Report of Green and Energy Audits

Submitted to

GOVERNMENT COLLEGE OF ENGINEERING
SALEM – 636 011, TAMIL NADU, INDIA

Date of Audit: 14.12.2022
Valid till: 14.12.2024

Regd. No. 114 / 2017

Submitted by

NATURE SCIENCE FOUNDATION
[A Unique Research and Development Centre for Society Improvement]
ISO 9001:2015; 14001:2015; 45001:2018;50001:2018 Certified Organization
No. 2669, LIG-II, Gandhi Managar, Peelamedu
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Report Number : NSF/PR/AR/67

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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 ***Government College of Engineering, Salem – 636 011, 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.
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 in line with ISO/IEC 17020:2012 standards and NABCB guidelines and for whole hearted support extended at the time of onsite audit. Our sincere thanks to NAAC, IQAC Coordinators 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: 16/12/2022
Place: Coimbatore

NATURE SCIENCE AUTHORIZED FOUNDATION, INDIA

Authorized Signatory
Nature Science Foundation

16/12/2022

Ms. V . Sri Sandhya, M.Sc., FNSF.,
Joint Director
NATURE SCIENCE FOUNDATION
No. 2669, LIG - II, Gandhi Managar
Coimbatore - 641 004, Tamil Nadu, India.

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PRINCIPAL
GOVT. COLLEGE OF ENGG.,
SALEM-636 011

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. 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 issuesand 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. Importance of National Building Code (NBC)

National Building Code (NBC) of India has a set of rules and guidelines that regulates construction of buildings and as well as ecofriendly activities of the campus without harming the environment. In order to achieve the minimum standards of welfare and safety of stakeholders of a campus, the Governing body of Central and State Governments 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.

NBC is not only offer a standard uniform benchmark that constructors and environmentalists 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 to the stakeholders. For instance, new and updated building codes put much emphasis on conservation as energy and the degradable and non-degradable wastes are the most expensive byproduct of older regions. This will not only offer environmental benefits to future generations but will also regulate indoor air pollution and greenhouse gas emissions to protect the health of human beings.

Before the introduction of NBC in the construction industry, building commercial and residential properties used a lot of energy which adversely affected the sustainable 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. While safety is the primary objective, new building codes are making significant contributions toward solving energy issues relating to the use of environmentally compatible construction techniques like planting trees, landscaping, rainwater harvesting and renewable and non-renewable energy sources.

- vegetative structures are available around the building to reduce energy consumption and maintain indoor climates.
- Soil health is maintained well without using any chemical fertilizers.
- Ecological design / conserving biodiversity such as Transplantation, climate and design in accordance with bio diversity, reduced pesticides and other activities are not applicable because no new construction is planned and raised.
- Plant and animal species are monitored by conducting the periodic survey in the Organization.
- Traffic survey is conducted to measure the number and type of vehicles passing on the existing main roads giving access to the campus.

2.3.1. Facilities for Human Comforts (NBC checkpoint 3.2. and 3.9.)

As per the National Building Code part 11 (Approach to Sustainability) 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. Accessible toilet facilities are observed for the comfort of person with disability. As no blind persons are observed in the campus divyang (blind) reading software, signages are not available. Water management, waste management, operation and maintenance plan are followed to maintain sustainability as per the standard.

Ramp walk for the comfort of person with disability.

2.3.2. Natural topography, vegetation and monitoring (NBC checkpoint 6.2.4.)

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 (NBC Checkpoint 7.1.1. – 7.1.3.)

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 (NBC Checkpoint 7.1.1. – 7.1.3.)

It is observed that Organization has implemented and maintaining terrace 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 ornamental garden is implemented in the campus.

Herbal, Cactus, Ornamental Garden observed in the Campus

2.3.5. Survey of Flora and Fauna (NBC Checkpoint 12.4.5. and 12.4.6.)

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.

