ENERGY AUDIT

STUDY PERIOD (TWO YEARS) 2021 – 2022 & 2022 - 2023

Sustainability study

AUDIT REPORT

Studied for

Aurora Educational Society's

Aurora's PG College (MBA)

H.No 6-3-542, 6-3-542/b,
Panjagutta, Hyderabad – 500082,
Telangana

Studied in the capacity of

Accredited and Certified

Green Building Professional

Studied by

Greenvio Solutions

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 the **Aurora Educational Society's Aurora's PG College (MBA)** located at *H.No 6-3-542, 6-3-542/b, Panjagutta, Hyderabad – 500082, Telangana* based on input data submitted by the Institute analysed by the team to the best of their abilities.

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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.

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

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2.1.2 Staff data

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Total Staff Members		**23**	**44**	**67**

Table 2: Staff data of the Institution for 2022-2023

The staff data shows the Institute premises had **67 Staff Members.**

2.2 Summarised Populace analysis for 2021-2022

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The data (shared by the Institute) shows there were **421 students.**

2.2.2 Staff data

S. No.	Type	Male	Female	Total
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Table 3: Staff data of the Institution for 2021-2022

The staff data shows the Institute premises had **66 Staff Members.**

2.3 Institute Infrastructure

2.3.1 Establishment

The Institute established and began its operations in **1997.**

2.3.2 Spatial Organisation

The Institute is located in a pollution free and healthy environment.

The Building is a Reinforced Cement Concrete (RCC) framework building.

There are provisions for staircase for accessibility on the premises, whereas there are amenities such as CCTV, a first aid room, etc.

2.4 Operation and Maintenance of the premises

The interview session was held with the staff regarding the operation and working hours. The Institution is open from Monday to Saturday with the timings being 09:00 am to 17:00 hours.

3. Research

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.

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The procedure included detailed verification as follows:

- Investigation
- Technical discussion with team
- Observations
- Inferences

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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.

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- Submission of the files

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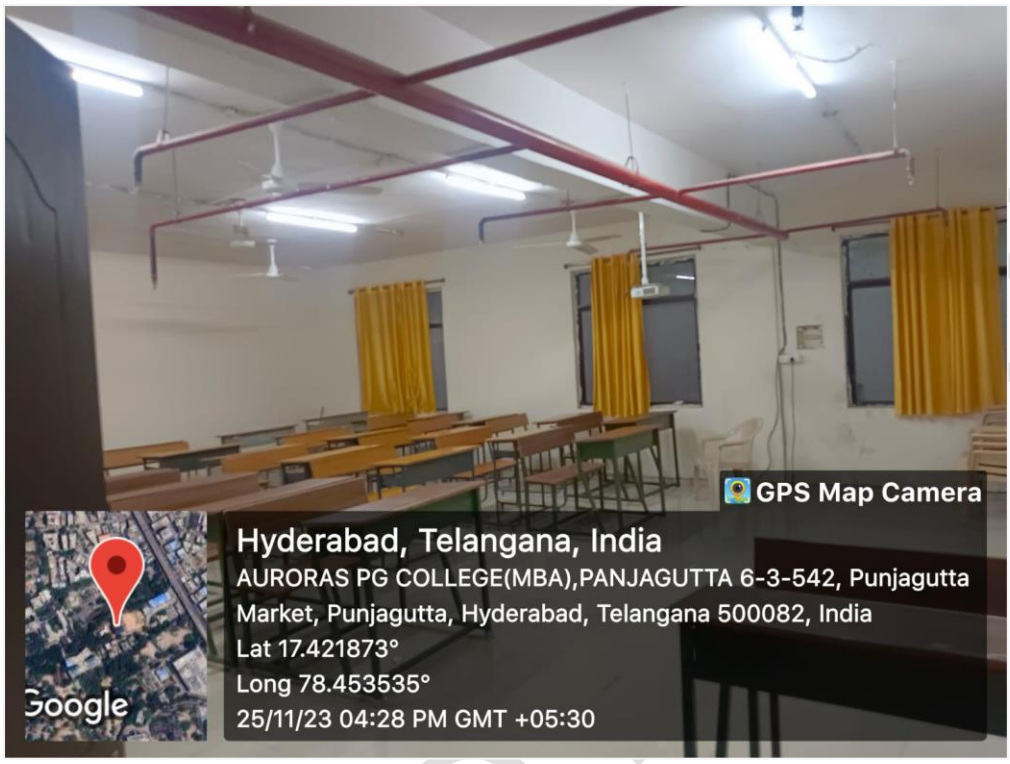

Plate 1: Electrical appliances in the premises

Plate 2: The facades of the campus

5. Documentation

5.1 Primary sources of energy consumption

- **Electrical (Metered) –** Light, Fans, Equipments, Pumps comprise these sources.
- **Renewable energy –** There are **'NO solar panels or alternate sources'** available.

5.2 Secondary sources of energy consumption

The existing sources are documented below:

S. No.	Name	Nos.
1	UPS	1
2	Induction stove	2

Table 4: Details of secondary sources of energy consumption

The observation related to above information states:

- Additional UPS purchase should increase to ensure backup of IT labs and office.
- Inverters/ batteries purchase should increase for Institute's electricity backup.

