, but will improve overall productivity.
- **Personalized recommendations:** The professional will customize a plan, recommending which upgrades will give the most return on investment which includes updated lightings, new HVAC system, weatherization measures like insulation and air sealing and more.
- **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 property value and longer equipment lifespan.
- **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). The audit will not only inform about the opportunities but also provide information with financial analysis.
- **Analyzing the quality of energy audit:** It provides information with emissions analysis to help understand the benefits ofthe decisions from an environmental standpoint.

4.2.3. Types of energy audit

The energy audit types depends on the following factors:

- ✓ Industry/ Organization 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.

Preliminary energy audit: Preliminary energy audit gives a quick access to 1) estimating and establishing energy consumption in the organization, 2) estimate the scope of audit, 3) identify the areas of maximum energy consumption, 4) identify the areas of improvement, 5) setting benchmark on the basis of existing data.

Detailed energy audit: 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 which include Phase I: pre-audit phase, Phase II: audit phase and Phase III: post audit phase.

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 audit

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: a) discussion on the aims and scope of the energy audit b) economic factors associated with the recommendations of theaudit, c) analysing the major energy consumption data with the concerned person, d) obtaining the available audit site drawings (building layout, electricity distribution, steam distribution, compressed air distribution, etc.) and e) walk-through audit around site.

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 the energy and material balances for specific departments. Possible checks of plant operations were carried outover extended periods of time, at nights and at weekends as well as during normal daytime working hours, to ensure that nothing is overlooked.

The information to be collected during the detailed audit includes

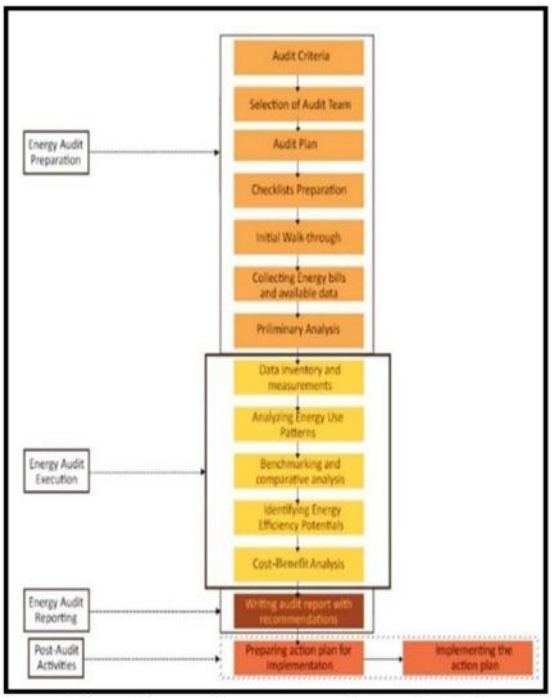
- Energy consumption by type of energy, by department/area, by type of process equipment, by end-use
- Energy cost and tariff data
- The distribution and generation of site services (eg. electricity, c ompressed air, steam).
- Sources of energy and its supply (e.g. electricity from the grid or self-generation)
- Potential alternative for fuel substitution, process modifications and the use of co-generation systems (combined heat and power generation).
- Energy conservation and management awareness training programs within the Organization.
- Besides audit team collects a) major equipment details, process/technology used, b) water/fuel/steam, electrical energy consumption and c) yield efficiency.

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.

4.3. Procedures followed in an energy audit

Several methods are adopted in the energy audit, walk-through audit is one among them. 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 audit Manual. 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 as per the regulation of Indian Green Building Council and World Green Building Council (IGBC, 2021). Physical verification of installed electrical appliances and when considering the cost or prospective cost savings in each of the above components, energy always wins and the energy management task becomes a key cost reduction area.

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; Rajalakshmi *et al.,* 202*1*; Leon- Fernandez and Dominguez-Vilches, 2015; Bae and Seol, 2006; Singh *et al*., 2012). It may be useful to check where carbon emission is prominent which could be taken into account to reduce. Finally, after the audit process, the energy auditincluded suggestions for energy cost reduction, preventive maintenance and quality control activities, all of which are critical for the utility operations in the auditee (Organization).



Flow chart of energy audit methodology

4.4. Carbon footprint

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 (Peters and Romi, 2014).

Components of Carbon Foot Print

4.5. Observations of the energy audit

4.5.1. Facilities visited

During onsite audit following departments were verified for physical facility availability (Table 20).