Acalypha wilkesiana

Hibiscus rosa-sinensis

Tectona grandis

Madhuca longifolia

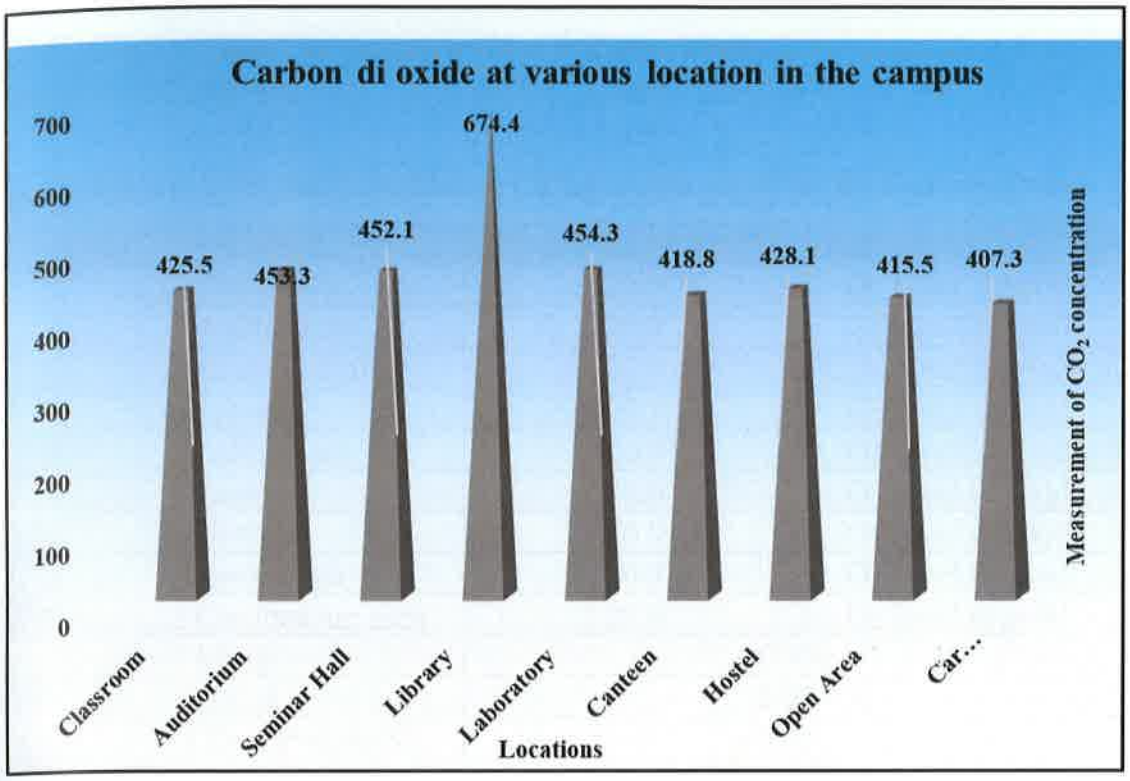


Figure 1. Measurement of CO_2 concentration in the Organization

Measurement of CO_2 level at College Campus

2.6. 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 14).

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

S. No	Location	Oxygen Level (%)*	Remarks
1.	Classroom	20.5	O_2 level is good
2.	Auditorium	20.9	O_2 level is good
3.	Seminar Hall	20.9	O_2 level is good
4.	Library	20.9	O_2 level is good
5.	Laboratory	20.9	O_2 level is good
6.	Canteen	20.6	O_2 level is good
7.	Hostel	20.9	O_2 level is good
8.	Open Area	20.7	O_2 level is good
9.	Car Parking area	20.9	O_2 level is good
	Mean	20.9%	
	SEC ±	0.01	
	CD at P=0.05%	0.02	

