ENERGY AUDIT

STUDY PERIOD (ONE YEAR) 2023 - 2024

Sustainability study

AUDIT REPORT

Studied for

CMR Technical Education Society's

CMR Technical Campus

Kandlakoya Village, Medchal Road,

Hyderabad- 501401, Telangana, India

Studied in the capacity of

Accredited and Certified

Green Building Professional

Studied by

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

Email: greenviosolutions@gmail.com

Background reference image Janko Ferlic on pexels

Disclaimer

The Audit Team has prepared this report for **CMR Technical Education Society's CMR Technical Campus** located at *Kandlakoya Village, Medchal Road, Hyderabad- 501401, Telangana, 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

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Acknowledgement

The Audit Assessment Team extends its appreciation to **CMR Technical Education Society's CMR Technical Campus, Telangana** for assigning this important work of Energy Audit. We appreciate the cooperation extended to our team during the entire process.

Our special thanks are extended are due to everyone from the Management.

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

Sustainable Academe
Brand of Greenvio Solutions, Palghar District, Maharashtra- 401208

Contents

1. Introduction

1.1 About the Institution

1.1.1 Vision

The Institute proposes *" To Impart quality education in serene atmosphere thus strive for excellence in Technology and Research."*

1.1.2 Mission

The Institute adheres and focuses

- *To create state of art facilities for effective teaching- learning process.*
- *Pursue and disseminate knowledge based research to meet the needs of industry & society.*
- *Infuse professional, ethical and societal values among learning community.*

2. Overview

2.1 Summarised Populace analysis for 2023-24

2.1.1 Students data

The data (shared by Institute) shows there were 4,832 students.

2.1.2 Staff data

Sl. No.	Particulars	Male	Female	Total
1	Admin Staff	08	04	12
2	Teaching Staff	153	138	291
3	Non-teaching Staff	45	15	60
Total		**206**	**157**	**363**

Table 1: Staff data of the Institution for 2023-2024

Above data documents 363 staff members.

Thus, total populace stands at 5,195 nos.

3. Observation

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: CMR Technical Campus **Date:** 4.12.2024

Document objective: Inferences of the Site visit

Observations (Positive aspects)	**Suggestions** (Improvement aspects)
Green Audit	
- Drinking water levels within norms 27. - NSS works actively for innumerable activities	- Healthy zone by 'No Smoking by No Tobacco zone' documentation by reflectance
Energy Audit	
- Better measure for rooftop taken by temperature is fair 28°C - 100% solar capacity fulfilled	- Safety by Danger zone for restricted by high electrical zone
Environment Audit	
- AQI is 62 scope for improvement	- Oxygen zone through shake by spider plants - IoT for smart gardening

Signature & round seal
Name: Dr. A. RajiReddy
Designation: Director
For the said Institute

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

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Plate 1: Evidence files related to inferences

Evidence documents for Site visit of external audit team

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Institute: CMR Technical Campus **Date:** 4.12.2024

Document objective: Proof of the Site visit

Meeting with the core team

Investigation of the systems

Signature & round seal
Name: Dr. A. Raji Reddy
Designation: Director
For the said Institute

CMR TECHNICAL CAMPUS

Signature & round seal
Name: Mrs. F. Shaikh
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Plate 2: Evidence files related to investigation

4. Investigation

The micro-climate temperatures of the site depends upon various factor including through evapotranspiration, trees and other vegetation cool the air around them. (Reference and further edited with details from dnr.louisiana.gov)

The base temperature for thermal comfort in India is 24°C (75°F) – Reference study https://www.researchgate.net/post/What_is_the_base_temperature_for_thermal_comfort_in_India#:~:text=The%20base%20temperature%20for%20thermal%20comfort%20in%20India%20is,C%20(75%C2%B0F).

The following results were carried out during visit on ***04 December 2024***.

S. No.	Space	Result (^{0}C)	Required (^{0}C)	Requires improvement
1.	Testing @ 12:40 D Block Auditorium on third floor	27	24	Not really since tempertaures are close to required temperatures
2.	Testing @ 12:50 K. Block	27	24	
3.	Testing @ 13:18 ABC combined block terrace and fourth floor with less time difference	28	24	

Table 2: Results for the micro-climate temperature study

The above study shows the spaces 'DO NOT' require an improvement in microclimate.

