

Report of Green, Environment and Energy Audits



Submitted to

**THE GANDHIGRAM RURAL INSTITUTE
(DEEMED TO BE UNIVERSITY)
DINDIGUL - 624 302, TAMIL NADU**

Date of Audit: 10.03.2023

Valid Till : 09.03.2026



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

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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 ***The Gandhigram Rural Institute (Deemed to Be University) Dindigul - 624 302, Tamil Nadu*** 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.
5. Provided the Auditee desired to publish or share the data with other agencies, Nature Science Foundation has no conflict of interest.

Date: 10.03.2023
 Place: Coimbatore



[Handwritten Signature]
 10/03/2023

Authorized Signatory
 Nature Science Foundation

Dr. D. Vinoth Kumar, M.Sc., M.Phil., Ph.D., FNSF.
 Director
 NATURE SCIENCE FOUNDATION
 No. 2669, LIG - II, Gandhi Managar
 Coimbatore - 641 004, Tamil Nadu, India.

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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 CO₂ emission and less or pollution free environment. Green Audit is a tool to evaluate environment management system which is systematically executed to protect and preserve the environment. Green 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. It strengthens the concept of 'Green Building' and 'Oxygenated Building' which in turn provides a healthy atmosphere to the stakeholders.

1.2. Environment Friendly Campus

As stated earlier, Organization is liable to provide an eco-friendly atmosphere along with good quality of 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 Council (IGBC) 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), Swach 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.

1.3. About Nature Science Foundation (NSF)

NSF is the ISO QMS (9001:2015), EMS (14001:2015), OHSMS (45001:2018) and EnMS (5001:2018) 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’.

1.4. About the Organization

The Gandhigram Rural Institute (Deemed To Be University)

Gandhigram Rural Institute (GRI), founded by two dedicated disciples and contemporaries of Mahatma Gandhi, Dr.G.Ramachandran and Dr.T.S.Soundaram Ramachandran, has as its foundation Mahatma Gandhi’s revolutionary philosophy of Nai Talim, which effectively bridges the cognitive and practical dimensions, and focuses on the holistic development of learners, with an emphasis on skill development through value-based education, rooted in indigenous cultures and traditions. Since its establishment in 1956, GRI has been unstintingly contributing to higher education and has successfully pioneered rural higher education.

The Institute which is administered by the Ministry of Education, Government of India and fully funded through UGC, New Delhi has developed academic programs in rural development, rural economics and extension education, rural oriented sciences, co-operation, development administration, rural sociology, English, Tamil and Indian languages. The institute runs B.Tech. in civil engineering with focus on habitat development and M.Tech. in renewable energy. The institute also offers B.Sc Agriculture program. Gandhigram Rural Institute is quite active on both campus and rural areas in the vicinity, benefitting and enriching one another. Besides, its contribution to teaching, from diploma, degree and all the way to post-doctorate levels, the Institute applies the learnings from both scientific and social research to solve contemporary rural problems.

1.5. Audit Detail

- | | |
|--|---|
| 1. Date of Audit | : 10.03.2023 |
| 2. Audit Site | : The Gandhigram Rural Institute Dindigul - 624 302, Tamil Nadu |
| 3. Inspection Body | : Nature Science Foundation Coimbatore, Tamil Nadu, India. |
| 4. Audit Scope | : Green, Environment and Energy Audits |
| 5. Name of the Auditing Chairman | : Dr. S. Rajalakshmi ISO QMS, EMS and EnMS Certified Lead Auditor, Founder & Chairman of NSF. |
| 6. Name of the Auditing Team Leader | : Dr. D. Vinoth Kumar ISO QMS, EMS and EnMS Certified Lead Auditor, Joint Director & Technical Manager, NSF. |
| 7. Name of the Lead Auditor for Green Audit | : Dr. R. Mary Josephine ISO EMS and EnMS Certified Lead Auditor. |
| 8. Name of the Lead Auditor for Environment Audit | : Ar. N. M. Pradeep Kumar ISO EMS and IGBC Certified Lead Auditor. |
| 9. Name of the Lead Auditor for Energy Audit | : Er. A. Karthik Bureau of Energy Efficiency Certified Auditor. |

2. GREEN AUDIT

2.1. Introduction

Green audit ensures the Organization's campus should have greenish with large diversity of trees, herbs, shrubs, climbers and lawns to reduce the environmental pollution and soil erosion; it is also useful in relation to biodiversity conservation, landscape management, irrigation/economic water utilization and maintenance of natural topography besides vegetation. For the benefit of stakeholders, solid waste management, recycling of water, disposal of sewage and waste materials (electronic and biomedical wastes), 'zero' use of plastics, single use plastic items, etc. should be followed consistently in the organization campus. Green Audit procedures includes the definition of green audit, methodology on how to conduct green audit at Educational Institutions and Industrial sectors.

2.2. Importance of green audit

The Management of the Organization (Auditee) should be exposed their inherent commitment towards making ecofriendly atmosphere through the green auditing and ready to encourage/follow all types of green activities. A clean and healthy environment will enhance an effective teaching/learning process. They should create the awareness on the importance of greenish initiatives through environmental education among the student members and research scholars. Green audit is the most effective, ecological approach to manage environmental complications (Rajalakshmi *et al.*, 2023). Green audit is a kind of professional care and a simple indigenized system about the environment monitoring in terms of planting more number of trees which is a duty of each and every individual who are the part of economical, financial, social and environmental factors. Green audit is a professional and useful measure for an Organization to determine how and where they are retaining the campus eco-friendly manner. It can also be used to implement the alleviation measures at win-win situation for the stakeholders and the planet. It provides an opportunity to the stakeholders for the development of ownership, personal and social responsibility.

2.3. Green audit observations

- It is observed that the Organization has facilities (ramp walk ,wheel chair etc.,) for disabled and different age group people.
- Adequate training and awareness programmes are conducted to the Stakeholders for sustainable development at all stages of building life cycle.
- More than 30% of open space is maintained as soft scapes (vegetation) to lower the energy conservation in the campus.
- Land scape design are planned to maintain the natural capacity of the site.
- Land scape irrigation are performed as per the microclimatic condition like during humid / winter season less watering through irrigation is observed.
- Vegetation / vegetative structures are available around the building to reduce energy consumption and maintain indoor climates.
- Roof Garden, Herbal and Ornamental Garden and green roof system are available to maintain sustainability.

2.3.1. Facilities for Human Comforts

As per the ISO Standards under elements of sustainability quality of plumbing services and buildings are maintained in line with the standard. Ramp walk and Wheel chair facilities are implemented for the benefit of disabled and different age group people.



Ramp walk, Wheel Chair facilities available for the comfort of person with disability.

2.3.2. Natural topography, vegetation and monitoring

Natural topography means the original geographical features and natural resources of the Site. It is observed that the organization has the natural features like rocks, water resources, slopes, landscape, pathways, etc. Vegetation is the cultivation of a bunch of plants irrespective of the plant *taxa* for the covering of the area or ground topography. The observation at the campus indicated that there are more than 40% natural topography and vegetation. Monitoring plan for maintaining the vegetation and sustainability are evident through separate operation and maintenance team & their records for regular watering as per the micro climatic condition through irrigation.