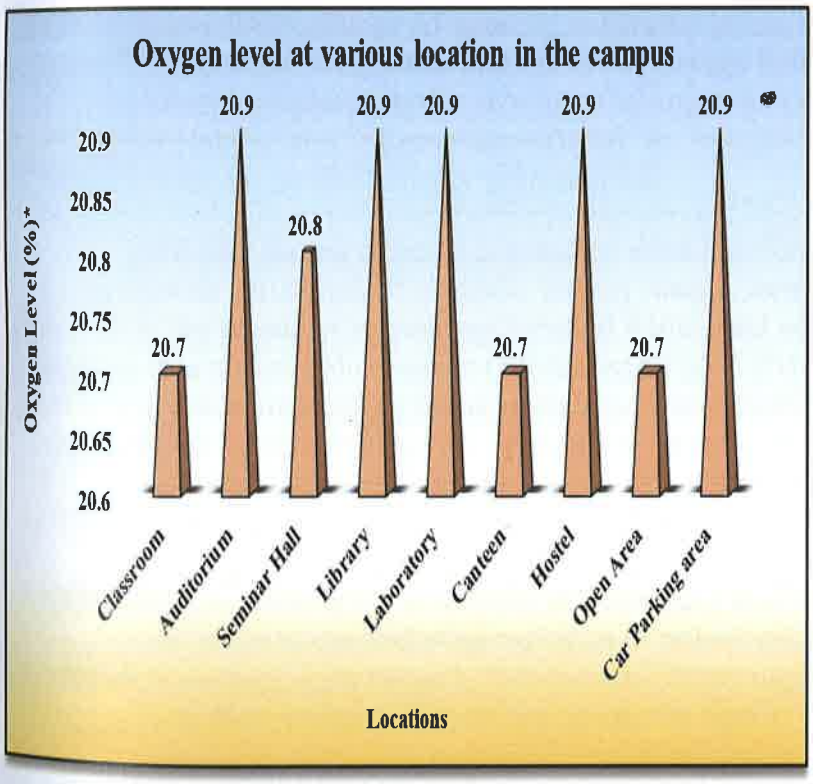


Figure 2. The oxygen concentration in the and O_2 level measured at the Organization using O_2 Meter

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

3.2.3. Building Service Optimization (NBC Checkpoint 11)

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 and Fire Safety facilities observed in the Campus

3.2.4. Energy consumption and cost profile (NBC Checkpoint 12.3.4.)

The following chart shows the profile of energy consumed and the cost for one year by the auditee (Figures 1 & 2; Table 3).