5. Documentation

Section 1 – Life safety management

5.1 Facilities study

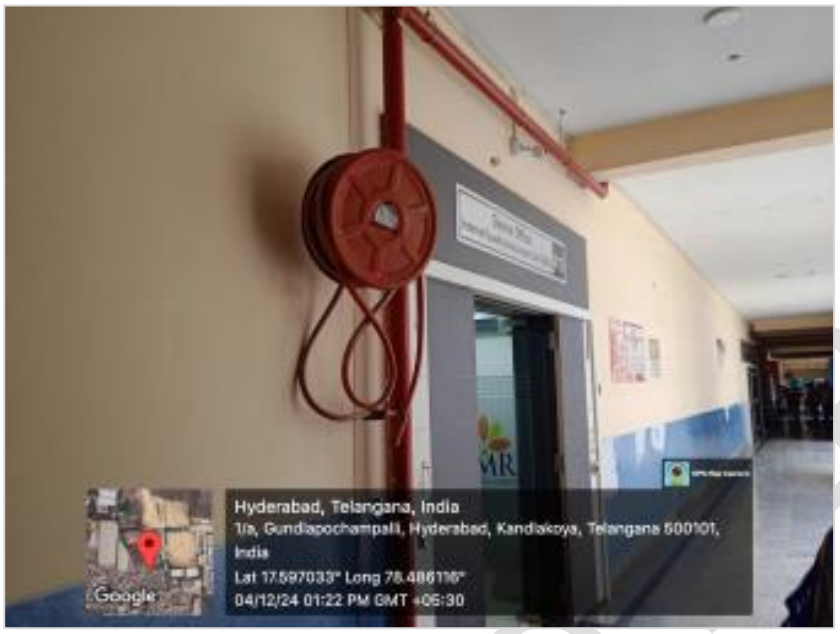

Plate 3: Fire and life safety measures undertaken

The facilities include information boards about usage of fire measures, extinguishers, hose reels etc. within premises.

Section 2 – Energy generation & expense incurred

5.2 Load distribution study

5.2.1 Categorization

Since the campus is an Educational Institute + Residential facility as hostel within site.

Thus, the type of load can be stated as 'Mixed use'

5.2.2 Primary sources of energy consumption

- **Electrical (Metered) –** Light, Fans, Equipments, Pumps comprise these sources.
- **Alternate sources of energy consumption –** Ther sources are documented below:
  - Solar panels - 400 nos.

Plate 4: Solar panels

5.2.3 Secondary sources of energy consumption

The sources are documented below:

Sources	Nos.
Batteries	678
Gas cylinders	8
Generator	2
Inverters	39

Table 3: Secondary sources of energy

5.3 Technical payload study

The data related to electricity bills is documented below.

Sr. No.	Month	Year	Amount	(A) Total units consumed	(B) Solar units generated	(C = A-B) Gross units consumed after deduction
Academic year between 2023-2024						
1	June	2023	2,29,354	27,300	18,000	93,000
2	July	2023	2,35,245	24,200	14,000	10,200
3	August	2023	3,47,568	15,300	15,000	300
4	September	2023	3,52,456	18,200	13,000	5,200
5	October	2023	3,70,254	15,600	11,000	4,600
6	November	2023	2,70,158	15,800	9,000	6,800
7	December	2023	2,80,145	15,300	8,000	7,300
8	January	2024	3,30,658	18,500	8,000	10,500
9	February	2024	2,69,985	22,600	9,000	13,600
10	March	2024	3,60,258	22,900	18,000	4,900
11	April	2024	3,12,054	27,100	18,000	9,100
12	May	2024	3,11,452	21,400	18,000	3,400

Table 4: Details of the electrical consumption

The observation related to above information states:

- The **total amount** spent is **Rs. 36,69,587/-**
- **Total units** consumed was **1,68,900 kWh (Only Electrical)**
- The **total units** consumed in past one year is **1,59,000 units (Only solar)**
- **Alternate source of energy is available through 400 sola panels.**
- **Percentage of energy met by alternate Renewable source is 65.11%**

Section 3 – Energy consumption

5.4 Calculated electrical consumption study

(Energy consumption by the electrical appliances study)

The following documentation is based on the consumption practice on a regular working day.

