

ENERGY AUDIT

STUDY PERIOD (TWO YEARS) 2020-2021 AND 2021-2022

Sustainability study

AUDIT REPORT

Studied for

The Loyola College Society's

Andhra Loyola College (Autonomous)

Door No. 54-16-14, Govt. Polytechnic Post,
Vijayawada - 520 008, Andhra Pradesh, India

Studied in the capacity of

An accredited & Certified Green Building Professional



Studied by

Greenenvia
Solutions

Valid till **December 2023**



Hereby presents the 'Sustainability Research' about

A Self-sufficient Sustainable premises

That has proved exceptional results with an amalgamation of

Social and Green practices

That has helped the premises become a

Nearly zero water premises

One of the premier and Andhra Pradesh's leading educational institute

Andhra Loyola College

(Autonomous)



Disclaimer

The Audit Team has prepared this report for **The Loyola College Society's Andhra Loyola College (Autonomous)** located at Door No. 54-16-14, Govt. Polytechnic Post, Vijayawada - 520 008, Andhra Pradesh, India based on input data submitted by the College analysed by the team to the best of their abilities.

The details have been consolidated and thoroughly studied as per the various guidelines for Green Buildings available in National and International Standards; the report has been generated based on comparative analysis of the existing facilities and the prerequisites formulated by various standards. The inputs derived are a result of the inspection and research. These will further enhance and develop a Healthy and Sustainable Institution.

These can be implemented phase wise or as a whole depending on the decision taken by the Hon'ble Management and College. The warranty or undertaking, expressed or implied is made and no responsibility is accepted by Audit Team in this report or for any direct or consequential loss arising from any use of the information, statements or forecasts in the report.

The audit is a thorough study based on the inspection and investigation of data collected over a period of time and should not be used for any legal action. This is the property of Greenvio Solutions and should not be copied or regenerated in any form.

The Report is prepared by the Team of Greenvio Solutions under their brand and department – Sustainable Academe as Consultancy firm with the Project Head - Ar. Nahida Shaikh who is an Accredited and Certified Green Building Professional-Architect. Green Building consultancy is her forte and she is one of the most sought after names when it comes to providing excellent quality services within the stipulated time frame.

The Study is conducted in capacity of Accredited & Certified Green Building Professional with extensive experience.

Greenvio Solutions

Developing Healthy and Sustainable Environments

We are an Environmental and Architectural Design Consultancy firm

Sustainable Academe is our department for conducting Audits

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Acknowledgement

The Audit Assessment Team thanks **The Loyola College Society's Andhra Loyola College (Autonomous), Andhra Pradesh** for assigning this important work of Energy Audit. We appreciate the cooperation extended to our team during the entire process.

Our special thanks are due to everyone from the Management.

Our heartfelt thanks to Chairperson of the entire process **Dr. G.A.P. Kishore, S.J.**, Principal for the valuable inputs.

We are also thankful to **College's Task force the faculty members** who have collected data required **Dr. G. Srinivasa Rao**, IQAC Coordinator; **Sri. G. M. Srirangam**, NAAC/RUSA/Autonomy Coordinator; **Dr. G. Sahaya Baskaran**, Placement Coordinator; **Dr. M. Srinivasa Reddy**, Best Practices.

We highly appreciate the assistance of the **entire Teaching, Non-teaching and Admin staff** for their support while collecting the data.

Sustainable Academe

Brand of Greenvio Solutions, Palghar District, Maharashtra- 401208

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DETAILED REPORT

1. Introduction

1.1 Statements of the Institution

1.1.1 Vision

The College proposes "To impart Higher Education with integral formation involving academic excellence, social commitment and value based leadership."

1.1.2 Mission

The College adheres and focuses "To form its students as "men and women for others" and mould them as global citizens with Competence, Conscience and Compassionate Commitment, with preferential option for the marginalized students."

1.1.2 Aim

The College has formulated the following aim to achieve its mission:

- To promote an integrated formation in and through academic, co-curricular and spiritual programmes
- To make the learners do their very best and to always strive for personal excellence in all aspects of life: intellectual, emotional, moral and physical, culminating in their holistic formation, and
- To conduct value-based programmes that enhances social commitment among faculty and students.

1.2 Assessment of the Institute

1.2.1 Affiliations

The Institute is affiliated to **Krishna University**, a state university located in Machilipatnam, Andhra Pradesh, India.

1.2.2 Certification

The College has received the following Certifications

- Certified as **an ISO 9001:2015 Institution** under the scope of certification "Providing Quality Education"
- Certified as **an ISO 14001:2015 Institution** under the scope of certification "Providing Quality Education"
- **NIRF** awarded the All India 24th Rank for Colleges in April 2017, **the highest rank for both the Telugu States**; 56th Rank (2018); 45th Rank (2019); 36th Rank (2020); 34th Rank (2021) and 94th Rank (2022)
- **AISHE** – The All India Survey of Higher Education code of the College is C-25376.

1.2.3 Accreditation

The following are details of the accreditation awarded by the National Assessment & Accreditation Council (NAAC) to the College.

Cycle	First	Second	Third
CGPA	-	3.65	3.66
Grade	A****	A	A+
Year	2002	2008	2017

Table 1: NAAC Accreditation details of the Institute

The College is due to enter its Fourth cycle of NAAC.

1.2.4 Recognitions

- Autonomous Status on 24.10.1987- Autonomy Implemented from the Academic Year 1988-1989 - Autonomy **First Extension** for five years from 1992-1993 – 1997-1998 **Second Extension** for five Years from 1997 -2002
- Autonomy **Third Extension** from 2001-2002 to 2005-2006
- Autonomy **Post Facto Approval for 2006-2007**; and **Fourth Extension** from 2007-2008 to 2012-13
- Autonomy **ex Post Facto Approval from 2013-2014 to 2016-2017 and Fifth Extension** from 2017-18 to 2021-2022
- Recognized as "**A-Grade College**" in the year 2015 and awarded the **First Rank**

in the College Rankings for 2017-2018 based on the **Key Performance Indicators** by the Commissioner of Collegiate Education, Govt. of A.P.

- ⇒ **Autonomy for P.G. Courses** by Krishna University on in May 2017

1.2.5 Approval

The technical course of Post Graduate Level, Management program and the Masters in Business Administration Course provided by the College are approved by **All India Council for Technical Education (AICTE), New Delhi.**

1.3 Achievements of the Institute

The Institute has a tremendous track record of excellence in Built form and educational services provided, below are some of the achievements of the prestigious Institute.

- ⇒ **'Certificate of Appreciation for maintaining Greenery in the premises'** by the Andhra Pradesh Greening and Beautification Corporation, 15 August 2022
- ⇒ **'Certificate of Recycling for handing over the waste'** to TES-AMM (India) Pvt. Ltd., 18 August 2022.
- ⇒ **'Certificate of Appreciation for securing 94th rank in NIRF Rankings, 2022'** awarded by the Andhra Pradesh State Council of Higher Education,
- ⇒ UGC awarded the status of a **"College with Potential of Excellence"** in September 2004 with a grant of Rs. 100 Lakhs
- ⇒ Selected under the UGC **Community College Scheme** in August 2015
- ⇒ Selected under the **Star College Scheme** in February 2016 by the Dept. of Biotechnology, Govt. of India, **becoming the first and only College in both the Telugu states** so far to have been selected under this Scheme.
- ⇒ Selected under Component 08 for *'Enhancing Quality and Excellence in select Autonomous Colleges'* by the **R.U.S.A.** of MHRD, Govt. of India, in June 2018.
- ⇒ Identified **for Support under the FIST Project of DST**, in January 2018, by the Ministry of Science and Technology, Govt. of India.

1.4 Facilities

The College emphasizes on latest technological advancement through its educational initiatives. Our interaction with the staff members and team showed that they are keen for further upgrading and use of sustainable features. Some of the current key facilities are listed below.

- Hostel facilities for boys and girl students; Health Check-up Centre
- Social welfare activities
- Library (Computerized), Teacher's Common room and Rest room for Non-Teaching Staff, Play Ground, Outdoor and Indoor games facilities, Multi-gym facility.
- NCC-Units and NSS Units
- Women's cell including committee against sexual harassment.
- Social interactions with neighbourhood society by extension activities.
- Education Tours and Surveys.

2. Institution overview

2.1 Populace analysis for Academic year 2021-2022

2.1.1 Students data

The student data (shared by the College) shows there were a total of **4,218 Boys and 2,212 Girl students**, thus there were **a total of 6,430 students** on the premises.

2.1.2 Staff data

Type	Male	Female	Total
Teaching staff	127	77	204
Non-Teaching staff	78	20	98
Total Staff Members	205	97	302

Table 2: Staff data of the Institution for 2021-2022

The staff data shows the premises had a total of **302** Staff Members.

2.2 Populace analysis for Academic year 2020-2021

2.2.1 Students data

The student data (shared by the College) shows there were a total of **4,013 Boys and 2,182 Girl students**, thus there were **a total of 6,195 students** on the premises.