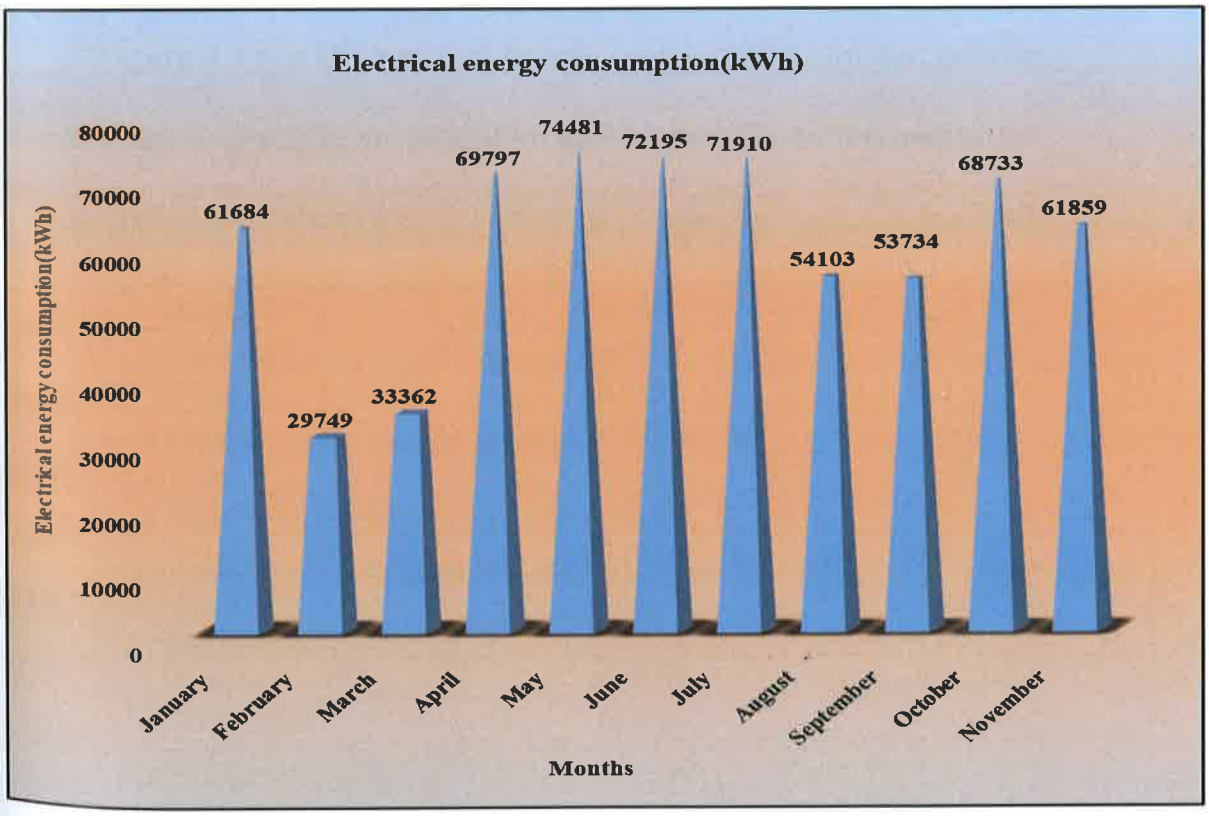


Figure 3. Electrical energy consumption profile

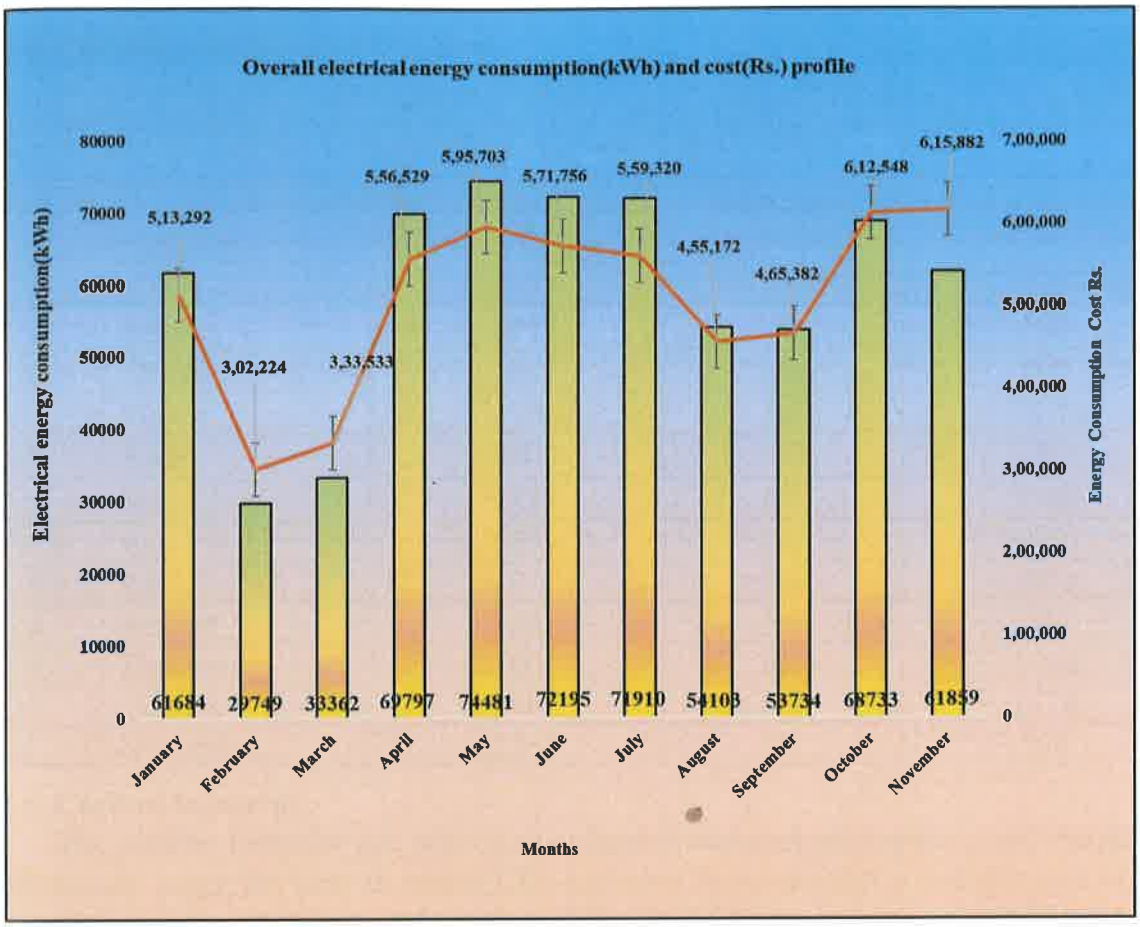


Figure 4. Overall electrical energy consumption and cost profile

Table 3. Electrical energy consumption and cost profile in the Institution

S. No	Months	Rating / Capacity units in kWh	Cost in Rs.
1.	January	61684	5,13,292
2.	February	29749	3,02,224
3.	March	33362	3,33,533
4.	April	69797	5,56,529
5.	May	74481	5,95,703
6.	June	72195	5,71,756
7.	July	71910	5,59,320
8.	August	54103	4,55,172
9.	September	53734	4,65,382
10	October	68733	6,12,548
11.	November	61859	6,15,882

Table 5. 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 6. Noise level at various location in the campus

S. No	Locations	Measurements (dB)	Major noise sources	Remarks
1.	Class room	63.2	Students and Staff	No Noise Pollution
2.	Auditorium	42.6	Students	No Noise Pollution
3.	Seminar hall	49.9	Students	No Noise Pollution
4.	Library	48.2	Staff members	No Noise Pollution
5.	Laboratory	60.6	Students	No Noise Pollution
6.	Canteen	59.1	Students and Staff	No Noise Pollution
7.	Hostel	50.2	Students and Staff	No Noise Pollution
8.	Open area	61.3	Students and staff	No Noise Pollution
9.	Car Parking area	57.6	Vehicles	No Noise Pollution
	Mean	54.73%		
	SE	3.65		
	CD	6.50		