Table 20. Facilities visited during the onsite energy audit

Date	Section where Energy audit is conducted
28.03.2023	Administrative Block
	Power House
	Faculty Rooms
	Classrooms
	Seminar Halls
	Auditorium
	Laboratories
	Computer Centers
	Well, Sump and pumps.
	Parking area
	Hostel
	Library

In all these areas lighting systems forms the major consumer of electrical energy. In all the sections lighting fixtures, installed energy efficient lighting systems/ safety systems were verified besides installed power backup systems (generators and UPS) were verified. The electricity consumption charges are audited and studied for the load demand requirement and efficient consumption of energy. The scope for improvement has been discussed with the auditees. Potential areas in which scope of energy conservation and saving opportunities available have been identified and suggested for implementation.

4.5.2. Qualitative measures available at the campus according to the checklist

It has been observed that except a criteria, all others are satisfied the checklist prepared in accordance with National Building Code (Part - 11) (Table 21).

Table 21. Qualitative measures available at the Institute

S. No.	Part 11 clause as per the National Building Code	Audit Checklist / Parameters	Audit Findings (C / NC/ PC)
1.	3.5. Energy efficient design and process	Use of non-fossil fuel energy for all needs at the campus (solar, wind, etc.,)	C
2.		Examine the natural lighting, cooling and ventilation facilities	C
3.	6.2.8. Optimal day lighting	Whether the building ensures 25% of day lighting which will be measured using Lux meter during onsite audit.	C

4.	7.1.3.3. Landscape design for controlling solar gain	Observation on energy conservation activities through vegetation (more number of trees)	C
5.	7.4.2. Long term public and private transportation plan	Availability of electric vehicles	C
6.		Use of public transport by the stakeholders to reduce air pollution	C
7.	8.3.1. Integration of solar thermal technologies	Availability of solar panel, solar street light and solar water heater.	C
8.	11.3. Natural and mechanical ventilation strategies	Availability of spatial cooling techniques through windows	C
9.	11.8. HVAC system	Whether the campus has air cooler, air conditioners, refrigerants, exhaust air fans, ceiling, pedestal fans and provision of separate server room / data centre facilities.	C
10.	11.9. Electrical system	Availability of appropriate metering for energy consumption and replacing old electrical items with latest star rated gadgets / appliances	C
11.		Replacement of fluorescent (tube) lights, incandescent lamp, insect traps and sodium vapour lights with CFL / LED lamps, insect traps towards energy saving opportunities.	C
12.		Whether transformer, generators and UPS are protected properly with fencing and kept awareness boards as 'Dangers' and 'Warnings'	C
13.		Use of Ultra-violet lights and any other harmful lights with safety precautions in the campus	C
14.		Sign boards indicating Switch OFF / ON, Danger at Electrical equipment and Power transformers	C
15.	12.3.4. Establishing energy consumption and creating bench marks	Database on annual energy consumption using cost profile	C
16.		Database on annual energy consumption of fuels (Diesel, petrol and LPG)	C
17.	12.4.4. Noise monitoring	Measure the noise level using Sound level meter during onsite audit	C
18.	13.3. Operation and maintenance programme	Calculate carbon foot print using electrical energy and fuel consumptions.	C

19.	Energy saving opportunities	Availability of transformer, generators, UPS convertor, invertor, compressor, stabilizers, etc.,	C

4.6. Quantitative measures

In this section, quantitative measures observed/verified and secondary data obtained from the management representative/ IQAC coordinator are presented.

4.6.1. Energy consumption and cost profile

The following chart shows the profile of energy consumed and the cost for one year by the auditee (Figs.8 & 9; Table 22).