Natural Topography and Vegetation at the Campus

2.3.3. Landscape design and soil erosion control

Landscape design is an important feature for any disasters to control especially

with respect to the soil erosion. In general, soil erosion occurs if the design of the land is not altered so as to prevent the slope features by strong vegetation and use of a plant buffer zone as safe for escape of nutrients or fertilizers entering the streams. Observation revealed that the audited site has very good landscape design without disturbing the natural vegetation. Contour ploughing is being done at right angles to the slope wherever possible and ridges and furrows are properly maintained to break the flow of water down to the empty land. These activities are widely adopted to control soil erosion in the campus. Microclimatic conditions are considered, during winter season irrigation and watering to plants are controlled as per the water management plan. External landscapes are designed based on the shading pattern of the building. Green vegetation are available around the building to reduce the energy consumption.

2.3.4. Establishment of different gardens, vertical landscaping and roof gardens

It is observed that Organization has implemented and maintaining gardens to lower the energy consumption. To maintain certain biomass critical for human health and also to reduce the bio-retention through water flow rates different types of gardens like roof garden, herbal garden and ornamental garden is implemented in the campus.



Roof Garden, Herbal and Ornamental Gardens observed in the Campus

2.3.5. Survey of Flora and Fauna

Ensuring the rich biodiversity in the green campus is an important parameter which reflects the real-time ecosystem. In general, plants improve the outdoor air quality with increased oxygen levels and reduced temperature and carbon dioxide. The record on maintenance of the plant biomass and its management are important with respect to green campus initiatives. The existence of such plants and birds in the green campus are recorded for the rich flora and fauna which are being considered as a value addition to the campus.

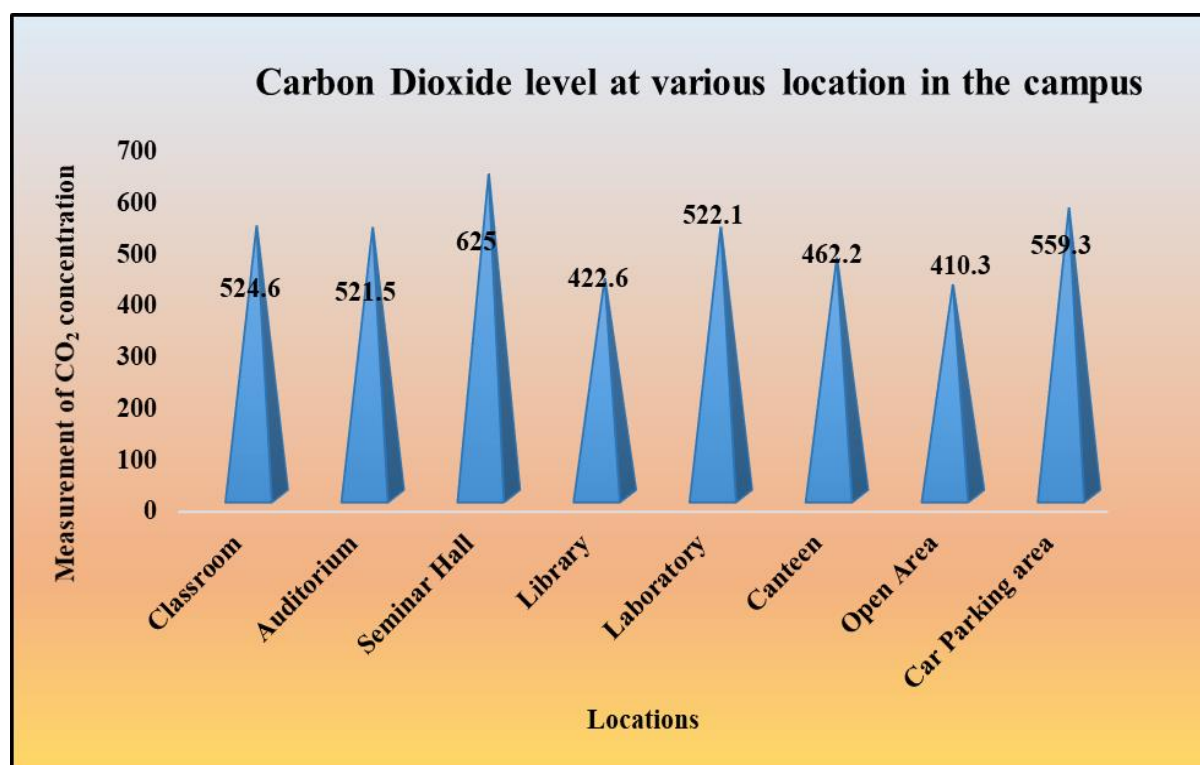
2.4. Air quality audit observations

It is observed that carbon dioxide and oxygen values are acceptable range. The air circulation is very good in all the places which in turn useful to give pure air to the stakeholders. The observation showed that the concentration of CO₂ in the atmosphere is found to be optimal which did not exceed the critical limit of CO₂. It is further revealed that all the selected locations are having pure air without any air contaminants with good air exchange/circulation in the campus. Some of the places like Canteen and Class Rooms are recorded with high level of carbon dioxide level due to student mobilization and the maximum number of electrical items fixed from which the carbon dioxide emission was observed followed by all laboratories and seminar and auditorium halls (Table 1).

Table 1. Measurement of CO₂ concentration in the Organization

| S. No. | Different locations of the Organization's Campus | Carbon dioxide level (ppm)* | Remarks |
|--------|--|-----------------------------|---------------------------|
| 1. | Classroom | 524.6 | Within permissible limits |
| 2. | Auditorium | 521.5 | Within permissible limits |
| 3. | Seminar Hall | 625 | Within permissible limits |
| 4. | Library | 422.6 | Within permissible limits |
| 5. | Laboratory | 522.1 | Within permissible limits |
| 6. | Canteen | 462.2 | Within permissible limits |
| 7. | Open Area | 410.3 | Within permissible limits |
| 8. | Car Parking area | 559.3 | Within permissible limits |