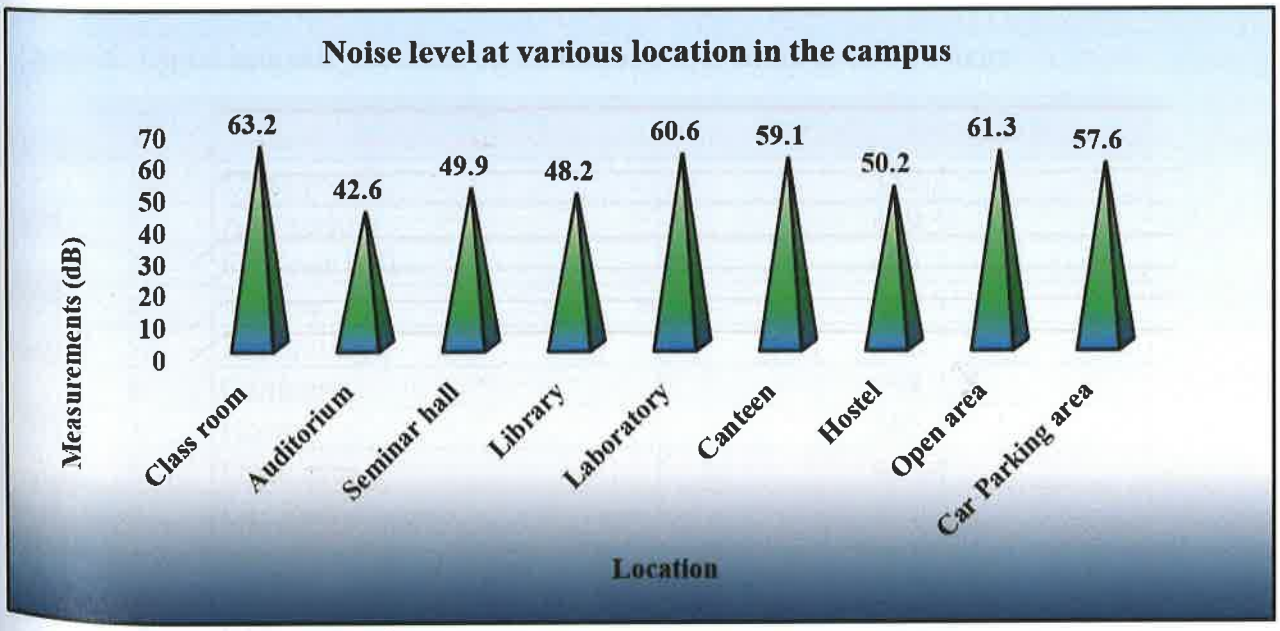


Figure 5. Noise level at various location in the campus

Noise level measured using Noise level analyzer at the College Campus

3.2.8.1. 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 6. Light intensity measured at various locations in the College

S. No	Type of Spaces	Illuminances (LUX)
1.	Class room	353.2
2.	Auditorium	439.5
3.	Seminar hall	425.7
4.	Library	279.9
5.	Laboratory	242.7
6.	Canteen	298.2
7.	Hostel	262.5
8.	Open area	444.4
9.	Car Parking area	353.2
	Mean	556.79%
	SE	15.96
	CD	28.44