2.2.2 Staff data

Type	Male	Female	Total
Teaching staff	144	78	222
Non-Teaching staff	76	22	98
Total Staff Members	220	100	320

Table 3: Staff data of the Institution for 2020-2021

The staff data shows the premises had a total of **320** Staff Members.

2.3 Total College Area & College Building Spread Area

The **total site area is 98 acres** and the **total Built-up area of the Institute is 1,20,000 sq. ft.** for an approximately 6,732 footfalls.

2.4 Institute Infrastructure

2.4.1 Establishment

The Institute was established in 1953.

2.4.2 Spatial Organisation

The College buildings are designed in one of the unique Architectural style's the stone material blocks are appropriately oriented. These provide an ambience of heritage and educational arena for the young minds.

The blocks are surrounded by huge walkways and driveways with appropriate zoning of the site maps; these walkways are landscaped with huge and an extensive number of plantations. The overall softscape and hardscape has a positive impact.

2.5 Operation and Maintenance of the premises

The data collection session was held with the staff regarding the operation and working hours. The schedule mentions that the College is working Monday to Saturday with the timings being 8:00 hours to 13:30 hours.

3. Green Building Study as a Research based technical audit

3.1 About the Green Building Study Audit

It is a systematic study of the aspects which make the Institution sustainable and healthy premises for its inhabitants.

3.2 Analysis of the Green Building Study Audit

The procedure included detailed verification for the following:

Energy Audit

- Analysis of the Lights, Fans, AC, Equipment
- Renewable energy
- Scope for reducing the current energy bills if any
- Improvement in the thermal comfort of the premises

Green Audit

- Green initiatives
- Hygiene audit
- Water Audit - Analysis of the current water consumption of campus; Rainwater harvesting and Wastewater treatment on the premises.
- Waste Audit - Current waste produced, its segregation, and usage; Strategies to be adopted for waste management and awareness

Environmental Audit

- Analysis of the current landscape + hardscape of the premises
- Analysis of the flora and fauna of the premises
- Strategies adopted at present to enhance vegetation
- Measures that can be adopted for ecological improvement of the premises.

3.3 Strategy adopted for Green Building Study Audit

The strategies included data collection from the admin department, actual inventory, investigation to check the operation and maintenance, analysis of the data collection, and preparation of the Report.

3.4 Activities undertaken for the Green Building Study Audit

- 25 November 2022 - Discussion with the College
- 7 December 2022 - Allotment and Initiation by the College
- 14 December 2022 - Site visit at the Institute
- 18 December 2022 - Survey of students and staff completed
- 30 December 2022 - Submission of the Report

4. Energy Audit

4.1 Sources of Energy consumption

The premise uses following sources of energy consumption.

4.1.1 Primary sources

- **Electrical (Metered)** – Light, Fans, Equipments, Pumps comprise these sources.
- **Renewable energy** – There are solar street lights available in 4 numbers as the only source of renewable energy at present.

4.1.2 Secondary sources

- **Gas cylinders** – There are gas cylinders in the premises for residential (hostel facilities) and academic purposes (laboratories)
- **Backup systems** – There are backup systems available in the form of 5 UPS.

4.2 Site investigation analysis

The Site investigation observations and interviews with the Maintenance staff, Electrical department in charge are summarised below:

- The **switch-off drills are practised at present**, the maintenance staff and Lab Attendants put off switches of all equipments regularly.
- All the **computers are shut-off after use** and also put on power saving mode.

4.3 Actual Electrical Consumption as per Bills

There was a detailed discussion held about the energy management aspects that are utilised at present and the benefit the College gets in terms of Green Building facilities. We were informed that even though there are certain levels of energy management initiatives such as LED lights, Solar panels (Only in a few places) the College is spending a huge amount on the electricity bills every month. We have suggested certain inputs based on site investigations during the interview however, this section requires major interventions in future.

4.4 Survey Results

An online survey was conducted to analyse the student and staff views about the Energy management practices adopted in College, following is the result received.

4.4.1 Participation

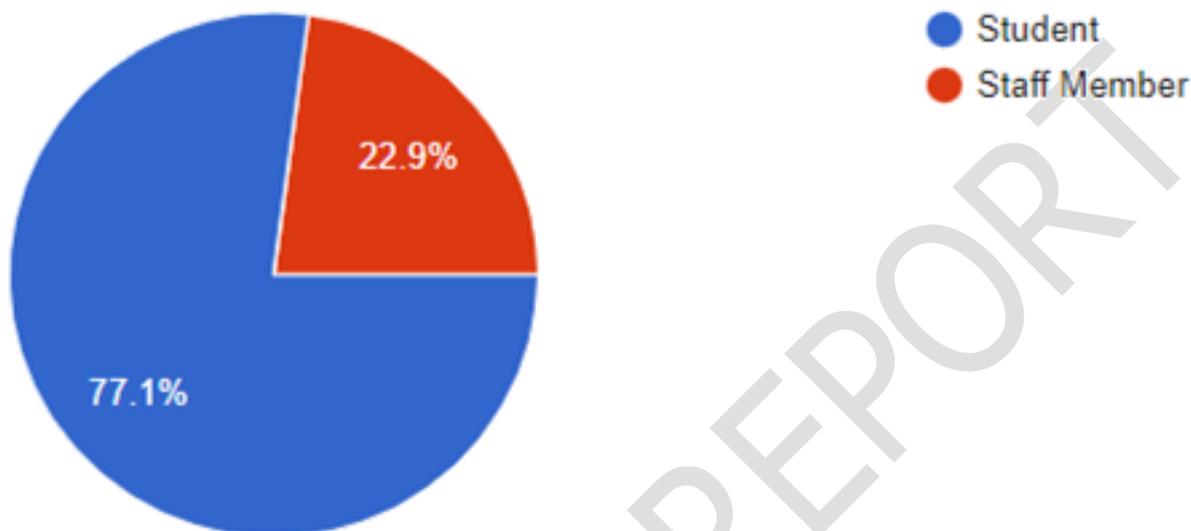


Figure 1: Participation analysis in the survey

A total of **118 responses** were received out of which 77% were students.

4.4.2 Review of the Energy management practices in the premises

Note: The Participants were asked to review the practice on a scale of 1-5 with scale components as follows:

- Scale 1 – Poor
- Scale 2 – Satisfactory
- Scale 3 – Good
- Scale 4 – Very good
- Scale 5 – Excellent

The figures in each of the columns of graph depict the Number of participants responses in numerical (Percentage of the participant response) – For example 101 responses (44.5%)

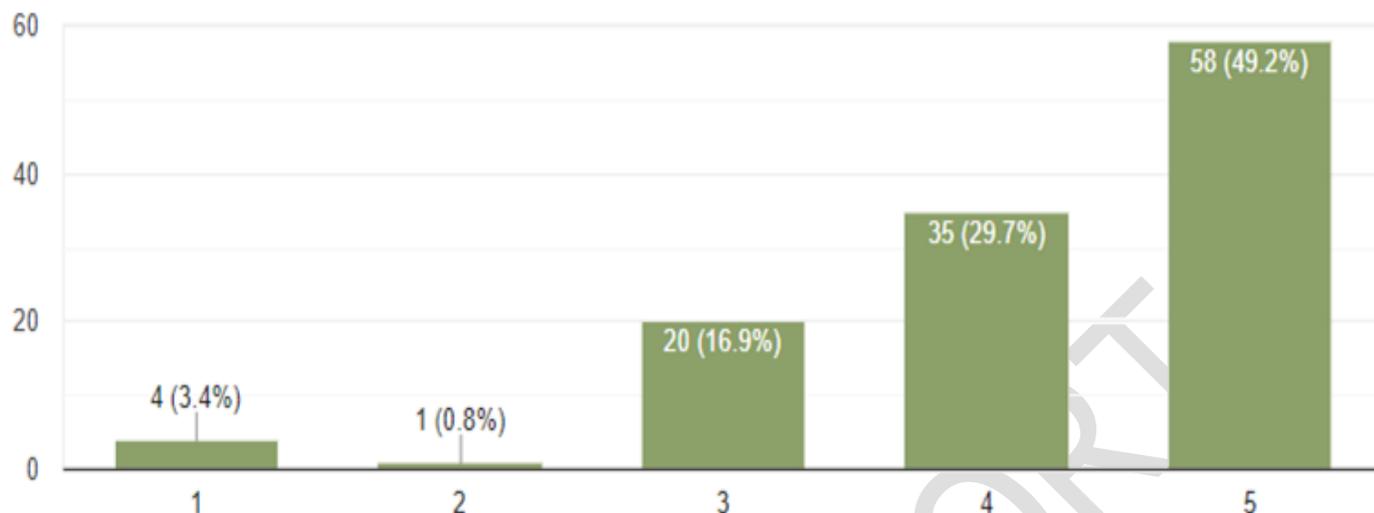


Figure 2: Energy management practices in college

Observation: The students and staff almost 49% of the respondents found the practices to be Excellent (Rating of 5); whereas almost 30% of the respondents found the practices to be Very Good (Rating of 4); and 17% of the respondents found the practices to be Good (Rating of 3).

Inference: Though the majority responses received is only 49% which has been given to 'Rating of 5' thus given the populace of the Institute this section requires a lot of improvement.