Figure 1. Measurement of CO₂ concentration in the Organization



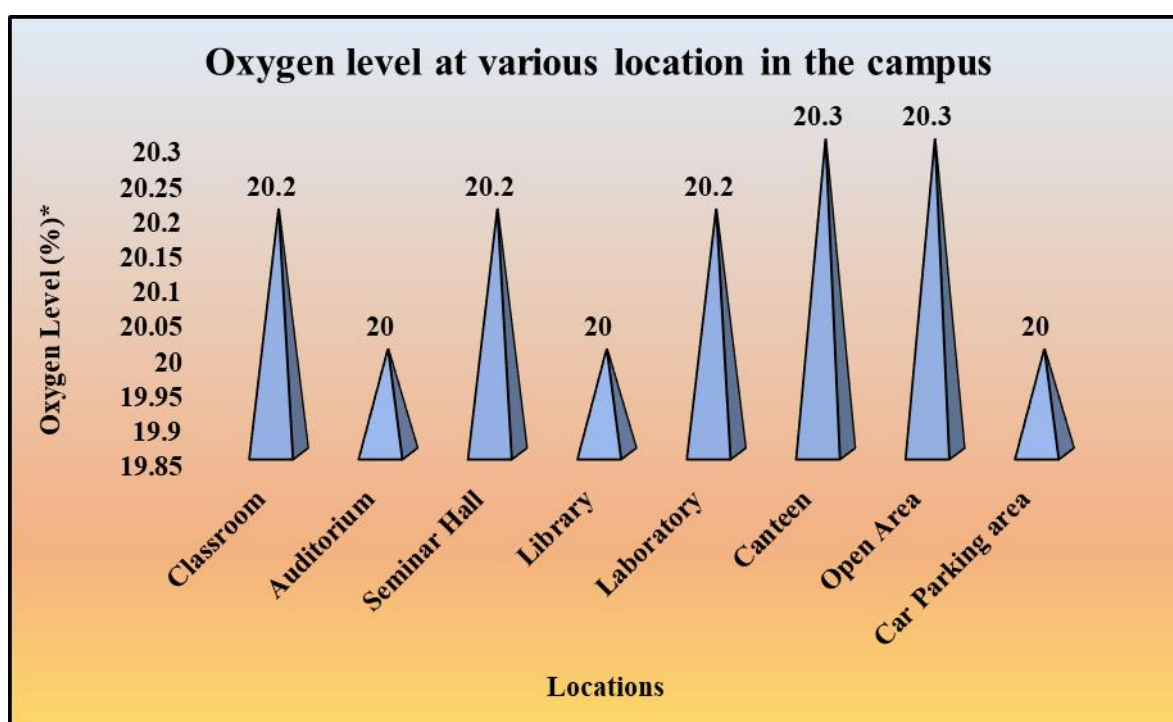
2.5. Atmospheric oxygen level measurements analysis and interpretation

Oxygen level refers to the amount of oxygen available within the atmosphere or water bodies. Oxygen is produced/released as a by-product of photosynthesis, the metabolic activity of all green plants besides certain microbes. Oxygen plays a paramount role in metabolic activities like respiration and the energy-producing chemistry of all living organisms. In order to quantify the oxygen level, Oxygen Meter is used. The atmosphere contains 18-21% oxygen concentration, 75-78.5% nitrogen and 2-3% other gases like carbon dioxide, neon and hydrogen. The amount of oxygen level in the atmosphere is determined by abiotic factors like altitude, latitude and longitude and biotic factors like plantations in the surroundings. If it excess, it causes oxygen toxicity and oxygen poisoning by creating coughing, breathing trouble and damage the lungs to human beings. The oxygen level of different places at the campus are monitored and presented (Table 2).

Table 2. The oxygen concentration at different places of audited organization

| S. No | Location | Oxygen Level (%)* | Remarks |
|-------|------------------|-------------------|------------------------------|
| 1. | Classroom | 20.2 | O ₂ level is good |
| 2. | Auditorium | 20.0 | O ₂ level is good |
| 3. | Seminar Hall | 20.2 | O ₂ level is good |
| 4. | Library | 20.0 | O ₂ level is good |
| 5. | Laboratory | 20.2 | O ₂ level is good |
| 6. | Canteen | 20.3 | O ₂ level is good |
| 7. | Open Area | 20.3 | O ₂ level is good |
| 8. | Car Parking area | 20.0 | O ₂ level is good |

Figure 2. The oxygen concentration in the Organization





CO₂ and O₂ analysis are observed in the campus

3. ENVIRONMENT AUDIT

3.1. Introduction

Environmental (Eco) audit is quantitative and qualitative data to track air, soil and water and to gain actionable insights to improve the operational performance in the atmosphere. It provides a 360° view of a surrounding campus and makes it easy for Owners / Managers / Environmentalists to collaborate, measure, control and reduce environmental negative impacts. Finally, it leads to enhance the quality of life of all living organisms. Eco audit initiatives are the need of the hour across the world due to changing environmental conditions and global warming besides ever-increasing human population and anthropogenic activities (NCP, 2016). Eco audit aims to make a sustainable and friendly environment for the stakeholders. In this context, to conserve eco-friendly atmosphere of an organization, well-developed environmental objectives and targets should be undertaken to reduce the harmful effects to a greater extent (Gnanamangai *et al.*, 2021).

The audit process can remarkably minimize the environmental pollution in the campus which in turn reduces the impact of global warming scenario. As per the Rules and Regulations laid by Government, the environmental legislations should be followed by all the Institutions and Organizations and make sure that their activities should not degrade the environment. The environmental audit involves systematic documentation of periodic objective review by a regulated entity on available facilities, their operations and practices related to resolve the environmental requirements. In general, environmental audit is planned to achieve an optimum resource utilization and improved process performance in the audit sites. Venkataraman (2009) stated that it is a 'Common Sense Approach' to identify the problems and solve those problems pertaining to curb eco-friendly atmosphere. Environmental audit enables an overall and complete overview at the audit sites to facilitate our understanding of flow of materials and to focus the priority areas where waste reduction is achieved thereby cost saving is made possible.

Purpose of the audit is to determine performance of the environmental management systems and equipment related to environmental safety. Audit reports can provide key information to the management in relation to risk areas, progress towards strategic objectives and targets. Audit work can be undertaken voluntary for the benefit/advantage of the company and it can be executed with the help of environmental auditing authorities. As mentioned earlier, it helps in the proper natural resource utilization and on the whole, it improves the quality of environment.

An environmental auditor will study an organization's performance towards the environmental sustainability in a systematic manner where environmental management systems and equipment are performing with the aims of a) facilitating management control of environmental practices, b) assessing compliance with company policies, c) facilitating professional competence, d) sustenance activities without harming the environment and e) practicing the environmental conservation.

3.2. Organization Details

Table 3. Campus details

| S.No. | Details / Descriptions | Quantity |
|-------|---|----------|
| 1. | Total strength of Students | 3868 |
| 2. | Total strength of Employees | 460 |
| 3. | Total number of Buses in the campus | 02 |
| 4. | Number of Cars entering in the campus | 25 |
| 5. | Number of Motorcycles entering in the campus | 50 |
| 6. | Number of other vehicles (Lorry, Ambulance, Jeep, Trucks, Cranes, Poclain, and etc. entering in the campus) | 2 |
| 7. | Number of E-Vehicles | 13 |
| 8. | Number of RO Water Plants | 3 |
| 9. | Number of Borewells | 21 |
| 10. | Number of Open wells | 5 |
| 11. | Number of Water Reservoirs | 30 |
| 12. | Number of Wastewater treatment facility | Nil |
| 13. | Number of Rain harvesting system | 30 |
| 14. | Number of Composting pits and Vermicompost units | 2 |

3.3. Environment audit observations.

- Human comforts are implemented and observed like ramp walk, fire safety, etc.,
- To reduce the demand of water, rain water harvesting system is implemented and used for irrigation facilities.
- Fire extinguishers are available in the building to consider the safety of all the Stakeholders and maintained properly.
- Parking is provided under the tree shade to reduce the Heat Island effect (Temperature).
- Rain water harvesting unit is maintained well without using any chemical, the water is used for irrigation purpose.
- Use of potable and non-potable waters are identified and differentiated to conserve water.
- Public transport facilities are available in the campus to control air pollution.
- Bicycle for internal mobility is implemented and used inside the campus.
- The pedestrian pathways are maintained with adequate shading facilities by planting more number of trees.
- No offsite and subsidized parking are encouraged in the campus.
- Waste are segregated before the disposal.
- Biodegradable waste are used in the vermicomposting as a recycling practice.
- Biogas plant available in the campus.