5.3 Actual electrical consumption as per bills

S. No.	Month	Year	Amount	(A) Total units consumed	(B) Solar units generated	(C = A-B) Gross units consumed after deduction
Academic year 1						
1	June	2021	18,200	1,690	0	1,690
2	July	2021	18,195	1,239	0	1,239
3	August	2021	20,910	1,928	0	1,928
4	September	2021	26,427	1,982	0	1,982
5	October	2021	26,450	2,320	0	2,320
6	November	2021	19,263	1,743	0	1,743

7	December	2021	18,340	2,673	0	2,673
8	January	2022	24,150	2,272	0	2,272
9	February	2022	18,900	1,510	0	1,510
10	March	2022	10,000	1,500	0	1,500
11	April	2022	18,784	1,760	0	1,760
12	May	2022	17,404	1,680	0	1,680
Academic year 2						
13	June	2022	17,433	1,680	0	1,680
14	July	2022	18,869	1,750	0	1,750
15	August	2022	19,915	1,820	0	1,820
16	September	2022	16,443	1,580	0	1,580
17	October	2022	12,836	1,370	0	1,370
18	November	2022	16,292	1,500	0	1,500
19	December	2022	18,326	1,780	0	1,780
20	January	2023	16,156	1,670	0	1,670
21	February	2023	17,700	1,690	0	1,690
22	March	2023	15,705	1,460	0	1,460
23	April	2023	17,200	1,600	0	1,600
24	May	2023	18,870	1,750	0	1,750

Table 5: Details of the electricity bills consumption

The observation related to above information states:

- **No solar panels or alternate sources of energy** used in the campus.
- The **average amount** spent every month is **~Rs. 17,145/-**
- The **average units** consumed through local governance sources are **~1,638 units**
- The major amount spent in **August, May, and July in 2022-2023** and **October, September, January in 2021-2022.**

5.4 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, air conditioner, and equipment. The inventory and data collection for sources of energy consumed in the premise in summarised in the following sections.

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

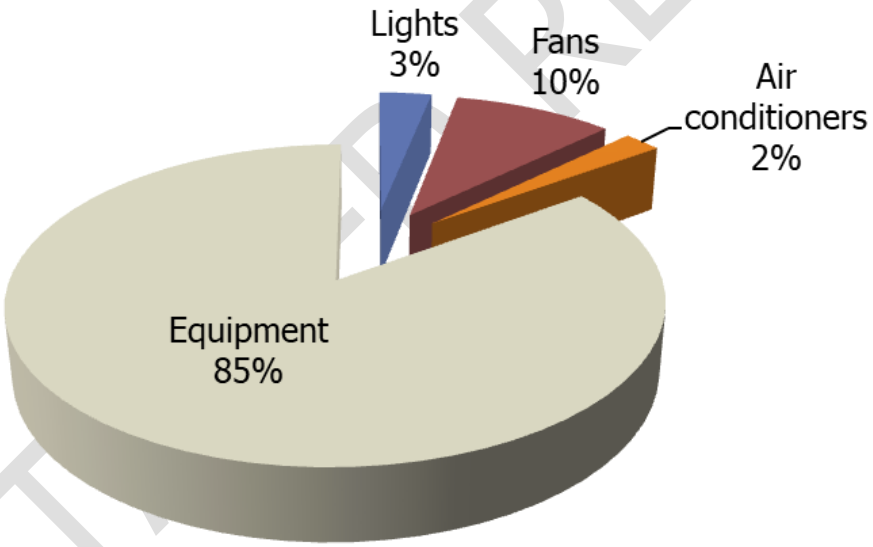

Figure 1: Summary of the calculated electrical consumption as per inventory

The above graph shows that equipment consume 85% whereas the fans consume 10% while the lights consume 3% and the air conditioners consume 2% of the total calculated electrical energy.

5.5 Lights

5.5.1 Types of lights based on the numbers

There are **225 nos. of LED** *(Energy efficient appliance)* **lights** on the premises.

5.5.2 Types of lights based on the power consumption

The **LED lights consume 100% of** total power **(6,874 kWh)** consumed by lights.

5.6 Fans

5.6.1 Types of fans based on the numbers

There are **222 nos. of ceiling fans** on the premises.

5.6.2 Types of fans based on the power consumption

The **Ceiling fans consume 100%** of total power (**17,186 kWh**) consumed by fans.

5.7 Air conditioners

5.7.1 Types of air conditioners based on the numbers

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

5.7.2 Building-wise consumption analysis

The energy consumption of air conditioners is **4,938 kWh** of energy.

5.7.3 About the replacement of current air conditioners

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

5.8 Equipment

5.8.1 Types of Equipment

There are **286 nos. of equipment** in the Educational sector.

5.8.2 Types of equipment as per their energy contribution

The energy consumption of equipment is **1,85,916 kWh** of energy.