Figure 8. Electrical energy consumption profile

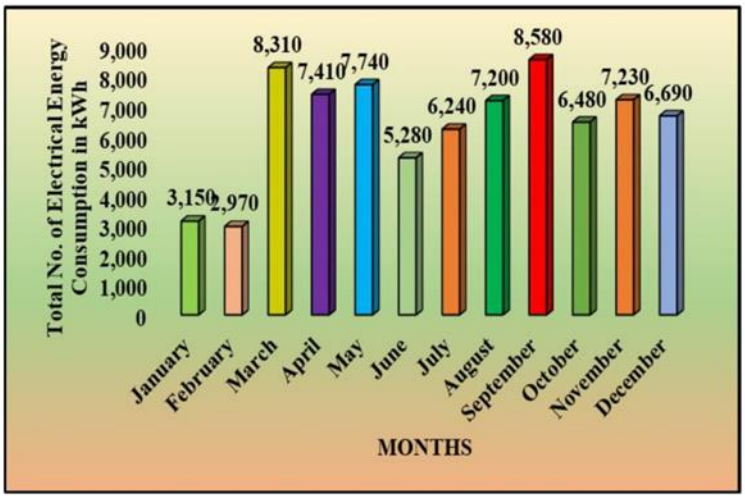


Figure 9. Overall electrical energy consumption and cost profile

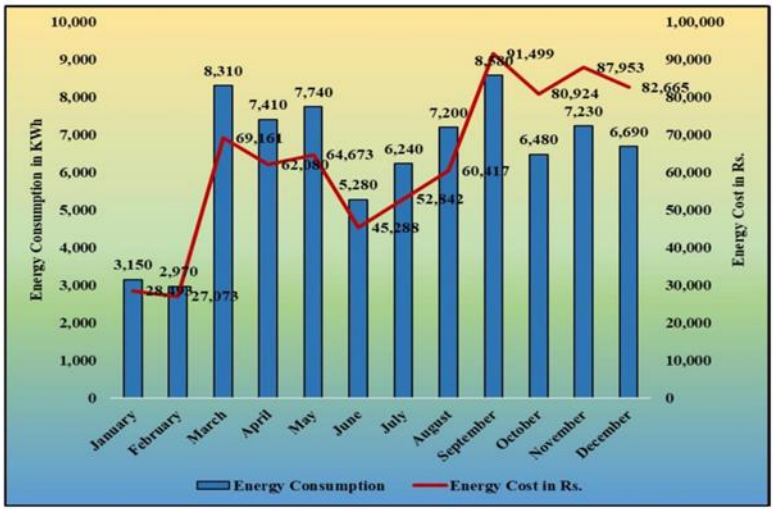


Table 22. Electrical energy consumption and cost profile in the Institution

S. No	Months	Energy Consumption in kWh	Energy Cost in Rs.
1.	January	3,150	28,493
2.	February	2,970	27,073
3.	March	8,310	69,161
4.	April	7,410	62,080
5.	May	7,740	64,673
6.	June	5,280	45,288
7.	July	6,240	52,842
8.	August	7,200	60,417
9.	September	8,580	91,499
10.	October	6,480	80,924
11.	November	7,230	87,953
12.	December	6,690	82,665

4.6.2. Power consuming equipment and electrical appliances

Other than electrical energy from grid, energy generated using fossil fuels for the year 2022 are presented in Table 23.

Table 23. Annual Energy Consumption of Fuels in the College

S. No	Months	Diesel Consumption (Liters)	Petrol Consumption (Liters)	LPG Consumption (kg)	Mean Consumption
1.	January	160	Nil	Nil	160
2.	February	42	Nil	170	106
3.	March	1440	Nil	170	805
4.	April	1163	Nil	17	590
5.	May	1276.03	Nil	136	706
6.	June	375	Nil	119	247
7.	July	998.86	Nil	Nil	998.86
8.	August	941.11	Nil	170	555.5
9.	September	1275.16	Nil	187	731
10.	October	1126	Nil	Nil	1126
11.	November	1011	Nil	170	590.5
12.	December	731.73	Nil	153	442.4

4.6.3. Energy consuming vehicles

Institution run the e-vehicles for the benefit of its stakeholders. Details of the same are presented in Table 24.

Table 24. Transportation Facilities available in the Campus

S. No	Type of Vehicle	Fuel Used	No. of Vehicles	Non-Pollution Certified (Y/N)
1.	Bus	Diesel	05	Y
2.	Car	Nil	Nil	Nil
3.	Jeep	Nil	Nil	Nil
4.	Bike	Nil	Nil	Nil
5.	Lorry	Nil	Nil	Nil
6.	Trucks	Nil	Nil	Nil

4.6.4. Calculation of carbon footprint

The carbon footprint analysis can be calculated based on the earlier reports as stated in www.carbonfootprint.com which is the sum of electricity usage per year (Padmini, 2007). According to the data provided by the Management, carbon emission due to electricity consumption and fossil fuels are presented hereunder.

The CO_2 emission from electricity

= (electricity usage per year in kWh/1000) x 0.84, where 0.84 is the coefficient to convert kWh to metric tons
= (77280 kWh/1000) x 0.84
= 64.91 metric tons

According to the above calculations, carbon emission due to electricity usage per year accounts for 64.91 metric tons.