4.5 Calculated Electrical Consumption as per inventory

The electricity bills provide actual consumption data. The following is the calculated consumption. It is done to understand the percentage of energy usage in the premises by various applications.

It is based on the inventory collected and interviews with the staff. The additional data such as wattage is taken from market research. In terms of electrical consumption, the main sources are lights, fans, and air conditioner. The inventory and data collection for sources of energy consumed in the premise is summarised in the following sections.

Note: The following analysis is combined for entire premise taking into considerations the duration before pandemic to understand the consumption pattern as post pandemic the premise is used only for a few hours; the equipment study has been excluded for statistical purposes.

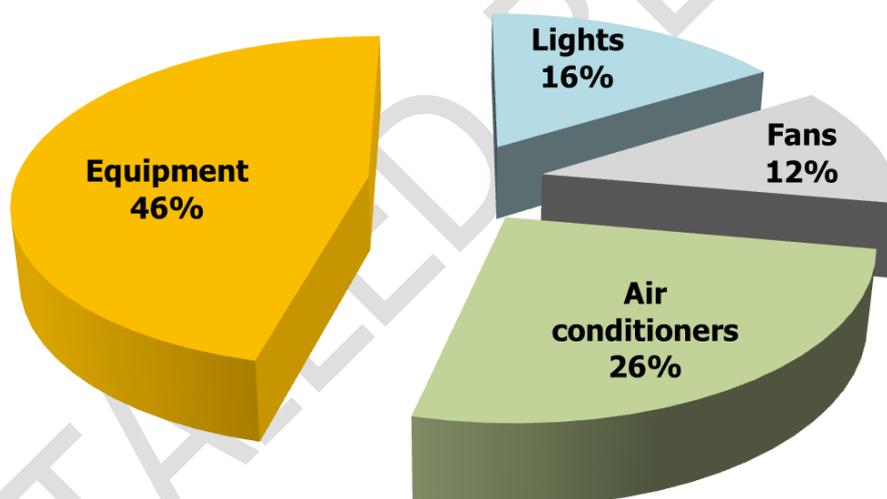


Figure 3: Summary of the calculated electrical consumption as per inventory

The above graph shows that equipments consume 46% while the air conditioners consume 26% the lights consume 16% and the fans consume 12% of the total calculated electrical energy.

4.6 Electromechanical systems - Lights

4.6.1 Types of lights based on the numbers

There are a total of **3,118 lights on the premises**; the following table shows the various types of lights on the premises.

S. No.	Type	Nos.
1	LED	1,817
2	Non-LED	1,301

Table 4: Summary of the types of lights on-premise

4.6.2 Types of lights based on the power consumption

The energy consumption of lights is **1,64,230 kWh** of energy.

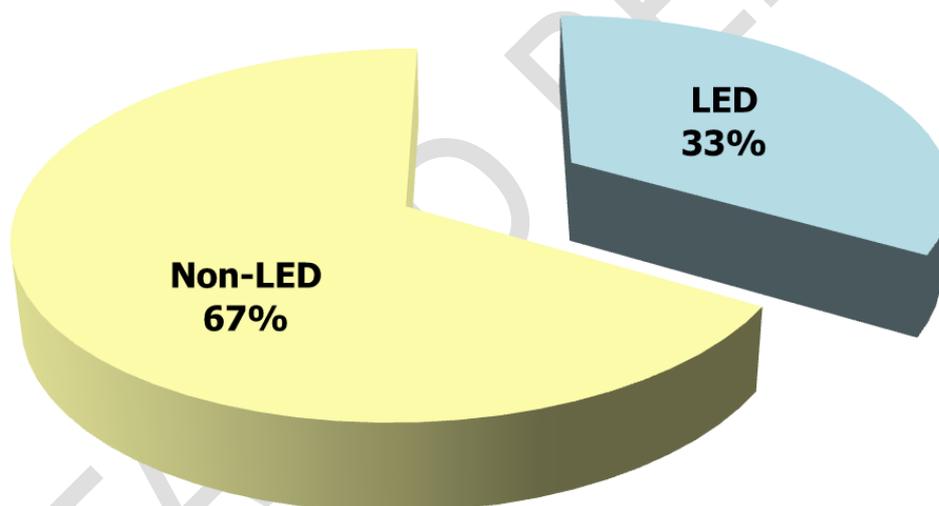


Figure 4: Energy consumed by types of lights in the premise based on the usage study

The analysis of the types of Lights on-premises shows **LED lights consume 33%** followed by **Non-LED lights consume 67%**

4.6.3 Section-wise consumption analysis

The following list shows Block-wise consumption where the Non-LED Lights should be replaced as and when possible.

- ➔ South block
- ➔ Post Graduate block

These blocks have maximum number of Non-LED lights and should be given priority.

4.6.4 Requirement of NAAC

4.6.4.1 Alternative energy initiative

Percentage of power requirement met by renewable energy sources – The College has solar panels but they support only about 10-15% of the energy requirement.

4.6.4.2 Percentage of lighting power requirement met through LED lights

The premise has LED Lights to contribute to 58% in terms of number and **33% of the power requirement** is met through the same. As per our study, we could conclude that both of these are the highest contributions among all the types of lights.

4.6.5 Site investigation observations

- ➔ All lights are in working conditions.
- ➔ There was no fuse defect observed.

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4.7 Electromechanical systems - Fans

4.7.1 Types of fans based on the numbers

There are a total of **2,076 fans** on the premises; the following table shows the various types of fans on the premises.

S. No.	Type	Nos.
1	Ceiling fans	1,362
2	Wall mounted fans	40
3	Pedestal fans	631
4	Exhaust fans	43

Table 5: Summary of the types of fans in the premises

4.7.2 Types of fans based on the power consumption

The energy consumption of fans is **1,19,542 kWh** of the energy.

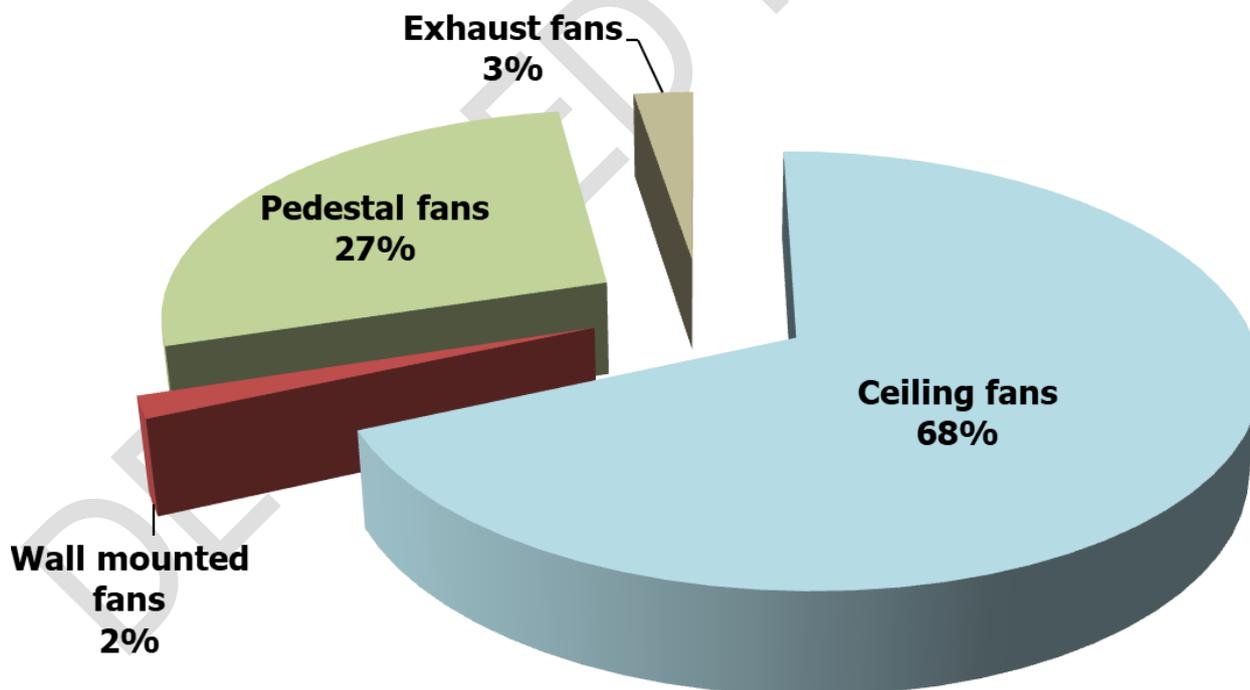


Figure 5: Types of fans based on power consumption

The above analysis shows the **Ceiling fans consume 68%** whereas the **pedestal fans consume 27%** of power; the **exhaust fans consume 3%** and the **wall mounted fans consume 2% each** of the total power.

4.7.3 Section-wise consumption analysis

Observation: The above analysis shows the fans on the Educational block consume more energy of the total power consumed by fans.

Inference: Whenever, there is an opportunity for replacements of all appliances under this specific section the first preference should be given to the Educational section specifically the South Block.