3.3.1. Integrated Water Management System

Water is one of the major source of living. Per capita water consumption in the building is calculated as per the water management plan (litres / person/ day). To reduce the demand of water consumption rain water harvesting unit is implemented and

practiced. Proper monitoring plan is made evident to reduce the water consumption in the leakage areas.



Water Management Activities observed in the campus

3.3.2. Corporate Governance

Training and awareness programmes are conducted to the stake holders to maintain sustainability. Some of the programmes conducted by the Organization are energy conservation awareness and practice among the stakeholders.



Energy conservation awareness program conducted by the college

3.3.3. Safety measures and green building conservation code

Environmental safety measures are very important in the buildings as far as students, staff members and other stakeholders are concerned and it requires vigilance and awareness. Management should extend by issuing guidance and the best safety tools. The organization has have a police force, escort services, call boxes, first aid box, fire extinguishers, fire alarms, security systems and staffs towards the safety measures. Organization has very good safety measures as per the green building conservation code such as fire extinguisher and fire bell and alarms in all the place.



Fire Safety measures observed inside the Campus

3.3.4. Applicability and Implementation

Guidelines of Architect, Designer and Civil contractor for the existing building addresses the choice of material, design methodology, operation and maintenance related options, etc., and also addresses the applicability.

3.3.5. Parking facilities to reduce Heat Island Effect

Heat island effect denotes the temperature level. It is observed that the vehicles are parked under the Tree shade to reduce the heat island effect for the benefit of stakeholders and to maintain sustainability. To reduce the heat island effect parking areas are made up of high albedo materials with light colored paints observed in the organization.

3.3.6. Public transport, low emitting vehicles and control of car smokes

Utility of public transportation (buses) reduces carbon emissions greatly and decreases the development of smog within the towns. This means that human beings have healthy air to respire. Comparing a bus travelling with a car transport for a person, it has been observed that buses are the most effective system by producing lower quantum of emission of carbon when compared to that of car transport. This will be a huge decrease in utility of natural resources per person. Other than this, it also gives more benefits like less noise and traffic congestion. Whenever possible, try to take public transport in place of one's own vehicle. The audited Organization is provided E-Vehicles to maintain eco-friendly environment in the campus and to reduce carbon dioxide emissions. Apart from the e-vehicles, students are encouraged to use bicycles. The tree species are planted abundantly to provide shade to the pedestrian.



Vehicles parked under the shades to reduce the Heat Island Effect

3.3.7. Pedestrian path facility at the campus

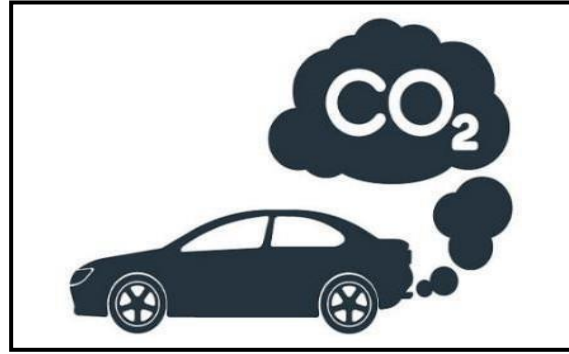
The concept of pedestrian path is to give safe space to walk freely by the pedestrian. It is very important in the green campus in terms of freely walk pedestrians or people going on foot without any obstacles. The pedestrian path is otherwise called as zebra crossing by the combination of black and white stripes remained to characterize the zebra. In addition, pedestrian path is created in the green campus along with road side which meant for walking only using special cement bricks and stones. The pedestrian path aims to end circulation not only cars, buses, vans, trucks and other vehicles but also giving safe space to the pedestrians, where cross and pass through blocks and also forcing vehicles to comply with it. The audited organization is having very good facility in creating pedestrian path for stakeholders with all the facilities such as accessible public toilets, barrier free environment, dustbins, stone benches, etc. Use of bicycles are encouraged in the Campus to control carbon emission and air pollution.



Stone benches observed in the campus

3.3.8. Carbon footprint

Carbon footprint means measuring/recording the greenhouse gases (GHG) emissions of an organization within its defined boundary. Observations on carbon dioxide and oxygen levels monitored in different parts of the campus are presented under Air Quality Audit section while observation on carbon footprint due to electricity usage per year at the Organization along with other fossil fuel utility are presented under Energy Audit portion of this Technical Report.



3.3.9. Selection of Building Material

Building materials are selected as per the Guidelines to Architect, Designer and Civil contractors. Low carbon emitting cements, bricks, etc., are used for the construction and recycled glass materials are used for windows. Construction material are not stored in the campus.

3.3.10. Waste and Water management activities

Management of water and waste are the two important parameters which plays a vital role to maintain sustainability. Rainwater harvesting is implemented and maintained properly for water conservation, this water is used for irrigation and domestic purpose. It is observed that different colored dustbins are used in the Organization to segregate the waste at the source of generation.



Waste Management practices observed at the Campus

3.3.11. Post Occupancy maintenance

Post occupancy maintenance is the activities performed after the completion of construction work and handed over to the owner for further maintenance. The following activities are observed during the onsite visit as post occupancy maintenance

- Vegetation and plants are maintained properly with regular watering through irrigation facilities.
- Soil is maintained well without adding any chemical fertilizers and pesticides.
- To reduce the energy consumption HVAC system are maintained properly.



Biogas Facilities were observed in the campus

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 extent. 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 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.

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.

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). 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. 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.

4.2. Energy audit observations

During onsite audit following departments were verified for physical facility availability.

- Adequate awareness programmes are organized and conducted to the stakeholders for the proper handling and maintenance of the appliances.
- Adequate external and vertical shading are provided to conserve energy.
- Natural ventilation through windows and shading is available adequately to reduce the energy consumption.

- It is observed that large foliage trees are planted inside the campus to reduce noise pollution.
- External and internal signage lits are differentiated to conserve energy.
- ‘Danger’ and ‘warning boards’ are available near transformer, generator and UPS.
- Outside air is introduced through windows for ventilation in the conditioned spaces.
- Five star rated appliances (AC, Air cooler, Refrigerator, etc.,) are procured to conserve energy.
- All the fluorescent (tube) lights are replaced with LED lights to conserve energy.
- Awareness posters like ‘Turn off when not in use’, ‘Save Energy’, etc., are displayed for conserving energy.
- Noise level observed in the different location resulted in normal range.
- Adequate training and awareness programmes are conducted to the stakeholders for energy conservation.
- To optimize the energy campus has implemented solar panel, water heater, sensor lights, operation and maintenance, etc.,

4.2.1. Energy Efficient Design and Process

In the campus, it is observed that for lighting, cooling and ventilation renewable sources of energy like solar panel, water heater, etc., are used. Local resources are made available in post occupant stage as per the operation and maintenance plan. Standard Operating Procedures for UPS, AC are available to conserve energy and to avoid damage.