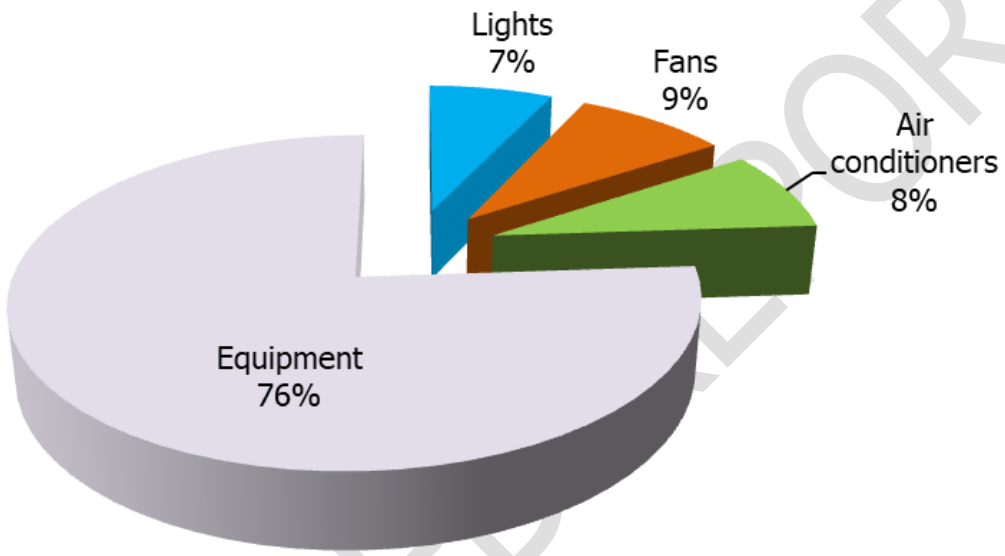

Figure 1: Summary of the calculated electrical consumption as per inventory

The above graph shows that equipment consume 76% whereas fans consume 9% while air conditioners consume 8% and lights consume 7% each of total calculated electrical energy.

5.5 Lights

5.5.1 Types of lights based on the numbers

There are **2,344 lights on the premises;** the following table shows the various types of lights on the premises.

S. No.	Type	Nos.
1	**LED lights** *(Energy efficient appliance)*	2,338
2	**CFL** *(Non-Energy efficient appliance)*	1
3	**Halogen** *(Non-Energy efficient appliance)*	1
4	**Non-LED** *(Non-Energy efficient appliance)*	2
5	**Tungsten** *(Non-Energy efficient appliance)*	2

Table 5: Summary of the types of lights on-premise

5.5.2 Types of lights based on the power consumption

The energy consumption of lights is **1,16,617 kWh** of energy.

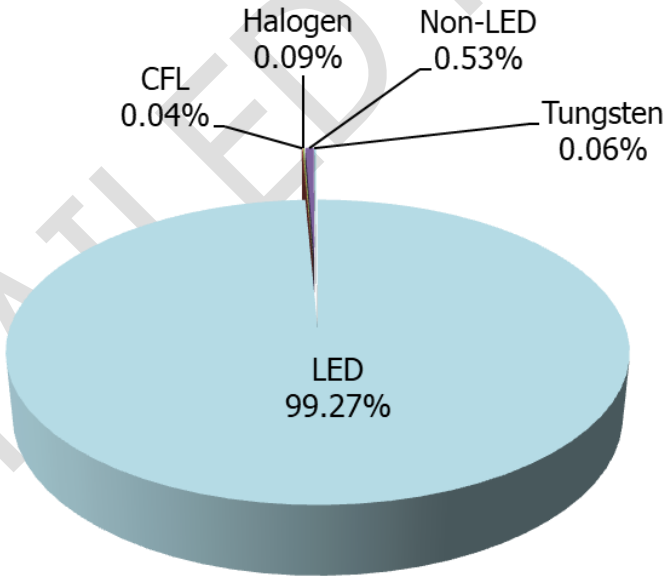

Figure 2: Energy consumed by types of lights in the premise based on the usage study

The analysis of the types of Lights on-premises shows **LED lights consume 99.27%** whereas the **Non-LED lights consume 0.53%** while the **Halogen lights consume 0.09%** whereas the **Tungsten lights consume 0.06%** while the **CFL lights consume 0.04%** of the total power consumed by lights.

5.6 Fans

5.6.1 Types of fans based on the numbers

There are **1,405 fans** on the premises as follows:

S. No.	Type	Nos.
1	Ceiling fans	1,373
2	Exhaust fans	6
3	Wall mounted fans	26

Table 6: Summary of the types of fans in the premises

5.6.2 Types of fans based on the power consumption

The energy consumption of fans is **1,43,894 kWh** of the energy.