4.7.5 Site investigation observations

- All fans are in working conditions.
- Windows do not have cracks and are caulked appropriately.

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4.8 Air conditioners

4.8.1 Types of air conditioners based on the numbers

There are **136 air conditioners** on the entire premises.

4.8.2 Section-wise consumption analysis

The energy consumption of air conditioners is **2,65,200 kWh** of energy.

Observation: The above analysis shows the air conditioners on the Educational block consume more energy of the total power consumed by air conditioners.

Inference: Whenever, there is an opportunity for replacements of all appliances under this specific section the first preference should be given to the Educational section specifically in the sequence as documented below:

- ➔ Seminar hall
- ➔ Post graduate block
- ➔ North block
- ➔ South block

The other areas can be given preference after the above sequence.

4.8.3 Site investigation observations

Some of the points noticed are as follows:

- ➔ Daily monitoring and check are done by the maintenance staff skilfully.
- ➔ The Outdoor units were not properly cleaned, maintained and had no dust collection problems.

4.8.4 About the replacement of current air conditioners

The current air conditioners are well maintained, though there is not an immediate requirement for replacement however, whenever the College undergoes redevelopment there can be provisions for replacement with energy-efficient appliances or new air conditioners that require less power consumption.

4.9 Equipment

4.9.1 Types of equipment based on the numbers

There are **1,087 numbers of general; 554 scientific and 54 other equipment** on the entire premises. *Disclaimer: Only the general equipment that has day-to-day usage are considered for research purpose, whereas the scientific ones and other equipment are excluded.*

4.9.2 Types of equipment based on the consumption

The energy consumption of general equipment is **4,70,542 kWh** of energy.

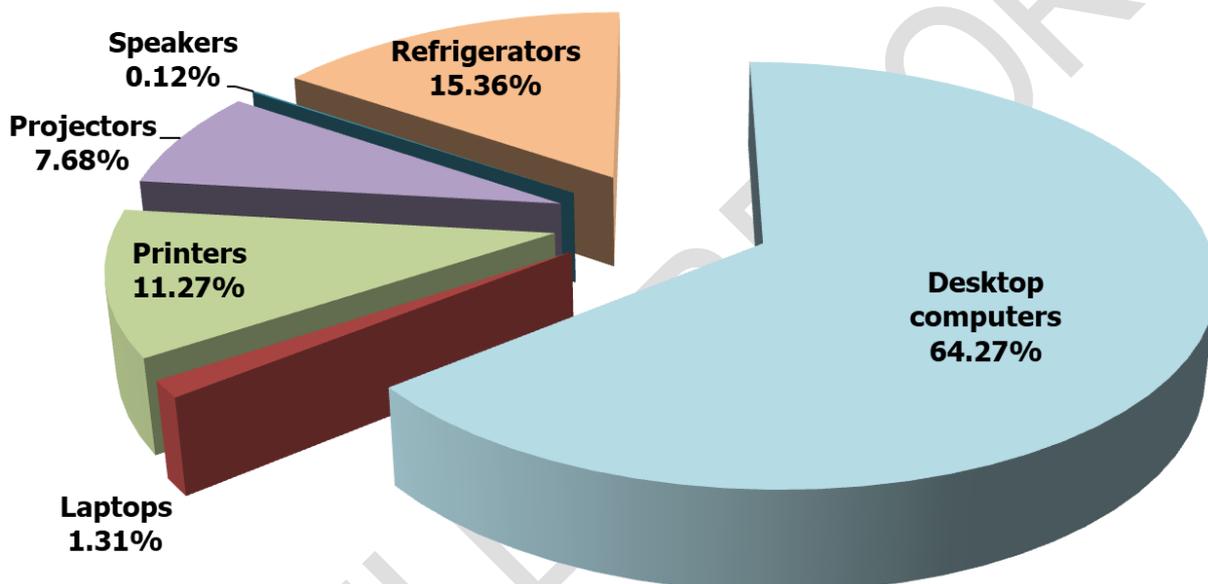


Figure 6: Summary of Energy consumed by equipment in the premises

The above summary shows that **desktop computer consumes more energy at 64.27%** while **refrigerator consumes 15.36%** and the **printers consumes 11.27%** these are maximum consumers as compared to other equipment. Batteries and Inverter (when used for electrical consumption else it is a battery backup and does not require electricity as an equipment) are also one of the equipment but are excluded in this calculation.

4.9.3 Site investigation observations

1. All equipments are in working conditions and daily monitoring and check is done by the maintenance staff and admin staff in an excellent manner.
2. No defect was found in any equipment of electrical consumption.

4.10 Recommendations for a Sustainable Habitat

To be considered as **first priority but first in sequence** for implementation under section wise study

Over the time energy efficient appliances have been a boon not only to the energy saving parameters they adhere to but also the eco-friendly habits it helps to inculcate. The Institution such as Schools and Colleges are the best way to implement these initiatives. It creates awareness among the students at a young age. The Institutions also act as a symbol and representative of being an energy efficient premise. Following the analysis we found are some of the suggestions which can be implemented for an energy efficient Institution. This would help in reduction of the current electrical consumption by a major percentage.

4.10.1 Electromechanical systems - Electrical and Lighting

Section 1 – Non - LED Lights

The current light analysis shows that the College has CFL/ Non-LED lights in certain areas, these should be replaced with LED lights which consume on an average 16-20W when in use. Our technical analysis shows that there would be a reduction of an average of **60% reduction** in energy consumption through lights specifically as a part of the electro-mechanical system if all **Non-LED lights** are replaced on all floors and buildings with an energy-efficient appliance whenever the College undergoes renovation.

Section 2 – Ceiling Fans

The current Fans are in proper working conditions and maintained well. The ceiling fans are in more quantity and consume at least 60W when in use. These should be replaced with energy efficient fans consuming 35W when in use.

Our detailed study states that is all the **ceiling fans on all floors** if replaced with star rated appliance results in a reduction of average of **42% reduction** in energy consumption if replaced with energy efficient appliance. It will be suggested to either replace these now if college can have certain plans else the replacement can be done when fans get damaged or are not in working condition **as currently the energy efficient appliances are available in the Boys hostel, Girls hostel and the Staff rooms.**

Section 3 – Desktop computers to laptops

Among all equipment, it suggested replacing the desktop computers with laptops as this would be energy efficient. A normal desktop computer consumes an average of 250W and it is to be connected all time when it has to be used. On the contrary, a laptop consumes 40W and has a battery backup that lasts up to 4 hours.

There is **an average 84% reduction** in energy consumption if replaced with an energy-efficient appliance which is a laptop in all the areas. This replacement is however dependent on a variety of factors as follows.

- ➔ **Some of the senior staff** members may be more convenient with computers; replacement with a laptop might result in a change of the working patterns and hours which may affect the productivity.
- ➔ **Laptops** in case are not handled with care such as if dropped unintentionally might result in data imbalance.
- ➔ **Students who are not day scholars** can use a laptop at their convenience; whereas in common areas there can monitor of the usage hours hence computers may be a preferable option then laptops in certain spaces.
- ➔ **Depending on the recent pandemic situation** in case it might be possible due to irregular usage the device might have issues while functioning.

Thus the Institute should analyze the above points and then devise a strategy for the replacement, when the devices get damaged or are not in working condition.

4.10.2 Facility management systems, controls (Smart premises)

The College has extreme potential to become 100% energy efficient premises. In addition to provisions in the electromechanical system some facilities can be introduced towards building management systems as well. These can be undertaken equally for educational and residential sections. (Includes electromechanical systems – Electrical, Water)

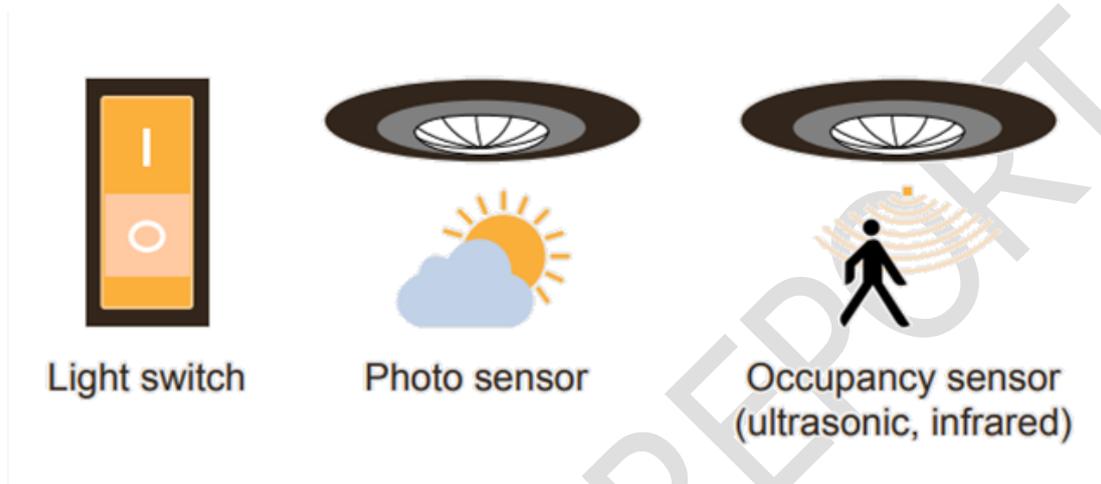


Plate 1: Understanding the lighting concepts

Source: https://seors.unfcc.int/applications/seors/attachments/get_attachment?code=NG125PFE4WHMWSYAK8TCAKIHMWX0F4QD

The above diagram provides a detailed study of how the system controls should be incorporated in the premises as far as lighting systems are considered. The suggesting for this sub-section are listed below.