Source: IS: 6665-1972

Light intensity measured in the Campus

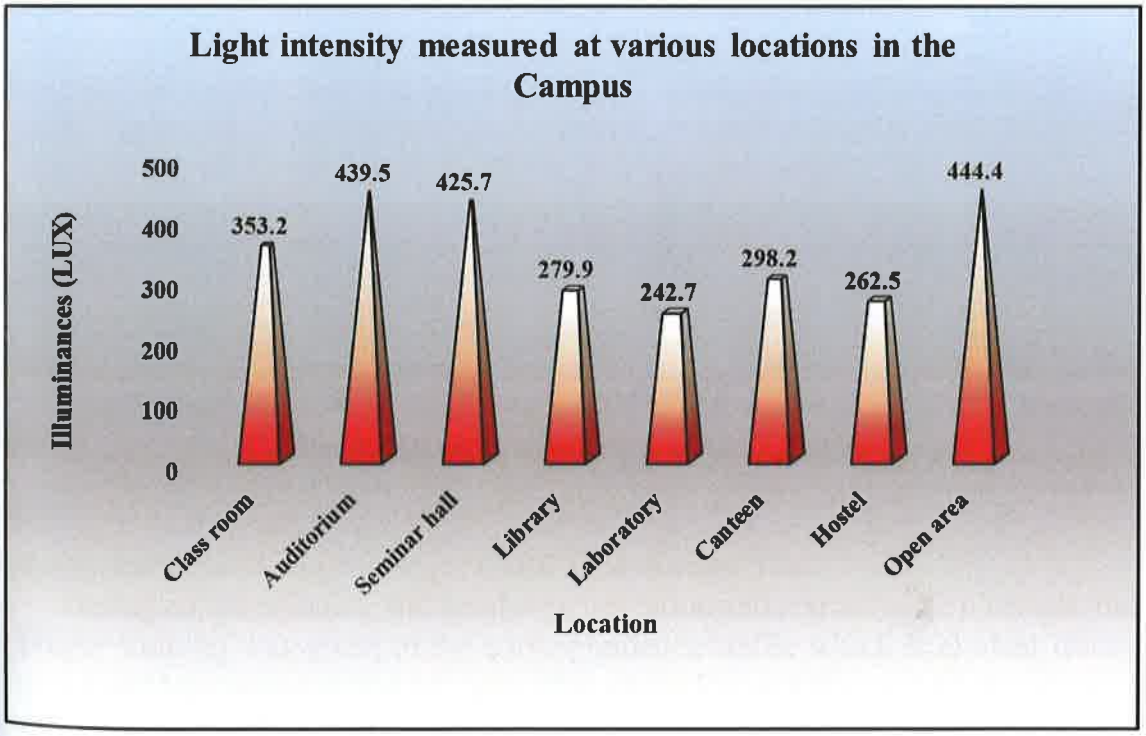


Figure 6. Light intensity Measured at the campus

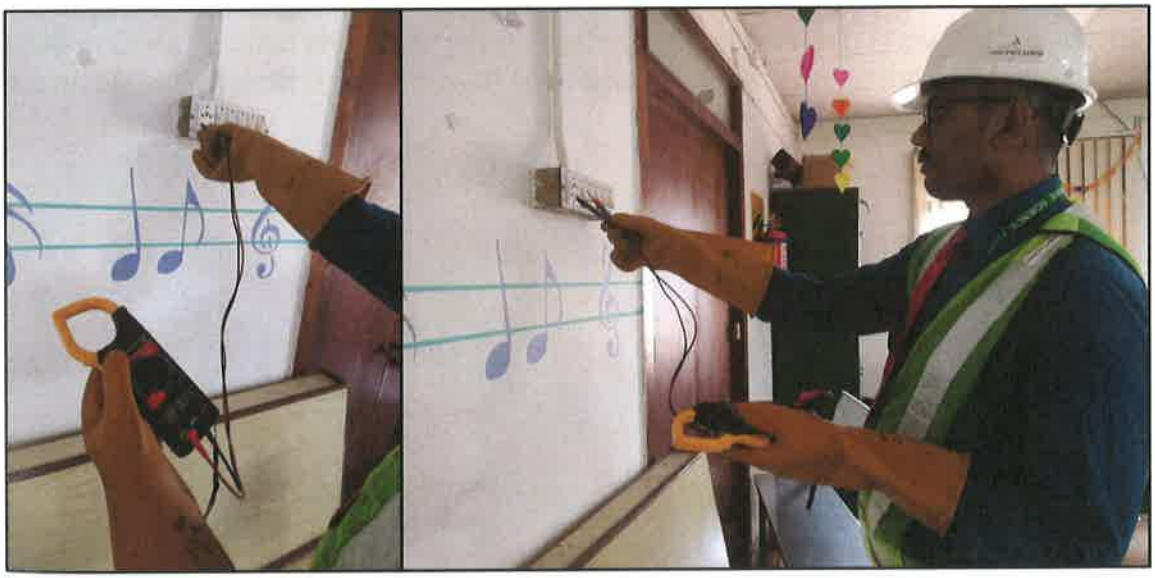
3.2.8.2. Voltage Measurement at the Campus

Voltage measurement in AC & DC at different places in the campus is measured using the clamp (voltage) meter to reduce the energy consumption.

Table 7. Voltage measured at various locations in the College

S.No	Name of the Place	AC & DC Voltage Measurement [Volt (v)]
1.	Class Room (AC)	231.3
2.	Auditorium (AC)	235.0
3.	Seminar Hall (AC)	230.0
4.	Library (AC)	222.7
5.	Laboratory (AC)	241.3
6.	Canteen (AC)	235.0
7.	Power Room (AC)	271.0
8.	Generator Area (AC)	233.3
9.	Battery (DC)	288.3
10.	Solar Panel (DC)	266.7
SD±		1.94

Source: BEE, 2015, Bureau of Energy Efficiency



Voltage intensity measured at the College

3.2.9. Operation and Maintenance (NBC Checkpoint 13)

During commissioning and handover, operation and maintenance plan was made and proper training was given to the correspondence staffs, which is evident through Operation and Maintenance (O&M) plan. This plan addresses the over all operation and maintenance of the building and proper monitoring facilities.

4. Conclusion

Considering the fact that the organization is a well-established academic institution and there is significant scope for conserving green and energy audits 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 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. Tree plantation at appropriate locations are maintained to resist the indoor climate and conserve energy as per the National Building Code (Part 11 – Approach to Sustainability). 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.