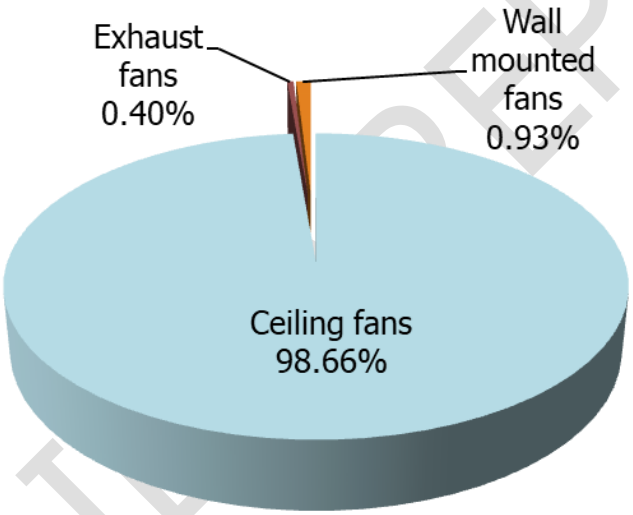

Figure 3: Types of fans based on power consumption

The above analysis shows Ceiling fans (Regular) consume 98.66% whereas the wall mounted fans consume 0.93% and exhaust fans consume 0.40% of total power consumed by fans.

5.7 Air conditioners

5.7.1 Types of air conditioners based on the numbers

There are **145 air conditioners** on the entire premises**.**

5.7.2 Building-wise consumption analysis

The energy consumption of air conditioners is **1,34,163 kWh** of energy.

5.8 Equipment

Only the major appliances information was shared.

5.8.1 Types of Equipment

There are **2,710 nos. of equipment** in the premises.

5.8.2 Types of equipment as per their energy contribution

The energy consumption of equipment is **12,54,256kWh** of energy.