- Install PIR control of the lighting in the toilet areas.
- Install low flow taps with automatic shut off in the toilets.
- Install push button timer control in all rooms lighting and ceiling fans.
- Install audible alarms on the laboratory doors to ensure doors remain closed at all times.
- Install Power Electronics control of the Foyer notice board lighting.
- Use of photo sensor switch for street light controlling helps in conserving the lighting energy.

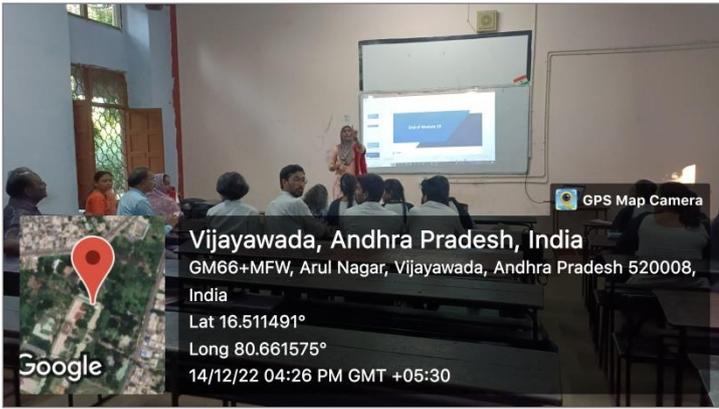
5 Inferences as Consolidated study

(Based on the site visit)

These are to be considered as **second priority** for implementation, once the section wise recommendations are implemented. The following recommendations should be *implemented within the next 2.5 – 3.5 years from the date of the Report submission.* The Institute can execute a plan of action after discussion with Project Head.

- ➔ **Solar farms** - This option can be explored with due discussion with the surrounding and adjacent farmland owners. This will serve as a noble project being one of its kind in the locality and will provide dual benefits to the farm land and the College w.r.t to electricity bill power reduction.
- ➔ **Solar tree** – Since there are certain space and structural constraints the option of providing an aesthetic beauty to the premises and benefit w.r.t to energy reduction can be provided with installation of solar tree in multiple places in the site.

On-site investigation and physical verification Audit Team during the visit on 14 December 2022



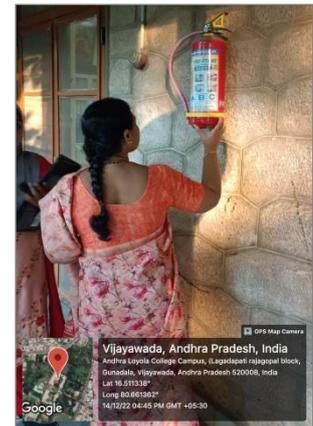
Discussion with the MBA Program Students on 'Green Buildings' and Induction meeting with the Core Team



On-site review with the team for water management, life safety aspects, environmental awareness campaign, universal accessibility and other features



Group photo with the Team



Site discussions with the Team



On-site review with the team for waste management, life safety aspects and organic farm



Site premises

5. References

The study is based on the data collected, analysed, rechecked, and confirmed through multiple modes. For the quality study, some standards/ notes have been referred to. These are listed and noted below. However, no direct references have been used anywhere. These are used as a base to analyse and study the data collected.

Specific references for study related to energy

- ➔ <https://www.energy.gov/eere/buildings/zero-energy-buildings>
- ➔ <https://www.dsaarch.com/zero-net-positive-energy>
- ➔ U.S. Energy Information Administration

DETAILED REPORT



Energy Audit Certificate

The study is conducted as per Indian and International Green Building Standards initiated in the capacity of an Accredited & Certified Green Building Professional

It is awarded for **2020-2021 and 2021-2022** to the Esteemed Institution
(Analysed for 2 years and extended validity for 1 year, thus total 3 years)

The Loyola College Society's

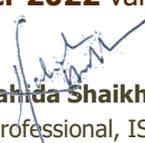
Andhra Loyola College (Autonomous)

Door No. 54-16-14, Govt. Polytechnic Post, Vijayawada - 520 008, Andhra Pradesh, India

(Site visit held on 14 December 2022)

As part of the Institution's initiatives for a Healthy & Sustainable College the audit was conducted.
We appreciate the immense efforts taken by Staff and students towards the Energy Management and Conservation.

Issued on **Friday, 30 December 2022** valid till **December 2023**


Ar. Namida Shaikh

Architect, IGBC Accredited Professional, ISO Certified I. A. (IMS)
Assocham GEM Certified Professional (Regn. No. 22/718)

Project Head and Green Building Professional-Consultant

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ENERGY AUDIT

STUDY PERIOD (TWO YEARS) 2022 - 2023 & 2023 - 2024

Sustainability study

AUDIT REPORT

Studied for

The Loyola College Society's
Andhra Loyola College
(Autonomous)

Door No. 54-16-14, Govt. Polytechnic Post, Vijayawada -
520 008, Andhra Pradesh, India

Studied in the capacity of

Accredited and Certified GBP



Website: <https://thegreenviosolutions.co.in/>

Email: greenviosolutions@gmail.com

Disclaimer

The Audit Team has prepared this report for **The Loyola College Society's Andhra Loyola College (Autonomous)** located at Door No. 54-16-14, Govt. Polytechnic Post, Vijayawada - 520 008, Andhra Pradesh, India based on input data submitted by the Institute analysed by the team to the best of their abilities.

The details have been consolidated and thoroughly studied as per the various guidelines for Green Buildings available in National and International Standards; the report has been generated based on comparative analysis of the existing facilities and the prerequisites formulated by various standards. The inputs derived are a result of the inspection and research. These will further enhance and develop a Healthy and Sustainable Institution.

These can be implemented phase wise or as a whole depending on the decision taken by the internal team. The warranty or undertaking, expressed or implied is made and no responsibility is accepted by Audit Team in this report or for any direct or consequential loss arising from any use of the information, statements or forecasts in the report.

The audit is a thorough study based on the inspection and investigation of data collected over a period of time and should not be used for any legal action. This is the property of Greenvio Solutions and should not be copied or regenerated in any form.

The Report is prepared by the Team of Greenvio Solutions under their brand and department – Sustainable Academe as Consultancy firm with the Project Head - Ar. Nahida Shaikh who is as an Accredited and Certified Green Building Professional-Architect. Green Building consultancy is her forte and she is one of the most sought after names when it comes to providing excellent quality services within the stipulated time frame.

The Study is conducted in capacity of Accredited & Certified Green Building Professional with extensive experience.

Ar. Nahida Abdulla

Greenvio Solutions

Developing Healthy and Sustainable Environments

We are an Environmental and Architectural Design Consultancy firm

Sustainable Academe is our department for conducting audits

Palghar District, Maharashtra- 401208

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Acknowledgement

The Audit Assessment Team extends its appreciation to **The Loyola College Society's Andhra Loyola College (Autonomous), Andhra Pradesh** for assigning this important work of Energy Audit. We appreciate the cooperation extended to our team during the entire process.

Our heartfelt thanks to Chairperson of the entire process **Dr. G.A.P. Kishore, S.J.**, Principal for the valuable inputs.

We are also thankful to Institute's Task force who have played a major role in data collection.

- ➔ Teaching staff member – **Dr. M. Srinivas Reddy, Vice Principal; Dr. A. Lavanya, Criteria 7 Incharge** and **Dr. G. Jameema, HOD Agriculture and Rural Development**
- ➔ Admin staff member – **Ms. Karuna**

We appreciate the cooperation of **entire Teaching, Non-teaching, and Admin staff** for their support while collecting the data.

Sustainable Academe

Brand of Greenvio Solutions, Palghar District, Maharashtra- 401208

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1. Introduction

1.1 Statements of the Institution

1.1.1 Vision

The College proposes "To impart Higher Education with integral formation involving academic excellence, social commitment and value based leadership."

1.1.2 Mission

The College adheres and focuses "To form its students as "men and women for others" and mould them as global citizens with Competence, Conscience and Compassionate Commitment, with preferential option for the marginalized students."

1.2 Assessment of the Institute

1.2.1 Affiliations

The Institute is affiliated to **Krishna University**, Machilipatnam, Andhra Pradesh, India.

1.2.2 Certification

- Certified as **an ISO 9001:2015 Institution** under the scope of certification "Providing Quality Education"
- Certified as **an ISO 14001:2015 Institution** under the scope of certification "Providing Quality Education"
- **AISHE** – The All India Survey of Higher Education code of the College is C-25376.

1.2.3 Accreditation

The College is due to enter its Fourth cycle of NAAC.