Solar panel observed in the campus

4.2.2. Lighting facilities

External shading facilities are made based on the sun path to reduce the energy consumption. Day light integration is implemented in the building by placing adequate

number of windows. Electrical lighting facilities during day time increases the energy consumption, it is observed that sufficient day lighting facilities are available through windows which in turn reduce the energy consumption bill of the Organization. Artificial lighting facilities are regularly monitored and maintained. In some areas sensor lights are implemented to save energy. External and internal signage lits are made up of recycled material with maximum light intensity. In the buildings windows head are higher to penetrate day light.



Natural Lighting facilities observed during day time

4.2.3. Building Service Optimization

To save energy in the buildings there should be a proper plan for HVAC system. In the organization it is observed that adequate natural ventilation is implemented and practices. In some places exhaust fans are used for ventilation especially in the canteen and laboratories. To reduce the heat inside the building shading patterns are maintained by planting trees in and around the campus. Solar panels are implemented at the roof top to reduce the heat and to save energy. Air conditioning are provided at specific areas. Energy conservation plays an vital role in maintaining the sustainability. It is observed that the Organization has replaced all the tube light with CFL / LED lamps, has proper metering and submetering facilities, availability of BEE star rated appliances in Air cooler, lift, AC, generator, etc., Solar water heater and panels are implemented to conserve energy. Instruments and meters are properly maintained and calibrated at regular intervals or annual maintenance plan is observed as one of the energy saving opportunity. Adequate energy saving awareness programmes are conducted to the stakeholders. Emissions and leaks are monitored through operation and maintenance manual.



Energy conservation facilities observed in the Campus

4.2.4. Energy consumption and cost profile

The following chart shows the profile of energy consumed and the cost for one year by the auditee (Figures 3 & 4; Table 4).