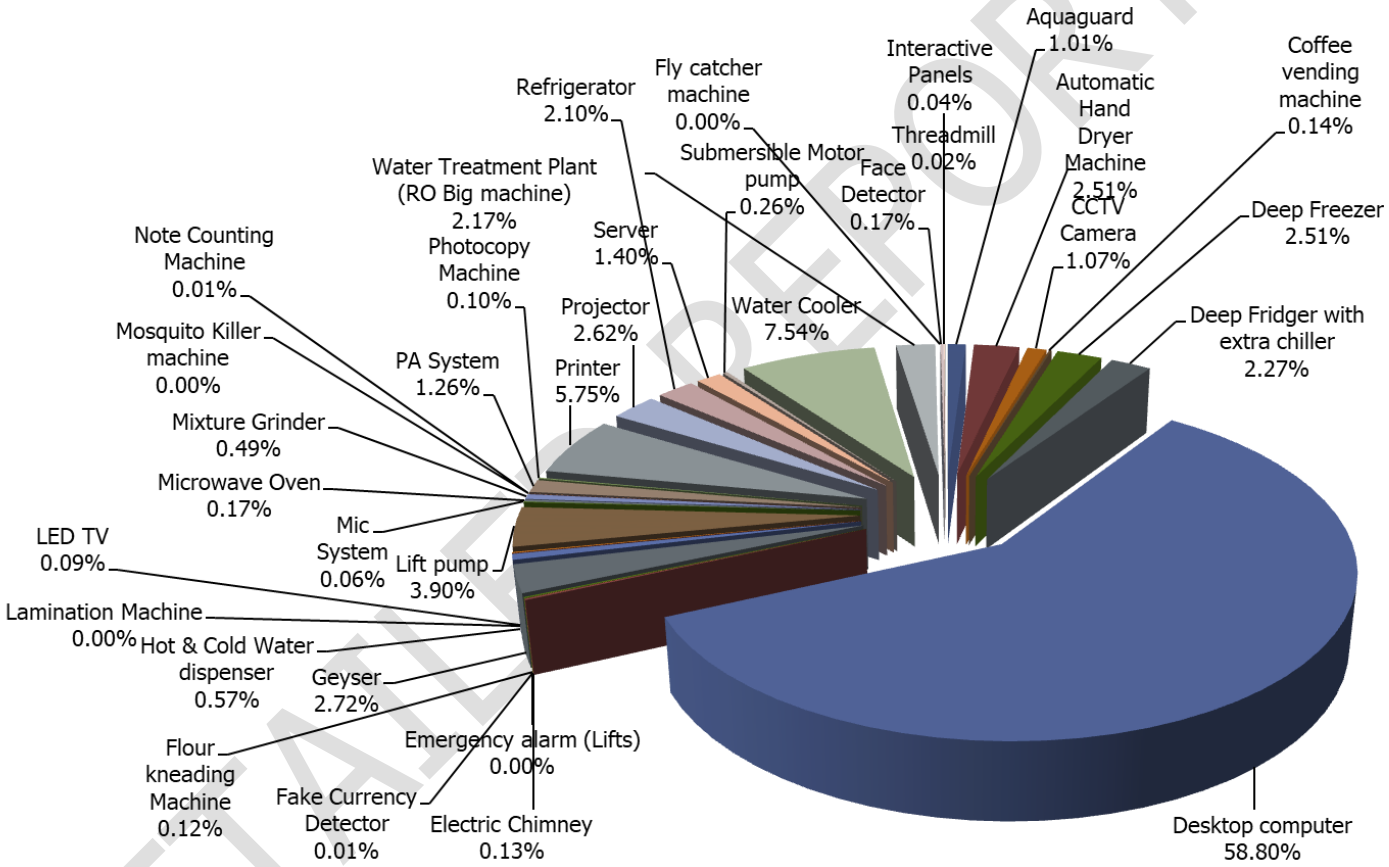

Figure 4: Energy consumed by types of equipment in the educational sector based on the usage study

The above summary shows that **desktop computer consumes more energy at 58.80%** while the **water cooler consumes 7.54%** whereas the **printer consumes 5.75%** and the **lift pump consumes 3.90%** these are major consumers as compared to other equipment.

Section 4 – Building safety

There is an extension and repair work going on, no major safety hazards were observed.

5.5 Comparison study

A. Calculated Electrical requirement (in kWh) as per inventory

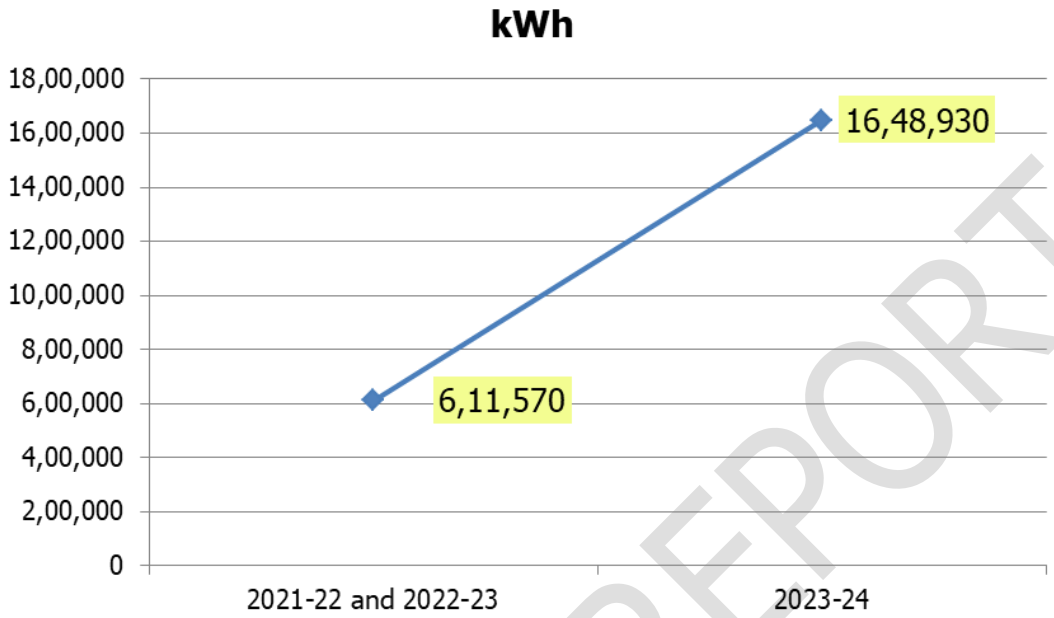

Figure 5: Comparative study of electrical requirement in kWh

There has been an increase of 10,37,360 kWh in the energy requirement. This highlights a negative update that energy consumption is on a rise.