1.2.4 Recognitions

Autonomy for P.G. Courses by Krishna University on in May 2017

1.2.5 Approval (AICTE)

Technical course are approved by **All India Council for Technical Education, New Delhi.**

2. Overview

2.1 Summarised Populace analysis

The information shared by the Institute shows there are more than 4,300 students and 220 staff members in the premises

2.2 Site & Institute building spread details



Plate 1: Site map of the campus

3. Evidence

1 | Page

Evidence documents for Site visit of external audit team

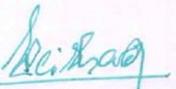
Audit team headed by external expert - Ar. Nahida Abdulla
Accredited & Certified Green Building Professional, ISO IA (IMS)
Audit objective: Green Building up gradation of the premises

Audits covered: Green audit Energy audit Environment audit

Institute: Andhra Loyola College Date: 13/2/24

Document objective: Inferences of the Site visit

Observations (Positive aspects)	Suggestions (Improvement aspects)
Green Audit	
- Waste water treatment plant; R.O. plant; rain water harvesting; medical facility; excellent waste management measures undertaken	No major suggestions but documentation of reflectance can be increased
Energy Audit	
- Energy efficient lights, fans are available - Fire & life safety measures are well undertaken	- Sensor based facilities, systems can be undertaken - Fabrication of electrical systems can be improved
Environment Audit	
- Green cover is good & well improved	Continue with the current practices; no changes



Signature & round seal
Name: Dr. Rev. Fr. G. A. P.
Designation: Principal
For the said Institute





Signature & round seal
Name: Mrs. P. S. Shalini
Designation: Project Coordinator
For The Greenvio Solutions



Website: thegreenviosolutions.co.in Email: greenviosolutions@gmail.com



Plate 2: Evidence files related to observations

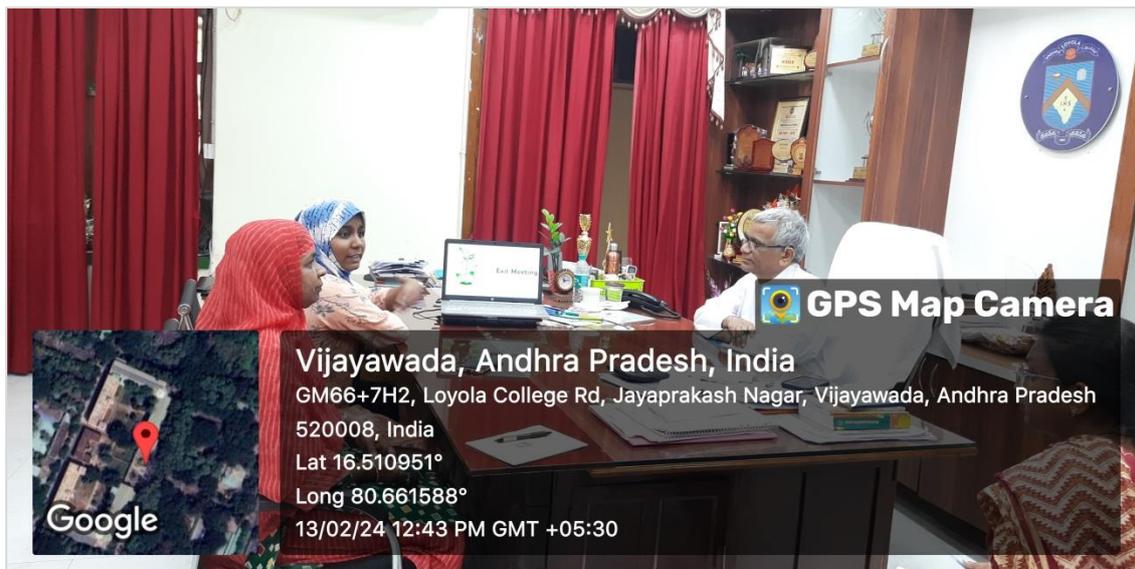


Plate 3: Discussion with the team

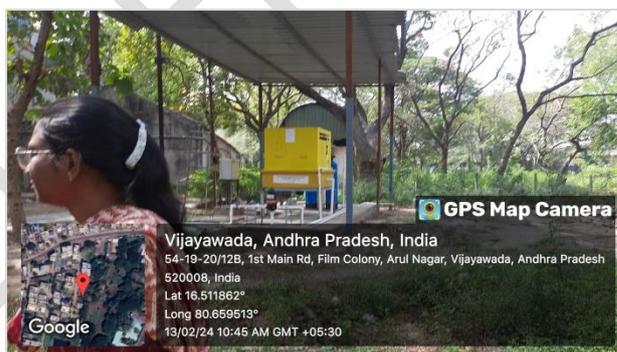


Plate 4: On-site inspection with the team

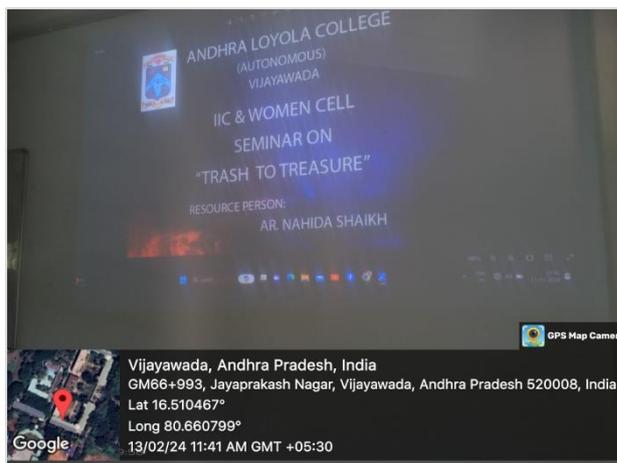


Plate 5: Seminar on 'Trash to Treasure' for stakeholders

Evidence documents for Site visit of external audit team

Audit team headed by external expert - Ar. Nahida Abdulla
 Accredited & Certified Green Building Professional, ISO IA (IMS)
 Audit objective: Green Building up gradation of the premises

Audits covered: Green audit Energy audit Environment audit

Institute: Andhra Loyola college Date: 13/2/24

Document objective: Induction Meeting attendance sheet

S. No.	Name	Committee	Designation	Signature
1.	Mrs. F. A. Shaikh	External	Project Coordinator	
2.	Ar. Nahida Abdulla	External	Project Head	
3.	Rev. Fr. Dr. G. A. P. Kishore, S.J.		Principal	
4.	Dr. M. Srinivas Reddy		vice principal	
5.	Dr. A. Lavanya		criteria & incharge	
6.	Dr. G. Jameema		HOD Agriculture and Rural development	

Signature & round seal
 Name: Rev. Fr. Dr. G. A. P. Kishore, S.J.
 Designation: Principal
For the said Institute



Signature & round seal
 Name: Mrs. F. A. Shaikh
 Designation: Project Coordinator
For The Greenvio Solutions



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Plate 6: Evidence file related to induction meeting attendance record



Evidence documents for Site visit of external audit team

Audit team headed by-external expert - Ar. Nahida Abdulla
 Accredited & Certified Green Building Professional, ISO IA (IMS)
 Audit objective: Green Building up gradation of the premises

Audits covered: Green audit Energy audit Environment audit

Institute: Andhra Loyola College Date: 13/2/24

Document objective: Exit Meeting attendance sheet

S. No.	Name	Committee	Designation	Signature
1.	Mrs. F. A. Shaikh	External	Project Coordinator	
2.	Ar. Nahida Abdulla	External	Project Head	
3.	Rev. Fr. Dr. G-A-P Kishore, SJ		principal	
4.	Dr. M. Srinivas Reddy		Viceprincipal	
5.	Dr. A. Lavanya		Criteria 7 incharge	
6.	Dr. G. Jameema		HOD Agriculture and Rural development	

Signature & round seal
 Name: Dr. Rev. Fr. Kishore
 Designation: principal
For the said Institute

Signature & round seal
 Name: Mrs. F. A. Shaikh
 Designation: Project Coordinator
For The Greenvio Solutions

Plate 7: Evidence file related to exit meeting attendance record



4. Observation

4.1 Positive/ Good practices

4.1.1 Certain outdoor air conditioner units are in shaded areas



Plate 8: Certain outdoor air conditioner units are in shaded areas

4.1.2 Fire and Life safety measures



Plate 9: Fire and Life safety measures

4.2 Areas of improvement

Note: The text mentioned in this type of font (red colour, bold and italics style) determines a suggestion

4.2.1 Exposed wiring within interior areas

This serves as a negative area for two circumstances:

- *Any short circuit in any area can lead to major accident*
- *Since there is no fabrication the spaces looks aesthetically unappealing*

4.2.2 Heavy electrical load concentrated at certain areas

This serves as a negative area for two circumstances:

- *The extreme loads can lead to short circuits*
- *There should be equal distribution of load, appropriate switchboard locations and fabrication and be designed*

4.2.3 Danger zones not demarcated well

However, there are fire extinguishers available nearby; the areas are not demarcated as 'DANGER ZONE' additional fire and life safety measure are required

DETAILS

5. Compliance

The compliance study was carried out through investigative ways. This was done to understand the **extent of suggestions and their implementations based on previous report of Academic years 2020-2021 and 2021-2022. The current study is for academic years 2022-2023 and 2023-2024.**

5.1 Compliance status

The details of compliance are analysed on previous year Report.