Transportation per year (Shuttle)

= (Number of the shuttle vehicle in the campus (2) x total trips for shuttle bus service each dayx approximate travel distance of a vehicle each day inside campus only (20 km) x 365/100) x 0.01
= ((5 x 20 x 1 x 365)/100)) x 0.01
= 3.65 metric tons

365 is the number of days per year
0.01 is the coefficient to calculate the emission in metric tons per 100 km for bus

a. Transportation per year (Car)

= (Number of cars entering the campus x 2 x approximate travel distance of a vehicleeach day inside campus only (in kilometers) x 365/100) x 0.02
= ((0 x 20 x 1 x 365)/100)) x 0.02
= 0 metric tons

365 is the number of days per year
0.02 is the coefficient to calculate the emission in metric tons per 100 km car

b. Transportation per year (Motorcycles)

= (Number of motorcycles entering the campus x 2 x approximate travel distance of avehicle each day inside campus only (in kilometers) x 365/100) x 0.01
= ((150 x 20 x 1 x 365)/100)) x 0.01
= 110 metric tons

365 is the number of days per year
0.01 is the coefficient to calculate the emission in metric tons per 100 km for motorcycles.

c. Total Carbon emission per year

= total emission from electricity usage + transportation (bus, car, motorcycle)
= (64.91 + 3.65 + 0 + 110
= 178.56 metric tons

4.6.5. 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 (Vinoth Kumar *et al*., 2021).

Food: Consumption of local and seasonal food products, limiting the consumption of meat, adopting sustainable fishing, avoiding plastic packed food products and practicing the use of reusable bags and sense of buying only necessary things that can impact on carbon emission.

Clothing: Taking good care of clothes, avoid buying second hand products or borrowing and using the clothes made from recycled products with eco label can also improves the reduction in carbon emission.

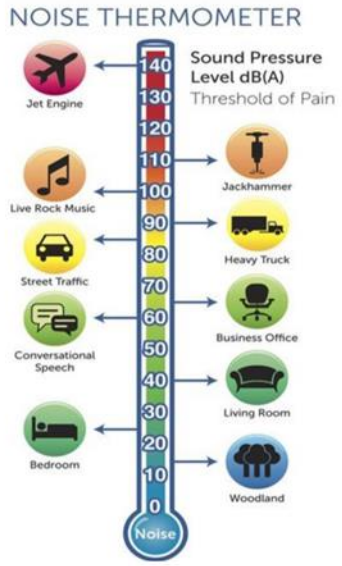
Transport: Adopting carpooling practice, using cycles and public transport and usage of "No Pollution" certified vehicles also contribute reduction in carbon emission.

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 and reduce and recycle of wastes can also contribute reduction in carbon emission.

4.7. Noise level measurements

Noise is all unwanted sound or set of sounds that causes annoyance or can have a health impact and noise level is measured in decibels (dB). Noise pollution is defined as consistent exposure to elevated sound levels that may cause adverse effects in humans or other living organisms. World Health Organization (WHO) defined environmental noise (sound produced by transport, industrial activities, construction sites, public works and services, cultural, sporting and leisure activities and neighborhood) as noise from all sources with the exception of workplace noise and recognizes that noise pollution is an increasing problem. Prolonged exposure to loud noises (>75 dB (A) over eight hours a day for years) can lead to hearing loss.

The body can also respond to lower noise levels. Level of noise are expected to be within 55 dB in residential areas, including institutions. Class room noise levels are supposed to be around 50 db (Table 25). From the graph, it is evident that mostof the noise level values across campus are above the normal or permissible range. Within the auditorium the noise levels were within range. Sound levels in other areas of campus are largely due to the interactions of people on campus than any other causes like construction or traffic. Sound Level Meter / NoiseThermometer are used to measurethe noise level in the surroundings which converts the sound signal to an equivalent electrical signal and the resulting sound pressure level in decibels (dB) referenced to 20 µPa. Noise level prescribed by Central Pollution Control Board was presented in (Table26).



Level of noise in variouslocations and working place

Table 25. Noise level at various location in the campus

S.No	Locations	Measurements (dB)	Major noise sources	Remarks
1.	Class room	70.9 ± 2.2	Students and Staff	No Noise Pollution
2.	Auditorium	35.8 ± 0.2	Students	No Noise Pollution
3.	Seminar hall	32.6 ± 0.5	Students	No Noise Pollution
4.	Library	23.1 ± 0.6	Staff members	No Noise Pollution
5.	Laboratory	25.7 ± 0.4	Students	No Noise Pollution
6.	Canteen	42.3 ± 1.6	Students and Staff	No Noise Pollution
7.	Open area	35.4 ± 1.2	Students and staff	No Noise Pollution
8.	Parking area	28.4 ± 0.5	Vehicles	No Noise Pollution
	Mean	36.8		
	SE	3.76		
	CD	6.70		

Table 26. Noise level standard prescribed by Central Pollution Control Board, Government of India