Figure 3. Electrical energy consumption profile

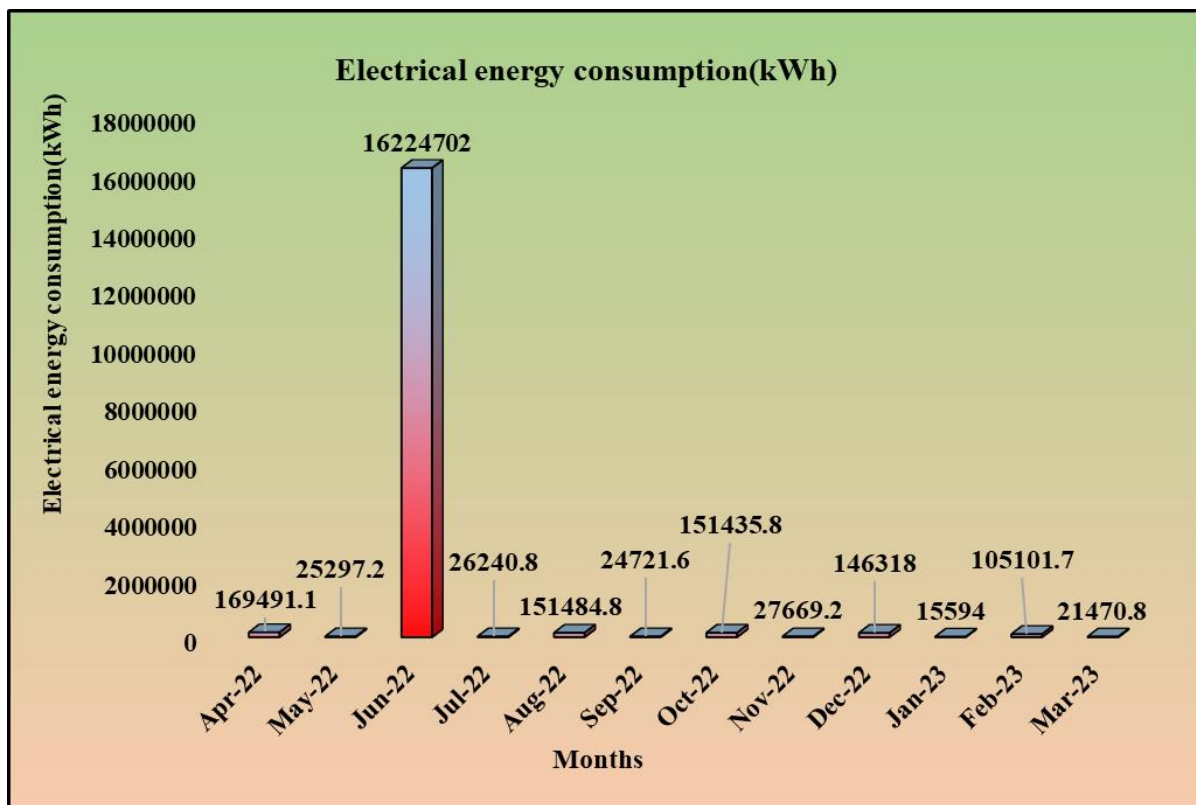


Figure 4. Overall electrical energy consumption and cost profile

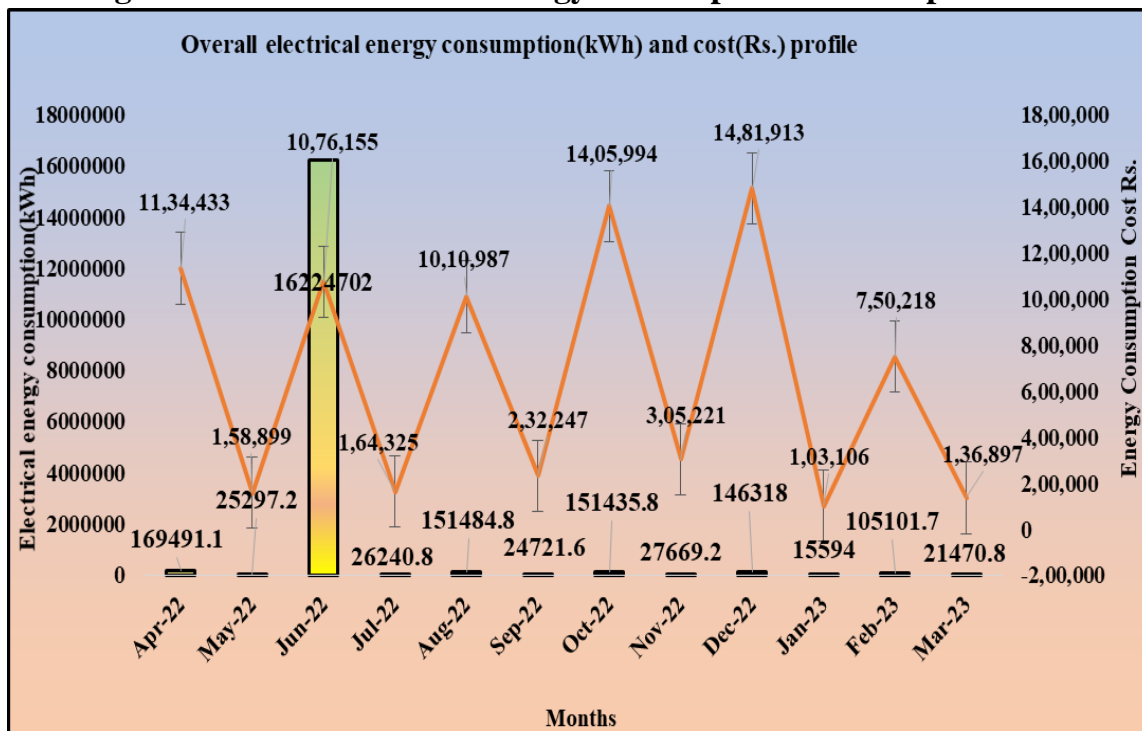


Table 4. Electrical energy consumption and cost profile in the campus

| S. No | Months | Rating / Capacity units in kWh | Cost in Rs. |
|-------|----------------|--------------------------------|-------------|
| 1. | January 2023 | 15594.0 | 1,03,106 |
| 2. | February 2023 | 105101.7 | 7,50,218 |
| 3. | March 2023 | 21470.8 | 1,36,897 |
| 4. | April 2022 | 169491.1 | 11,34,433 |
| 5. | May 2022 | 25297.2 | 1,58,899 |
| 6. | June 2022 | 1622470.2 | 10,76,155 |
| 7. | July 2022 | 26240.8 | 1,64,325 |
| 8. | August 2022 | 151484.8 | 10,10,987 |
| 9. | September 2022 | 24721.6 | 2,32,247 |
| 10. | October 2022 | 151435.8 | 14,05,994 |
| 11. | November 2022 | 27669.2 | 3,05,221 |
| 12. | December 2022 | 146318.0 | 14,81,913 |

4.2.5. Power consuming equipment and electrical appliances

Other than electrical energy from grid, energy generated using fossil fuels for the year are presented in the Table 5.

Table 5. Annual Energy Consumption of Fuels in the campus

| S.No | Month | Diesel consumption (Liters) | Petrol consumption (Liters) | LPG consumption (kg) |
|------|----------------|-----------------------------|-----------------------------|----------------------|
| 1 | January 2023 | 572.37 | 49.42 | Nil |
| 2 | February 2023 | 1224.62 | 76.11 | Nil |
| 3 | March 2023 | 1812.64 | 248.90 | Nil |
| 4 | April 2023 | 1458.52 | 117.34 | Nil |
| 5 | May 2022 | 743.05 | Nil | Nil |
| 6 | June 2022 | 1285.02 | 20.01 | Nil |
| 7 | July 2022 | 1483.63 | Nil | Nil |
| 8 | August 2022 | 1082.74 | 210.97 | Nil |
| 9 | September 2022 | 2022.15 | 215.24 | Nil |
| 10 | October 2022 | 1304.55 | 343.42 | Nil |
| 11 | November 2022 | 2407.62 | 211.29 | Nil |
| 12 | December 2022 | 1100.26 | 220.50 | Nil |

4.2.6. Carbon footprint

The carbon footprint per year is calculated (www.carbonfootprint.com) based on electricity usage per year in which CO₂ 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 CO₂ in metric tons per year. Humans contribute to a massive increase of carbon dioxide emissions by burning fossil fuels, deforestation, and other industrial activities.

4.2.7. 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. According to the data provided by the Management, carbon emission due to electricity consumption and fossil fuels are presented hereunder.

The CO₂ emission from electricity

$$\begin{aligned}
 &= (\text{electricity usage per year in kWh}/1000) \times 0.84, \text{ where } 0.84 \text{ is the coefficient} \\
 &\text{to convert kWh to metric tons} \\
 &= (17089527 \text{ kWh}/1000) \times 0.84 \\
 &= 14355.20 \text{ metric tons}
 \end{aligned}$$

According to the above calculations, carbon emission due to electricity usage per year accounts for 14355.20 metric tons.

Transportation per year (Shuttle)

$$\begin{aligned}
 &= (\text{Number of the shuttle vehicle in the campus (2)} \times \text{total trips for shuttle bus service each day} \times \text{approximate travel distance of a vehicle each day inside campus only (20 km)} \times 365/100) \times 0.01 \\
 &= (2 \times 2 \times 30 \times 365/100) \times 0.01 \\
 &= 4.38 \text{ metric tons}
 \end{aligned}$$

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)

$$\begin{aligned}
 &= (\text{Number of cars entering the campus} \times 2 \times \text{approximate travel distance of a vehicle each day inside campus only (in kilometers)} \times 365/100) \times 0.02 \\
 &= ((25 \times 20 \times 1 \times 365)/100) \times 0.02 \\
 &= 36.5 \text{ metric tons}
 \end{aligned}$$

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)

$$\begin{aligned}
 &= (\text{Number of motorcycles entering the campus} \times 2 \times \text{approximate travel distance of a vehicle each day inside campus only (in kilometers)} \times 365/100) \times 0.01 \\
 &= ((50 \times 20 \times 1 \times 365)/100) \times 0.01 \\
 &= 36.5 \text{ metric tons}
 \end{aligned}$$

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

$$\begin{aligned}
 &= \text{total emission from electricity usage} + \text{transportation (bus, car, motorcycle)} \\
 &= (14355.20 + 4.38 + 36.5 + 36.5) \\
 &= 14432.58 \text{ metric tons}
 \end{aligned}$$

4.2.8. 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). 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. Sound Level Meter / Noise Thermometer are used to measure the 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 μ Pa. Noise level prescribed by Central Pollution Control Board was presented in the Table 6.

Table 6. Noise level standard prescribed by Central Pollution Control Board, Government of India

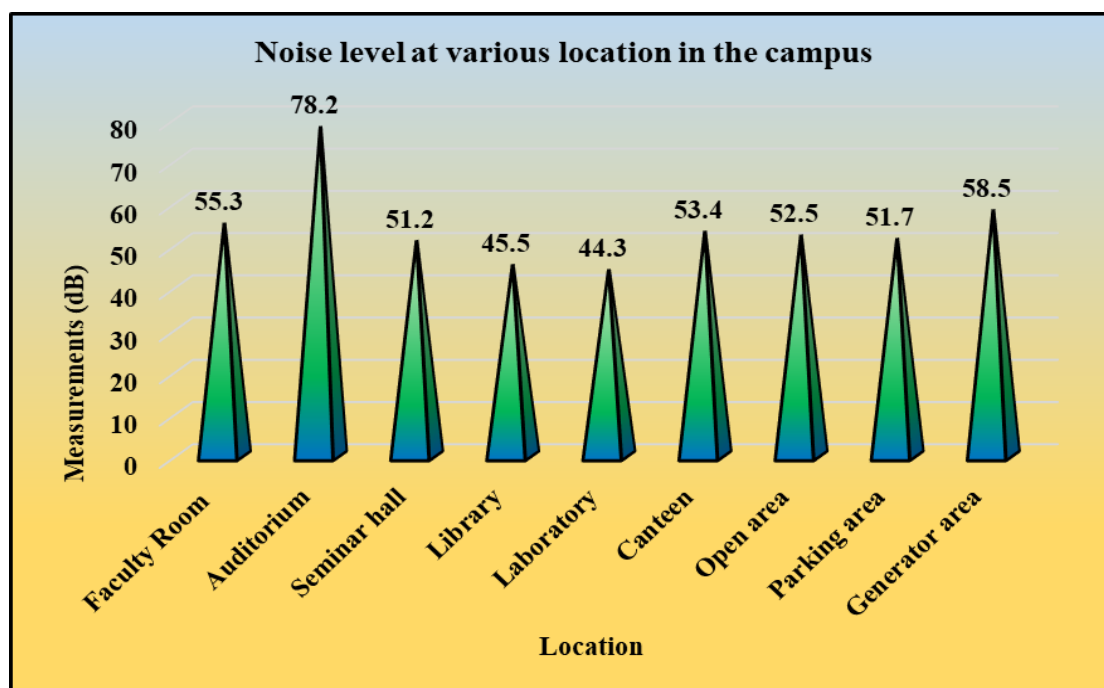
| Area Code | Zone | Limits in dB (A) Leq | |
|-----------|-------------|----------------------|------------|
| | | Day Time | Night Time |
| A | Industrial | 75 | 70 |
| B | Commercial | 65 | 55 |
| C | Residential | 55 | 45 |
| D | Silence | 50 | 40 |