B. Energy generation – Only solar units generated study

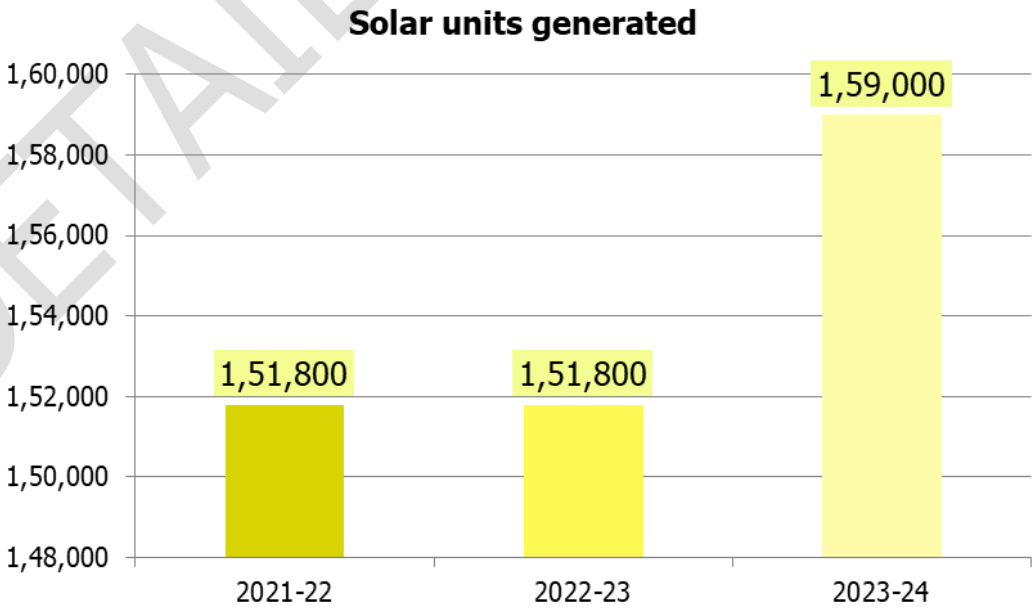

Figure 6: Comparative study of electrical requirement in kWh

There has been an increase of 7,200 kWh in energy generation by solar.

C. Energy management – Percentage of energy consumed by LED lights study

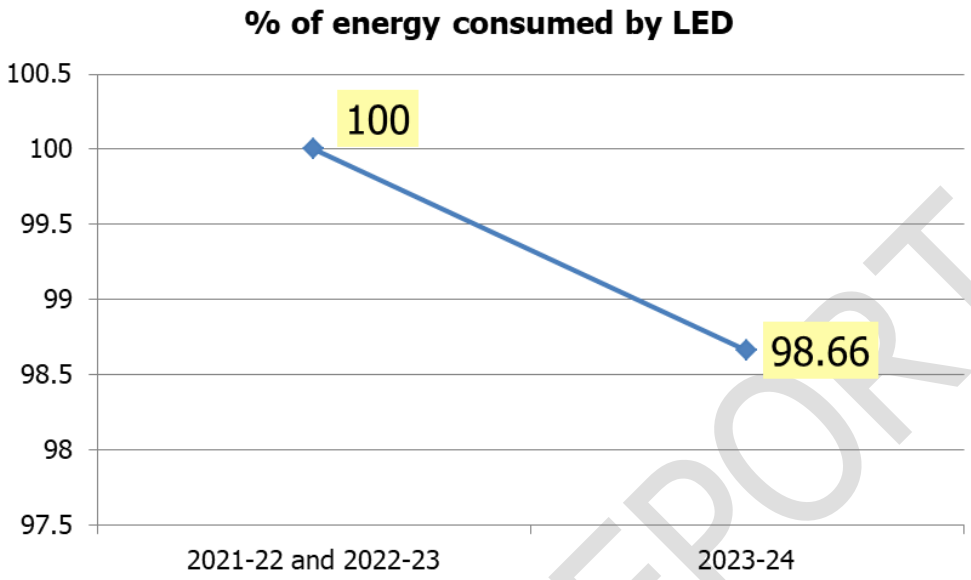

Figure 7: Comparative study of electrical requirement in kWh

There has been decrease of 1.34% it highlights a negative trend.

6. Compliance

The compliance study was carried out through investigative ways. This was done to understand extent of implementations based on previous reports.

- Original report study was for June 2021 to May 2022 and June 2022 to May 2023
- Renewal study currently done is for June 2023 to May 2024

6.1 Compliance status in form of Action taken report

The inputs are documented below.