S. No.	Recommendation Title	Compliance Status
1.	Non-LEDs to LED	Completed as per the discussion the campus now has 100% LED lights
2.	Non-energy efficient ceiling fans	Total ceiling fans of hostel areas was replaced with energy efficient fans
3.	Desktop computers to Laptops	Not undertaken in the way recommended but new appliances are purchased for digital campus
4.	Energy efficient air conditioners	Under process
5.	Sensor based appliances	Not undertaken

Table 1: Details of the compliance study

5.2 Compliance technical study

S. No.	Month	Year	KWh	Net consumption	Solar consumption	Amount
Academic year 1						
1	April	2023	10,69,662	47,800	848	5,74,164
2	May	2023	10,93,562	42,224	1,490	5,27,846
Academic year 2						
3	June	2023	11,14,674	25,926	1,684	3,87,645

4	July	2023	11,27,637	45,716	910	5,59,977
5	August	2023	11,50,495	47,170	1,122	5,96,986
6	September	2023	11,74,080	55,430	730	6,74,513
7	October	2023	12,01,795	63,212	28	7,60,119
8	November	2023	12,33,401	51,010	1,640	6,38,759
9	January	2024	12,83,986	46,042	8	6,00,160
10	February	2024	13,07,007	42,892	126	5,72,283

Table 2: Details of the electrical consumption

The observation related to above information states:

- The **total amount** spent in past ten months is **Rs. 58,92,452/-**
- The **average amount** spent every month are **Rs. 5,89,245/-**
- The **total units** consumed in past ten months **~4,67,422 units (Electrical + solar)**
- The **average units** consumed every month are **~ 46,742 units (Electrical + solar)**
- The **total units** consumed in past ten months is **~ 8,586 units (Only solar)**
- The **average units** consumed every month are **~859 units (Only solar)**
- **Alternate source of energy is available in form of rooftop solar panels.**

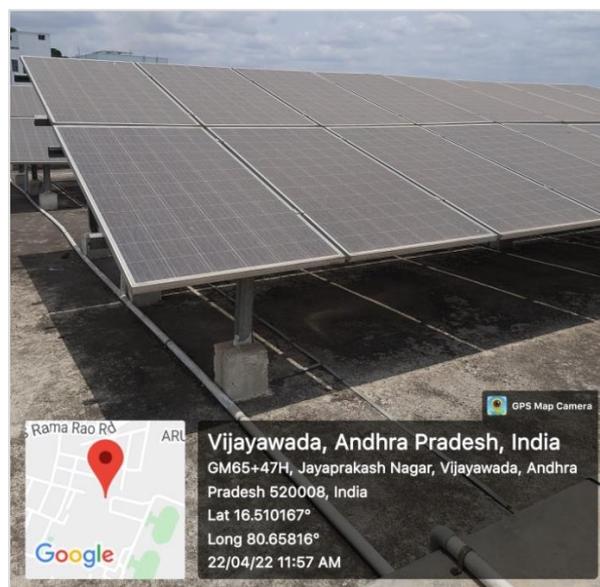
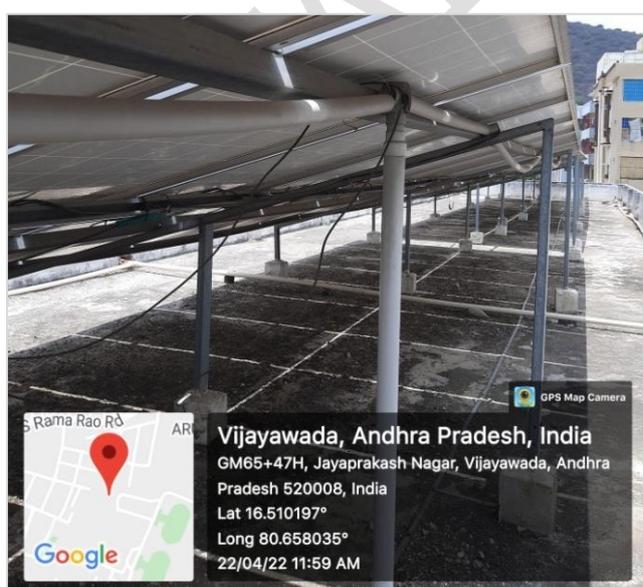


Plate 10: Rooftop solar panels in the premises

5.3 Compliance comparative study

The study focuses only on those appliances that have a scope of energy reduction and preservation as the other appliances are a mandatory requirement and cannot be overlooked.

➔ Lights – Source of electrical usage

- Previously there were 1,817 LED lights consuming 54,946 kWh and 1,301 Non-LED lights consuming 1,09,284 kWh of energy
- The current data as discussed states that all Non-LED lights are converted to **LED lights thus there are 3,118 nos. of lights contributing to 94,288 kWh of energy**

➔ Fans – Source of electrical usage

- Previously there were 1,362 non-energy efficient ceiling fans in the educational areas consuming 81,720 kWh of energy
- **Whereas currently there are 1,362 non-energy efficient ceiling fans in educational areas and 1,500 energy efficient ceiling fans in hostel areas; thereby contributing 1,93,020 kWh through 2,862 fans, apart from the other types of fans that consume less energy**

➔ Air conditioners – Source of electrical usage

- There is no change, thus **136 nos. consuming 2,65,200 kWh of energy.**

The following documentation is based on consumption practice of the premises.

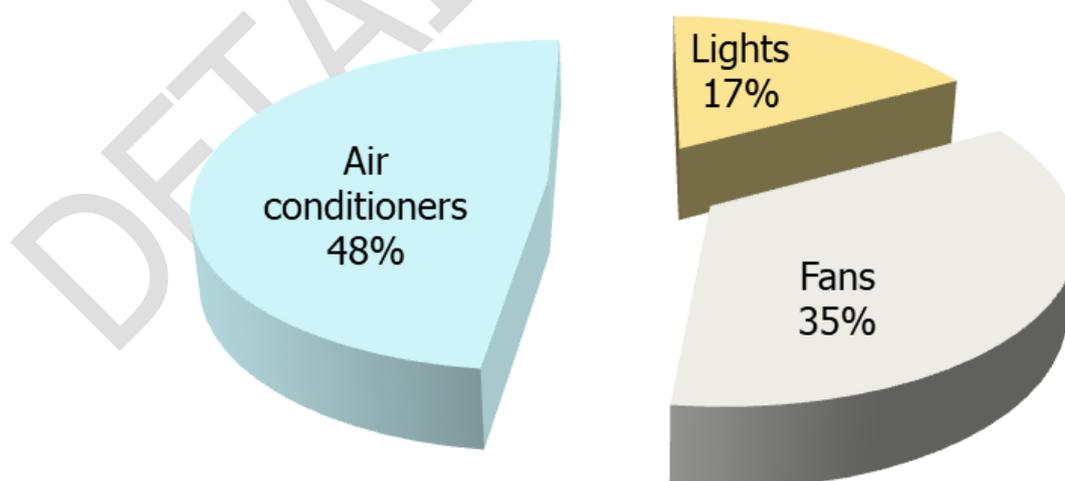


Figure 1: Summary of the calculated electrical consumption as per inventory

The above graph shows that air conditioners consume 48% while the fans consume 35% the lights consume 17% of the total calculated electrical energy.

6. Roadmap

The roadmap refers to the recommendations/ inferences/ suggestions that have been derived after the 'Green Building study' of the premises.

6.1 About the Green Building Study Audit

It is a systematic study of the aspects which make the Institution sustainable and healthy premises for its inhabitants.

6.2 Roadmap

The Institute suggested to prepare a roadmap for data collected, observed, investigated for a specific duration. This was due to the systematic steps undertaken to conduct the exercise.

The roadmap would act as a 'PLAN OF ACTION' to implement all the suggestions in a detailed manner. The same has been identified in two phases for a total duration of three years.

➔ Phase 1

- *Duration: One year from the date of Report submission – Shared currently*
- These are first hand suggestions
- They are easy and quick to implement
- They involve close very less or almost no expenses
- They can serve as a foundation for the entire plan of action

➔ Phase 2

- *Duration: Within two years of Phase one completion – Not shared currently*
- There are certain expenses but no major cost involved in implementation

The study does not complete in just two phases, but it sets a benchmark to achieve the goal of achieving the next stages of green building:

- ➔ Nearly Net zero campus (Energy/ Water)
- ➔ Net Zero campus (Waste/ Energy/ Water)
- ➔ Net positive campus (Waste/ Energy/ Water)

Phase 1 – First priority

To be implemented within 'ONE' year from date of Report submission.

Section 1 – Energy management

➔ General practice

- The stakeholders should be educated to
 - i. Keep the lights on in the class room only when needed and unplug electrical devices when not in use.
 - ii. Electrical appliances consume energy even when you are not using them hence plugging something in only when needed can save electrical energy usage in your college, school and Home.
 - iii. At the time of locking the departments all fans, lights should be switched off.
 - iv. The students should be trained to switch off fans and lights when there is no need of them.
 - v. Staff should be trained to switch of lights and fans in their rooms when they leave the room.