Area Code	Zone	Limits in dB (A) Leq	
		Day Time	Night Time
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence	50	40

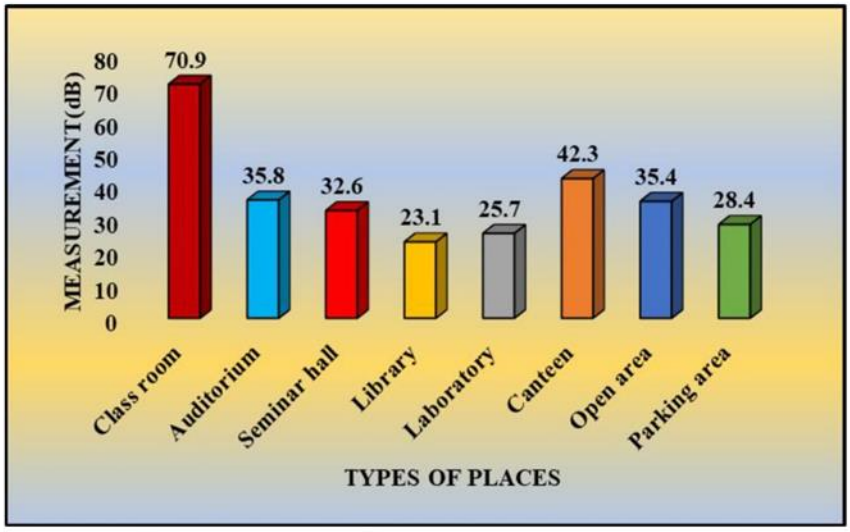


Figure 10. Noise level at various location in the campus

4.8. Light intensity measurement at the campus

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 (Table 27) (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 thebaseline measurement from illuminated level gives the light intensity of the particular room (Table28).

Table 27. Recommended level as per (ASHARE 62-2019) Iluminance (LUX)

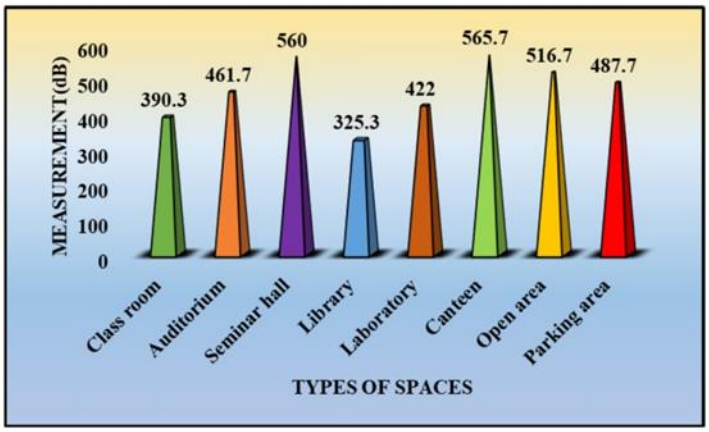
S. No	Building Type	Space Type	Illuminances (LUX)
1.	Barracks / Dormitories	Bed Rooms	300
		Laundry Rooms	
2.	Educational Buildings	Play Room, Nursery, Classroom, Lecture Hall	400
		Computer Practice Rooms	300
3.	Office Buildings	Single Offices, Open plan Offices	400
		Conference Rooms	300
4.	Hospitals	General ward Lighting	300
		Simple Examination	500
		Examination and Treatment Ward	1000
5.	Hotels and Restaurants	Kitchen	500
		Buffet	100
6.	Sports Facilities	Sports halls	300
7.	Circulation areas	Corridors and Stairs	500
		Cloak Rooms, Wash Rooms,	
		Bath Rooms, Toilets	300
8.	Industrial areas	Metal working / Welding	300
		Simple Assembly	300
		Difficult Assembly	1000
		Exacting Assembly	3000-10000

Reference set of values for LUX

Table 28. Light intensity measured at various locations in the Institute

S. No	Type of Spaces	Illuminances (LUX)
1.	Class room	390.3 ± 4.0
2.	Auditorium	461.7 ± 2.5
3.	Seminar hall	560.0 ± 3.6
4.	Library	325.3 ± 4.0
5.	Laboratory	422.0 ± 2.6
6.	Canteen	565.7 ± 3.0
7.	Open area	516.7 ± 3.5
8.	Parking area	487.7 ± 4.2
	Mean	466.17
	SE±	2.95
	CD	5.25

Figure 11. Light intensity measured at various locations in the Institute



4.9. Other facilities

Within the auditee's premises, there are other facilities are available that are depicted as glimpses of photographs