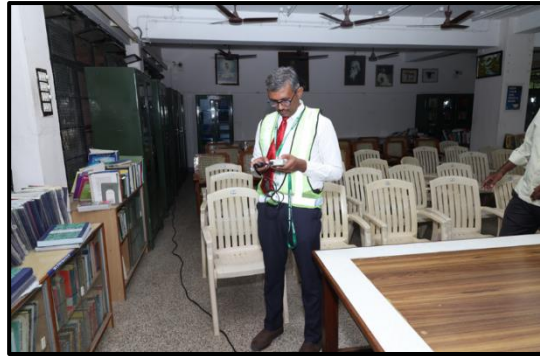
Source: IS : 12065 - 1987

Table 7. Noise level at various location in the campus

| S.No | Locations | Measurements (dB) | Major noise sources | Remarks |
|------|----------------|-------------------|---------------------|--------------------|
| 1. | Faculty Room | 55.3 | Students and Staff | No Noise Pollution |
| 2. | Auditorium | 78.2 | Students | No Noise Pollution |
| 3. | Seminar hall | 51.2 | Students | No Noise Pollution |
| 4. | Library | 45.5 | Staff members | No Noise Pollution |
| 5. | Laboratory | 44.3 | Students | No Noise Pollution |
| 6. | Canteen | 53.4 | Students and Staff | No Noise Pollution |
| 7. | Open area | 52.5 | Students and staff | No Noise Pollution |
| 8. | Parking area | 51.7 | Vehicles | No Noise Pollution |
| 9. | Generator area | 58.5 | Generator Sound | No Noise Pollution |

Figure 5. Noise level at various location in the campus





Noise level analysis observed in the campus

4.2.8.1. Light intensity measurement at the campus

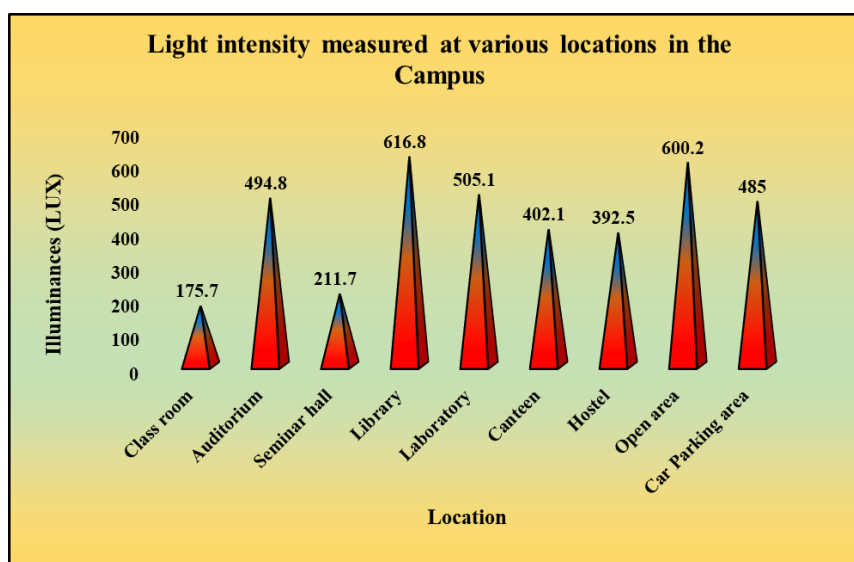
Light intensity or light output is used to measure whether a particular light source provides enough light for an application needed. There is a well-established light level recommendation for a wide range of applications in lighting industry and also for the type of space. Light intensity is measured in terms of lumens per square foot (foot-candles) or lumens per square meter (lux). 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.

Table 8. Light intensity measured at various locations in the College

| S. No | Type of Spaces | Illuminances (LUX) |
|-------|------------------|--------------------|
| 1. | Class room | 175.7 |
| 2. | Auditorium | 494.8 |
| 3. | Seminar hall | 211.7 |
| 4. | Library | 616.8 |
| 5. | Laboratory | 505.1 |
| 6. | Canteen | 402.1 |
| 7. | Hostel | 392.5 |
| 8. | Open area | 600.2 |
| 9. | Car Parking area | 485 |

Source: IS: 6665-1972

Figure 6. Light intensity Measured at the campus





Light Intensity and Noise level analysis in the Campus

5. Conclusion

Considering the fact that the organization is a well-established academic institution and there is significant scope for conserving green, environment and energy, which in turn make the campus as self-sustained. The organization has taken enormous efforts to maintain green campus in a sustainable manner. It has conducting a large number of activities for the benefit of rural and tribal community people without disturbing the natural environment. The installation of a rainwater harvesting system and irrigation system to conserve rainwater and improve the ground water levels are noteworthy. The Organization has created medicinal, herbal and ornamental gardens at small scale level for establishing a massive reforestation / afforestation programme in which a large number of trees and shrubs species were planted together for providing an eco-friendly atmosphere to the stakeholders in a sustainable manner.

The energy conservation initiatives taken by the organization are substantial. Water and Soil conservation activities are also implemented and practiced. Proper facilities and procedures are followed for waste collection, segregation, disposal, recycle and reuse. Quality of soil and water observed to be good. Hygienic practices are monitored and maintained considering the health and sustainability of the stakeholders at canteen and hostel premises. Tree plantation at appropriate locations are maintained to resist the indoor climate and conserve energy. The organization has made significant progressive contributions with respect to teaching learning, research and consultancy, innovation and transfer of technology, community service and value education, in toto. It imparts quality education to rural, tribal and urban people across the nation which is excellent in terms of academic activities and providing an eco-friendly atmosphere to the stakeholders

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Partha Bagchi
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2nd Surveillance Audit Due: 8th August 2024