ESTD: 2009

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Accredited by NBA & NAAC with 'A' Grade
Approved by AICTE, New Delhi and JNTU Hyderabad

Energy Audit Action Taken Report

6.1.1 Electromechanical systems - Electrical and Lighting

Section 1 - Non-LED lights

The current light analysis shows that non-LED lights consume anywhere between 50W to 54W and even more when in use; these should be replaced with LED lights which consume on an average 12-16W when in use.

Our technical research shows that there would be a reduction of an average of **67% reduction** in energy consumption if replaced with energy efficient appliance. It will be suggested to either replace these now if the Institute can have certain plans else the replacement can be done when fans get damaged or are not in working condition.

Action Taken: At CMRTC, the remaining 1% of lights have been replaced with LEDs, achieving 100% LED usage. Additionally, fan capacitors have been replaced to enhance their performance, ensuring efficient maintenance of electrical goods as per the established process.

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 45W when in use. These should be replaced with energy efficient fans consuming 14W when in use.

Our technical research shows that there would be a reduction of an average of 69% reduction in energy consumption if replaced with energy efficient appliance. It will be suggested to either replace these now if the Institute can have certain plans else the replacement can be done when fans get damaged or are not in working condition.

Action Taken:

It is challenging to replace all the ceiling fans with energy-efficient models immediately; however, a phase-wise approach will be adopted to gradually reduce energy consumption. For future needs, only energy-efficient fans will be procured. Additionally, fan capacitors have been replaced to enhance performance, ensuring proper maintenance of electrical goods as per the established process.

6.2 General suggestions

6.2.1 Alternatives to increase renewable energy

6.2.1.1 Solar tree Since there is availability of space; the solar trees can be installed in multiple places as they will provide dual benefits of aesthetic and energy reduction**.**

The Institute has a rooftop solar system with net metering connected to the grid, providing most of the required electrical power. Considering the establishment cost, the implementation of solar trees will be explored in the future.

Action Taken:

The Institute has a rooftop solar system with net metering connected to the grid, providing most of the required electrical power. Considering the establishment cost, the implementation of solar trees will be explored in the future.

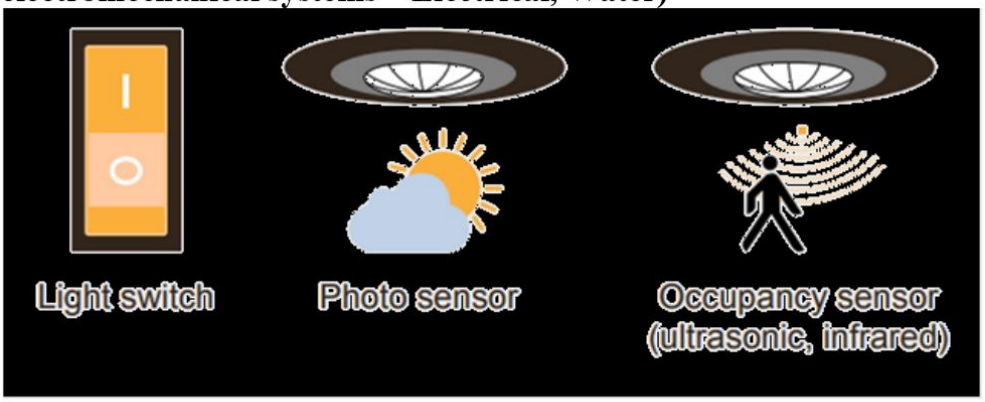
6.2.1.2 Solar parking. The Institute can turn its existing parking areas into solar panel powered parking areas. This will provide shade and renewable energy benefit to the Institute.

Action Taken:

The Institute will explore the feasibility of transforming existing parking areas into solar-powered parking spaces. This initiative will provide both shade and renewable energy benefits, aligning with sustainability goals.

6.2.2 Alternatives towards Smart premises mechanisms

6.2.2.1 Facility management systems, controls (Includes electromechanical systems – Electrical, Water)



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

Action Taken:
The suggestions provided will be reviewed and implemented where feasible to enhance energy efficiency.

6.2.2.2 Smart gardening

The Institute can undertake a Smart Gardening system using IoT Technology. This will result in saving time by scheduling time for watering; saving money through automated water schedules tracking dampness of soil to know when, how much water garden needs.

Action Taken:
The Institute will consider implementing a Smart Gardening system using IoT technology to optimize water usage. This will save time, reduce costs, and ensure efficient garden maintenance by automating watering schedules based on soil dampness.