Transport Facility available in
Soka Ikeda College of Arts and Science for Women

Solar Panel are Observed in
Soka Ikeda College of Arts and Science for Women

Voltage Transformers and UPS System Facility
in Soka Ikeda College of Arts and Science for Women

Energy Audit towards Generator and Power Room in the Campus

Noise Level and Light Level (LUX) Analysis in the Campus

E-Vehicles are Used in the Soka Ikeda College of Arts and Science for Women

4.10. Compliances

- Transformer, generators and UPS are protected properly with fencing and kept awareness boards.
- Most of places, sign board of 'Switch ON' and 'Switch OFF' are kept towards saving energy measures to the users.
- Electrical wires, switch boxes and stabilizers are properly covered which will cause any problems to the staff and students.
- Solar power plants were installed on roof top of two buildings and power generated through solar power plant is exported.
- Usage energy efficient light-emitting diode, bulbs instead of incandescent and CFL bulbs and replaced old generation computers and TVs with LED monitors.
- Maintenance of appliances and replaced old appliances in all laboratories
- HVLS fans are fitted in the auditorium.
- Water level controllers are used besides STP is used for water recycling which is functioning well.
- 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.
- Promoting ECON awareness and practice among the stakeholders are being conducted periodical through Association, Clubs, Forums and Chapters.
- Value added / Non-formal / Certificate / Diploma course on 'Energy and Environment Management Audits' are being conducted for the benefit of students and research scholars.

4.11. To improving the energy efficiency within the Organization

- Procurement of equipment with energy efficiency (4-5 star rated equipment) during replacement may be considered.
- Daylight sensors can be implemented in future Star rated fan can be used and DG set Automatic syne can be implemented
- 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.
- Internal energy policy such as preventive maintenance and breakdown maintenance policy should be implemented.
- Energy meter in each building to be implemented
- 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.

4.12. Conclusion

Considering the fact that the organization is a well-established, there is significant scope for conserving energy and make the campus as self-sustained in it. The energy conservation initiativestaken up by the institution are substantial. There are some best practices followed as listed above. Consideration provided in this report can further improve energy savings of the organization which in turn reduce the carbon emissions effectively. 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.

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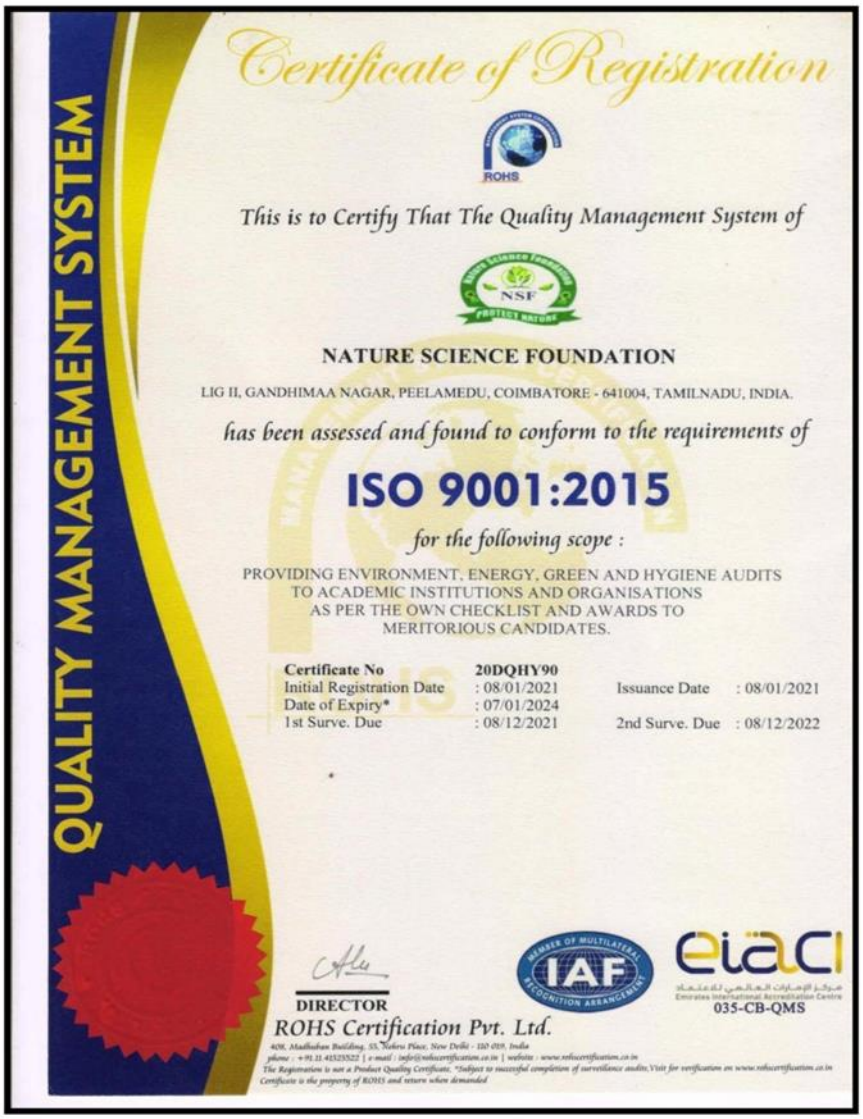