1st Surveillance Audit Due: 8th August 2023

Certificate Expiry: 8th August 2025

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| S.No. | Name of Unit(s) | | | | | | | | | | | | | | | | | | | | | | |
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| DATE OF COMMENCEMENT OF PRODUCTION/BUSINESS | | 12/03/2020 | | | | | | | | | | | | | | | | | | | | | |
| NATIONAL INDUSTRY CLASSIFICATION CODE(S) | | <table border="1"> <thead> <tr> <th>SNo.</th> <th>NIC 2 Digit</th> <th>NIC 4 Digit</th> <th>NIC 5 Digit</th> <th>Activity</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>69 - Legal and accounting activities</td> <td>6920 - Accounting, bookkeeping and auditing activities; tax consultancy</td> <td>69201 - Accounting, bookkeeping and auditing activities</td> <td>Services</td> </tr> <tr> <td>2</td> <td>85 - Education</td> <td>8542 - Cultural education</td> <td>85420 - Cultural education</td> <td>Services</td> </tr> <tr> <td>3</td> <td>85 - Education</td> <td>8549 - Other education n.e.c.</td> <td>85499 - Other educational services n.e.c.</td> <td>Services</td> </tr> </tbody> </table> | | SNo. | NIC 2 Digit | NIC 4 Digit | NIC 5 Digit | Activity | 1 | 69 - Legal and accounting activities | 6920 - Accounting, bookkeeping and auditing activities; tax consultancy | 69201 - Accounting, bookkeeping and auditing activities | Services | 2 | 85 - Education | 8542 - Cultural education | 85420 - Cultural education | Services | 3 | 85 - Education | 8549 - Other education n.e.c. | 85499 - Other educational services n.e.c. | Services |
| SNo. | NIC 2 Digit | NIC 4 Digit | NIC 5 Digit | Activity | | | | | | | | | | | | | | | | | | | |
| 1 | 69 - Legal and accounting activities | 6920 - Accounting, bookkeeping and auditing activities; tax consultancy | 69201 - Accounting, bookkeeping and auditing activities | Services | | | | | | | | | | | | | | | | | | | |
| 2 | 85 - Education | 8542 - Cultural education | 85420 - Cultural education | Services | | | | | | | | | | | | | | | | | | | |
| 3 | 85 - Education | 8549 - Other education n.e.c. | 85499 - Other educational services n.e.c. | Services | | | | | | | | | | | | | | | | | | | |
| DATE OF UDYAM REGISTRATION | | 26/02/2022 | | | | | | | | | | | | | | | | | | | | | |

* In case of graduation (upward/reverse) of status of an enterprise, the benefit of the Government Schemes will be availed as per the provisions of Notification No. S.O. 2119(E) dated 26.06.2020 issued by the Mo MSME.

Disclaimer: This is computer generated statement, no signature required. Printed from <https://udyamregistration.gov.in> & Date of printing - 26/02/2022

For any assistance, you may contact:

1. District Industries Centre: COIMBATORE (TAMIL NADU)

2. MSME-DI: CHENNAI (TAMIL NADU)

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8. Certificates of Lead Auditors

1. Bureau of Energy Efficiency (BEE), LEED AP and GRIHA Certificates of Er. D. Dineshkumar, Energy and Environment Auditor of NSF.
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.



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.

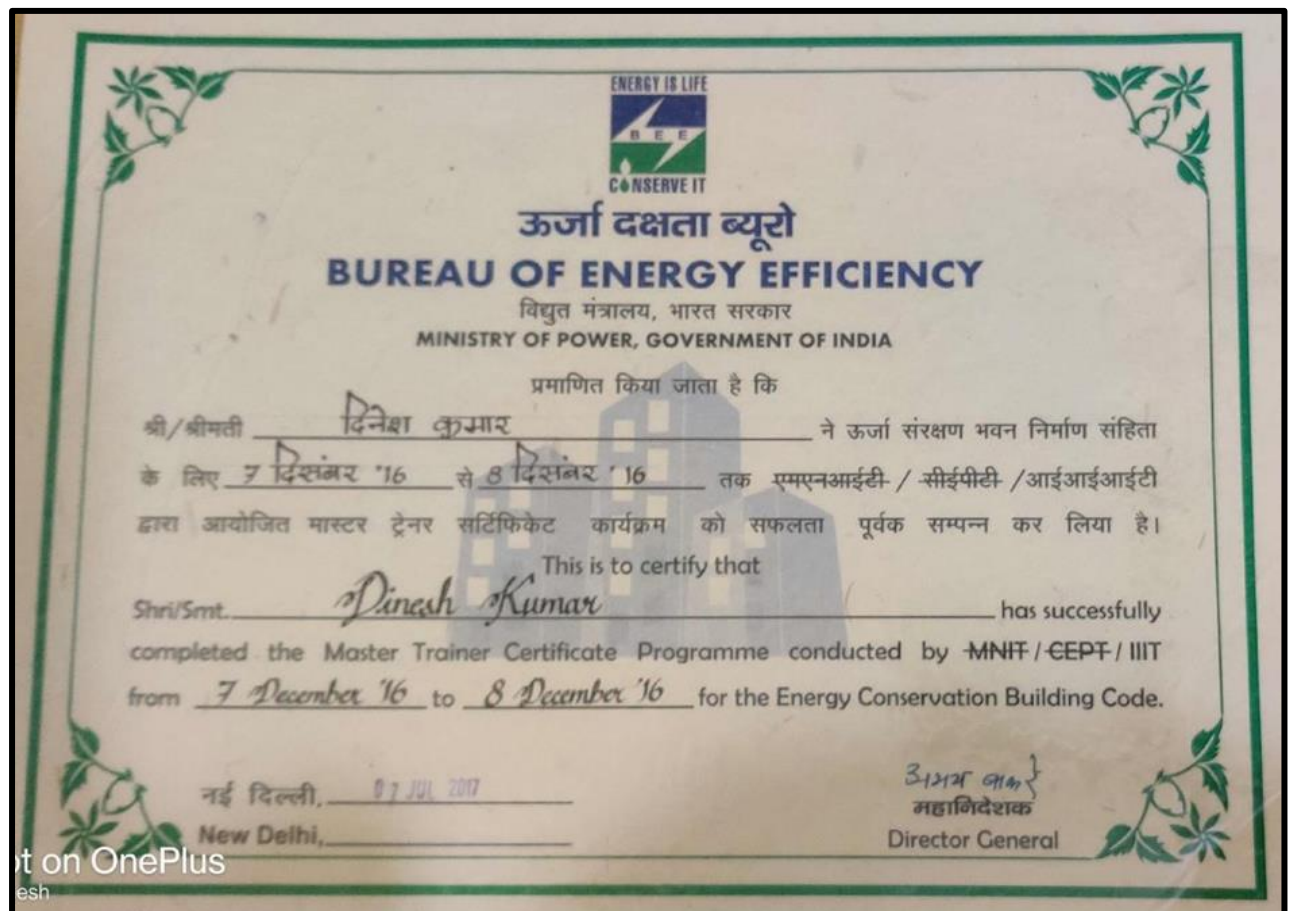
Mr./Mrs./Ms. **Dinesh Kumar D** is deemed to have qualified for appointment or designation as energy manager under clause (i) of Section 14 of the Energy Conservation Act, 2001 (Act No.52 of 2001).


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

Secretary
Bureau of Energy Efficiency
New Delhi

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

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





10531234-AP-BD+C

CREDENTIAL ID

26 DEC 2016

ISSUED

25 DEC 2022

VALID THROUGH

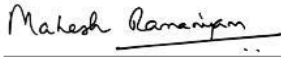
GREEN BUSINESS CERTIFICATION INC. CERTIFIES THAT

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.



MAHESH RAMARAJAM
PRESIDENT & CEO, U.S. GREEN BUILDING COUNCIL
PRESIDENT & CEO, GREEN BUSINESS CERTIFICATION INC.




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



V Suresh
Chairman
Indian Green Building Council



Gurmit Singh Arora
Vice-Chairman
Indian Green Building Council

210122

17 April 2021