General aspects

- **Laboratories spaces (Equipment) -** Use of Microwave synthesizers to minimize consumption of electricity for research work and practical.
- **Laboratories spaces (Equipment) -** Use of Ultrasonic bath and ultrasonic probe sonicator to minimize consumption of electricity for research work and practical.
- **Public spaces (Water management) -** Use of Sensor Based Automatic Flushers in toilets.
- **Public spaces (Water management) -** Use of Sensor Based hand wash taps and dryers in toilets.
- **Building system spaces (Fire and Life safety)** – Use of Sensor Based Fire Alarm system in corridors.
- **Building system spaces (Water conservation)** – Use of Sensor Based Water Meter Networked to Cloud in the required areas.
- **Building system spaces (Energy conservation connected via bluetooth)** – Use of Sensor Based air conditioners in required areas.
- **Building system spaces (Security & Building Automation)** – Use of sensor-based entrance and exit management system

Action Taken:

The Institute will explore the implementation of advanced sensor-based technologies across laboratories, public spaces, and building systems to enhance energy efficiency, water conservation, safety, and automation. These measures aim to optimize resource utilization and improve operational sustainability.

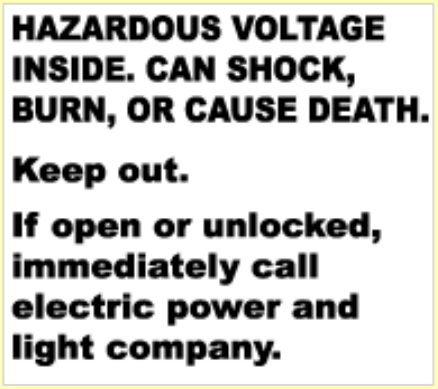
7. Suggestion

The suggestion (inference) would act as a 'PLAN OF ACTION' to implement all the suggestions in a detailed manner.

- Conduct the 'Before' and 'After' study with photos
- Document the same in 'Action taken report'

S. No.	Aspect with evidence if any	Suggestion
1.	Fire and life safety aspect **Aspect area:** **Display information**	Introduce intruction manual for: ➲ Name each fire alarm and hose reel such as CMRTC/Fire Hose Reel/ Block II/ Ground floor/ NO. (1, 2 etc.) ➲ Along every fire mechanism include display board such as 'Last maintenance date – Done by (Name) – Under supervision of Institute incharge (Name)) For report contact adminitration'
2.	Fire and life safety aspect **Aspect area:** **Lift safety**	➲ Introduce sigange 'DO NOT USE LIFT IN CASE OF FIRE' ➲ Intrdouce fire escape route pland ○ Highlight the corridors in light green highlighter ○ Signify the outline of staircase block ○ Include a ✘ symbol on lift and note on plan 'Do not use lift' ○ Highlight the locations of fire extinguisher in a blue or brown box and mention same in legend ○ Include 'You are here' indication on the route plan 

3.	Fire and life safety aspect **Aspect area:** **Sand bucket**	Remove thrash from sand buckets and display a signboard to avoid such measures 
4.	Energy generation aspect **Aspect area:** **Solar panels**	Include specification in ground floor are about rooftop solar panel with ifnoration about: ➲ Do and Don't for the specific type of plant ➲ Plant name ➲ Capacity ➲ Location ➲ Type of renewable energy system ➲ Nos. of units ➲ Installation date, month and year ➲ Energy generated per day and annually ➲ Energy consumption actual requirement per day and annually ➲ Energy saved per day and annually ➲ Last maintenance date and vendor ➲ Institute name and logo

5.	Energy generation aspect **Aspect area:** **Danger areas**	Signage about 'Danger zone' with a signboard of size A2 or A3 should be displayed and sand bucket/ fire ball should be placed nearby Transformer/ Battery storage areas. **Transformer/ Diesel generator /Meter room/ Electrical board**   The space referred to here is:   **Battery storage area/ Meter rooms** 

		The space referred to here is 
6.	Energy consumption aspect **Aspect area:** **Document switches**	The switches should be indicated as follows:  Image source: Amazon

7.	Energy consumption aspect **Aspect area:** **Unwanted aspects**	Remove unwanted switches/ appliances/ wirings  
8.	Energy consumption aspect **Aspect area:** **Ventilator**	Open ventilators and introduce chicken mesh jali from interiors for better ventilation 
9.	Structural safety aspect **Aspect area:** **Safety signages**	Include 'Restricted area ZONE' board for access near terrace area  ***Sample signages***

Table 7: Observation based suggestion study of the campus

8. 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