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Village/Town	Gandhinaanagar S.O	Block	LIG-II
Road/Street/Lane	Podamedu	City	Coimbatore South
State	TAMIL NADU	District	COIMBATORE , Pin 641004
Mobile	9566777255	Email:	chairmannsf@gmail.com

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DATE OF COMMENCEMENT OF PRODUCTION/BUSINESS	12/03/2020

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2. Indian Green Building Council (IGBC AP) Accredited Professional of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.

3. Tamil Nadu Fire and Rescue Service Certificate of Er. S. Srinivash, Energy Auditors of NSF.

4. Energy Management System ISO 50001:2018 Certificate of Dr. D. Vinoth Kumar, Joint Director of NSF.

5. ISO 17020:2012 certificate of Ms. V. Sri Santhya, Assistant Director of NSF.

BUREAU OF ENERGY EFFICIENCY

Examination Registration No. : EA-14056 Serial Number: 9176

Certificate Registration No. : 9176

Certificate For Certified Energy Manager

This is to certify that Mr./Mrs./Ms. Dinesh Kumar D Son/Daughter of Mr./Mrs. R M Dhanasekaran who has passed the National Examination for certification of energy manager held in the month of October 2011 is qualified as certified energy manager subject to the provisions of Bureau of Energy Efficiency (Certification Procedures for Energy Managers) Regulations, 2010.

This certificate shall be valid for five years with effect from the date of award of this certificate and shall be renewable subject to attending the prescribed refresher training course once in every five years.

His /Her name has been entered in the Register of certified energy manager at Serial Number 9176 being maintained by the Bureau of Energy Efficiency under the aforesaid regulations.

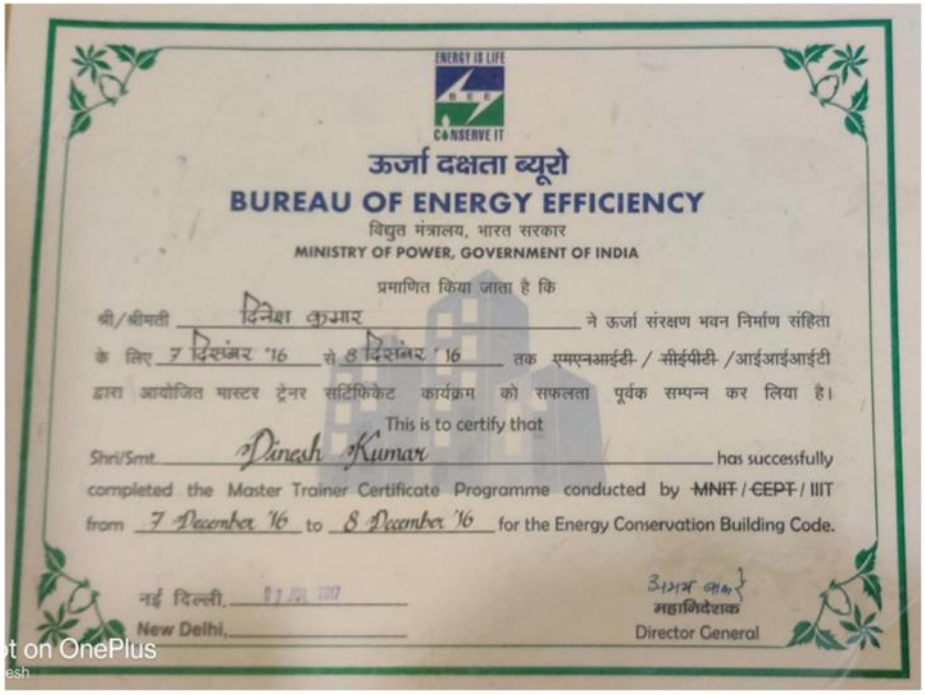
Mr./Mrs./Ms. Dinesh Kumar D is deemed to have qualified for appointment or designation as energy manager under clause (/) of Section 14 of the Energy Conservation Act, 2001 (Act No.52 of 2001).