➔ Awareness and vigilance

- Strict instructions for avoiding wastage of energy including rules such as if anyone is found putting on the switch unnecessary may be a punishable offence or fine
- Seminars/ Webinars/ Workshops o stakeholders on energy preservation, use of e-vehicles
- Conduct visits and monitoring by authority for check of appliances/ their working conditions/ energy usage etc. every fifteen to twenty days

➔ Facilities intervention to reduce electrical load

- Use white colored interiors and exterior façade to reflect light and
- Avoid dark colored interior and exterior façade, especially exterior façade
- Cover the inverters/ solar meters on the rooftop areas
- Demarcate the areas as 'DANGER' and do not allow any other stakeholder except the skilled or expertise staff member

- Cover the rooftop of outdoor air conditioner units to avoid any direct sun exposure on the top area as this may lead to increased electrical consumption and reduce the duration of quick cooling

➔ Display information about the technical facilities

- Any space that has any source of renewable energy in the block certain information as follows should be displayed on a board near the entrance or foyer area of the block for sensitization
 - i. 'DANGER ZONE' and 'NO SMOKING ZONE' boards
 - ii. Do and Don't for the specific type of plant
 - iii. Plant name
 - iv. Capacity
 - v. Location
 - vi. Type of renewable energy system
 - vii. Nos. of units
 - viii. Installation date, month and year
 - ix. Energy generated per day and annually
 - x. Energy consumption actual requirement per day and annually
 - xi. Energy saved per day and annually
 - xii. Last maintenance date and vendor
 - xiii. Revenue generation (if any) per day and annually
 - xiv. Institute name and logo

Section 2 – Life safety management

➔ Display boards for awareness

- All fire and life safety exit signages as per NBC norms should be displayed at every nook and corner including assembly point, exit points
- A RACE Board at the location of extreme populace/ footfalls.
- There should be a PASS Board alongside every fire extinguisher



Reference suggestions 1: PASS Board display

➔ Fire and life safety measures

- Every space that has a gas cylinder/ air conditioner/ combustible appliance/ more than ten electrical or electronic appliance and Server rooms there should be EITHER sand bucket/ fire ball/ fire extinguisher

➔ Laboratory safety measures

- *There should be additional provisions in the LABORATORIES including:*
 - i. *Eye washers*
 - ii. *First aid box*
 - iii. *Concealing of exposed wiring*
 - iv. *Display chart about the 'dos and don'ts, a workshop for stakeholders about fire and life safety*
 - v. *Rubber flooring as an electrical safety measure*

Laboratory Safety

LABORATORY SAFETY

LABORATORY DRESS

Splash Goggles

Gloves

Face Shield

Laboratory coat
Also wear shoes that are closed from all sides

HOUSEKEEPING

Keep the laboratory clean and organized.

A place for everything and everything in its place.

CHEMICAL SPILLS

- Wear shoes covered from all sides while cleaning chemical spills.
- Do not just sweep spilled chemicals with a broom.
- Spray agents that solidify chemical spills or neutralize them.
- Do not dump the cloth soaked in spilled chemical in a waste bin. That cloth then becomes hazardous.
- Ventilate the room.

TRANSFERRING LIQUIDS

Pour the liquid down a stirring rod to avoid splattering

Never pipette by mouth

Always add acid to water

Use funnel while pouring from a wide mouth container to a small mouth container

LABELING CHEMICALS

CAUTION
CHEMICAL STORAGE ONLY
NO FOOD OR DRINK IN THIS UNIT

Always store chemicals in a rack and place a caution sign.

Do not use chemicals from unlabeled containers

HEATING CHEMICALS

Keep the direction of the mouth of the test tube away from yourself and others.

Wear safety glasses while heating in a laboratory

Heat gently to avoid splattering

While boiling, leave the stirring rod in the beaker

EYE WASH

Let water go directly into the eyes. Keep your hands free to hold your eyes open. Rinse eyeballs and interior of the eye gently for about 15 minutes.

WATER REACTIVE METALS

- Water reactive metals react violently with water.
- Handle them with extreme caution. Direct contact with them causes burns.
- Store Sodium, Lithium and Potassium under dry mineral oil or dry kerosene.
- Store metals in tight containers.
- Do not store Potassium for very long periods.

Metal cans provide durable storage, are fire resistant and break resistant for several hazardous chemical.

Potassium and dry mineral oil

Absorbent material

FIRE EXTINGUISHERS

CAUSE OF FIRE	TYPE OF FIRE EXTINGUISHER				
	HALON	DRY CHEMICAL	CARBON DIOXIDE	POWDER CLASS	SAND BUCKET
A. easily combustibles like paper, wood and trash	YES	YES	NO offers very little protection	NO	NO
B. flammable liquids like alcohol	YES	YES	YES	NO	NO
C. electrical equipments	YES	YES	YES	NO	NO
D. water reactive chemicals	NO	NO	NO	YES	YES

HARMFUL VAPOURS

Ventilate the room. Open all doors and windows.

Use respirator

Use fume hood

Switch on the exhaust fan and open all windows to let the vapours out.

WASTE CONTAINERS

- Sort your laboratory waste.
- Dispose hazardous and non-hazardous waste in separate bins and bags.
- Maintain separate bins for chemicals, broken glasses, and general waste.
- Identify all bins by marking them or by different colours.

SAFETY RULES

- Do not perform unauthorized experiments.
- Never work alone in the laboratory.
- Report all accidents immediately to the teacher or the laboratory in-charge.
- If toxic vapours are generated, use fume hood.
- Wear a chemical splash goggles and resistant gloves.
- Wear a chemical resistant apron or coat.
- Tie back long hair.
- Do not wear loose sleeves.
- Do not wear shorts.
- Do not wear sandals.
- No food or beverage inside the laboratory.
- Do not leave experiments unattended.
- Keep knowledge of the exits, safety showers, eye wash, fire blankets and extinguishers.
- Do not run around in the laboratory.
- Keep the working shelf and the laboratory clean.
- Extinguish burners when away from desk.

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Plate 11: Lab safety manual in the premises

➔ **Earth pit zones**

- Add signboard about 'Outdoor Electrical area'
- Code the earthing pits in the courtyard.

➔ **DG and Transformer area**

- Add safety signages such as 'Danger-do not touch' etc.
- Add signboards about the usage such as 'Transformer areas' and 'Diesel Generator area' etc.
- Every user in this space should compulsorily jacket, helmet, gloves, boots while working and being a part of this space.
- Code the earthing pits in the courtyard.
- Add additional fire extinguishers

DETAILED REVIEW

7. Compilation

The study is based on the data collected, analyzed, rechecked, and confirmed through multiple modes. For the quality study, some standards/ notes have been referred to. These are listed and noted below. However, no direct references have been used anywhere. These are used as a base to analyze and study the data collected.

Specific references for study related to energy

- ➔ <https://www.energy.gov/eere/buildings/zero-energy-buildings>
- ➔ <https://www.dsaarch.com/zero-net-positive-energy>
- ➔ U.S. Energy Information Administration
- ➔ <https://www.happysprout.com/inspiration/what-is-smart-gardening/>
- ➔ <https://ieeexplore.ieee.org/document/6779316>
- ➔ <https://www.murata.com/en-global/apps/industry/security/entranceandexitsystem>
- ➔ <https://www.energuide.be/en/questions-answers/what-are-the-alternatives-to-air-conditioning/2121/>
- ➔ IGBC Green Campus rating system Abridged Reference Guide
- ➔ GEM Sustainability Certification Rating Program
- ➔ Inference study reference images
 - https://seors.unfccc.int/applications/seors/attachments/get_attachment?code=NG125PFE4WHMWSYAK8TCAKIHMWX0F4QD
 - <https://housing.com/news/smart-gardening/>
 - <https://solarpowerproject.in/solar-panels-for-parking-lots.php>

(Renewal) Energy Audit Certificate

The study is conducted as per Indian and International Green Building Standards initiated in the capacity of an Accredited & Certified Green Building Professional

It is awarded for **2022-2023 and 2023-2024** to the Esteemed Institution
(Analysed for 2 years and extended validity for 1 year, thus total 3 years)

The Loyola College Society's

Andhra Loyola College (Autonomous)

Door No. 54-16-14, Govt. Polytechnic Post, Vijayawada - 520 008, Andhra Pradesh, India

(Site visit held on 13 February 2024)

As part of the Institution's initiatives for a Healthy & Sustainable College the audit was conducted.
We appreciate the immense efforts taken by Staff and students towards the Energy Management and Conservation.

Issued on **Tuesday, 13 February 2024** valid till **31 January 2025**


Ar. Nahida Shaikh

Architect, IGBC Accredited Professional, ISO Certified I. A. (IMS)
Assocham GEM Certified Professional (Regn. No. 22/718)

Project Head and Green Building Professional-Consultant

Sustainable Academe

Sustainability Department of Greenvio Solutions, Naigaon

An environment Design and Consultancy developing Healthy and Sustainable Environments

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