Given under the seal of the Bureau of Energy Efficiency, this 7th day of February, 2013

Digitally Signed: RAKESH KUMAR RAI
Sun Mar 01 10:58:55 IST 2020
Secretary, BEE New Delhi

Secretary
Bureau of Energy Efficiency
New Delhi

Dates of attending the refresher course	Secretary's Signature	Dates of attending the refresher course	Secretary's Signature
22.12.2019			



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This is to certify that

Shri/Smt. Dinesh Kumar has successfully completed the Master Trainer Certificate Programme conducted by ~~MNIT~~ / ~~CEPT~~ / IIIT from 7 December '16 to 8 December '16 for the Energy Conservation Building Code.

नई दिल्ली, 11 JAN 2017
New Delhi,

महानिदेशक
Director General

TAMILNADU FIRE & RESCUE SERVICES
THIRUVALLUR DISTRICT
THIRUVALLUR

CERTIFICATE

This is to certify that Mrs. / Mr S. SRINIVASH S/o B. SWAMIYAPPAN H/855, ST. Xavier's Street, Ponnur, Thiruvallur District has under gone the "Basic Fire Fighting & Rescue Operation" Training course conducted from 11.08.2016 to 20.08.2016 by Tamil Nadu Fire & Rescue Services Department at Thiruvallur District, Thiruvallur as per G.O.M.S. No.713, dated 17.08.2005 Home (Police XVII) Department, Government of Tamil Nadu.

Station : Thiruvallur.
Date : 20.9.16

District Officer 20.9.16
Fire & Rescue Services
Thiruvallur District
Thiruvallur

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ASSOCHAM

ASSOCHAM hereby certifies that

Dr. B. Mythili Gnanamangai

has successfully passed the

Green and Eco-friendly Movement Certified Professional Test (GEM CP)

with

"Excellent Performance"

on

16 July, 2021

He/she is now eligible to execute the GEM Sustainability Certification Projects.
ASSOCHAM feels proud to award the GEM Certified Professional title to him/her.

Pankaj R. Dharkar
Chairman, GEM

GEM CP 20/649

Deepak Sood
Secretary General, ASSOCHAM

IGBC

CII
Confederation of Indian Industry

The Indian Green Building Council

hereby certifies that

B Mythili Gnanamangai

has successfully demonstrated knowledge on the Green Building Design & Construction, Building Standards & Codes, IGBC Resources & Processes and Green Design Strategies & their Impacts, required to be awarded the title of

IGBC Accredited Professional

K S Venkatagiri
Executive Director
CII-Godrej GBC

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17 April 2021

TAMILNADU FIRE & RESCUE SERVICES

THIRUVALLUR DISTRICT

THIRUVALLUR

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Station: Thiruvallur.
Date: 20.9.16

District Officer 20.9.16
Fire & Rescue Services
Thiruvallur District,
Thiruvallur

GRIHA

GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT

GRIHA CERTIFIED PROFESSIONAL CERTIFICATE

This is to certify that

Dinesh Kumar Dhanasekaran

has qualified as a **GRIHA** Certified Professional For V. 2015

Date of issue: 19th June 2020

Note : This certification is valid only for GRIHA version 2015.

Chief Executive Officer
GRIHA Council

LEED AP BD+C

GREEN BUSINESS CERTIFICATION INC. CERTIFIES THAT

DINESH KUMAR D

HAS ATTAINED THE DESIGNATION OF

LEED AP® Building Design + Construction

by demonstrating the knowledge and understanding of green building practices and principles needed to support the use of the LEED® green building program.

10531234-AP-BD+C
CREDENTIAL ID

26 DEC 2016
ISSUED

25 DEC 2022
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Mahesh Ramanujam

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The CPD Accreditation Office

Certificate of Successful Attainment

This is to certify that

DR. D. VINOTH KUMAR

HAS SUCCESSFULLY COMPLETED THE FIVE DAYS (40 HOURS)

LEAD AUDITOR COURSE

BY PASSING THE WRITTEN EXAMINATION BASED ON

ISO 50001:2018

ENERGY MANAGEMENT SYSTEMS

Examination Date: 15/07/2022
Certificate issue Date: 22/07/2022
Certificate registration number: QCS/TR/C/0056
Total Course duration: 40 hours CPD Credits Earned: 32

Remarks: Roughly one hour of study time equals to 1 CPD Credit.

This certificate can be validated online from the industry wide Global Professional Register at www.qcspl.com.

Partha Bagchi
(Managing Director)

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