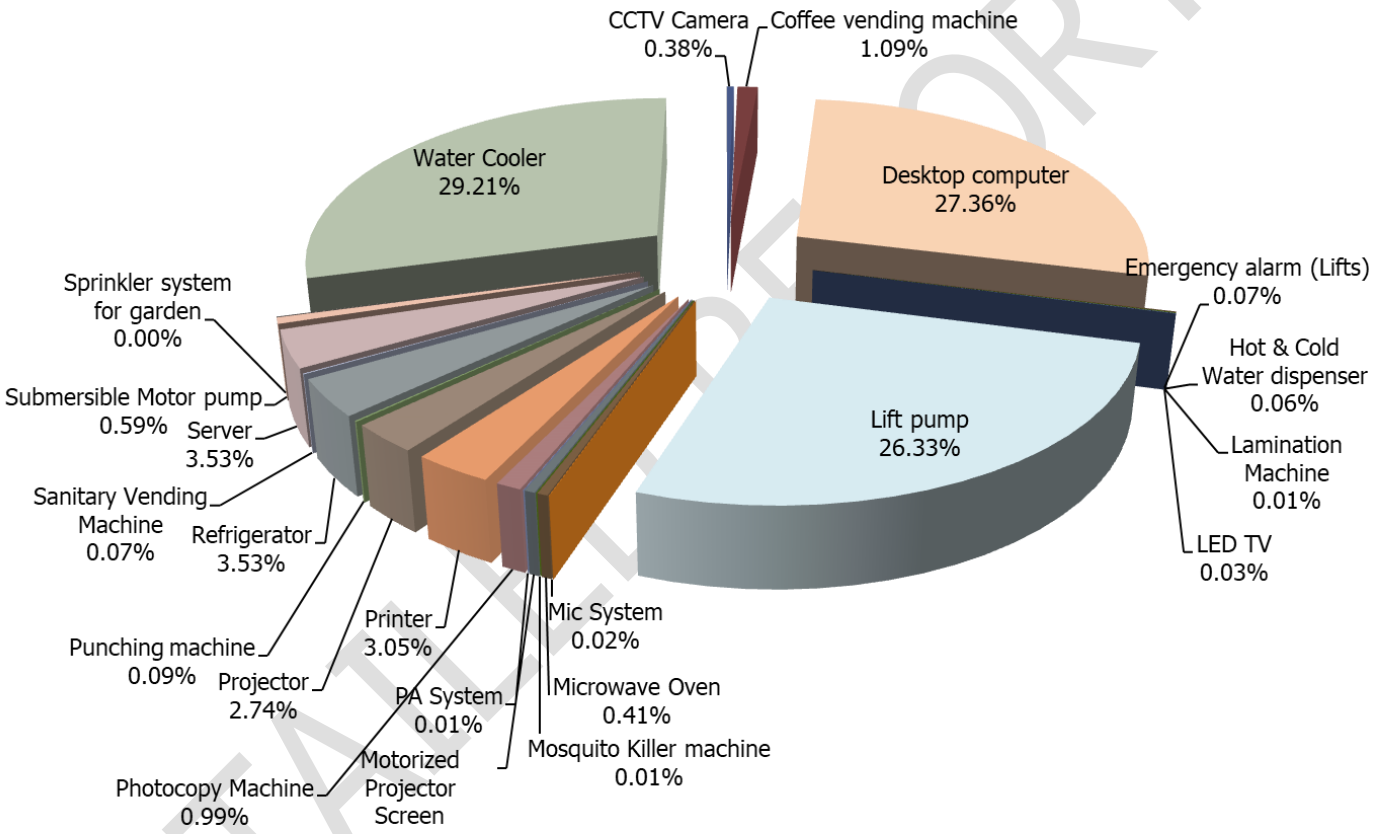

Figure 2: Energy consumed by types of equipment in the educational sector based on the usage study

The above summary shows that the **water cooler consumes more energy at 29.21%** while the **desktop computer consumes 27.36%** whereas the **lift pump consumes 26.33%** and the **refrigerator consumes 3.53%** these are the maximum consumers as compared to other equipment.

6. Suggestion

6.1 Section-wise suggestions

The following suggestions are to be considered as a ***first priority*** for implementation

6.1.1 Electromechanical systems – 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 is suggested to either replace these now if the Institute can have certain plans else the replacement can be done when fans damaged or not in working condition.

6.2 General suggestions

The following are consolidated study related to 'entire Institute' should be considered as ***second priority*** once section wise recommendations are implemented.

6.2.1 Alternatives sources to become clean and green energy campus – 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.

Plate 3: Solar farm concept for the Institute (For reference purpose only)
Image source: https://housing.com/news/smart-gardening/
Data source: https://www.happysprout.com/inspiration/what-is-smart-gardening/

6.2.2 Alternatives to increase renewable energy - 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.

Plate 4: Solar tree concept for the Institute (For reference purpose only)

Source: Image by https://timesofindia.indiatimes.com/india/cmeri-installed-the-worlds-largest-solar-tree-at-durgapur/articleshow/77856790.cms

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://housing.com/news/smart-gardening/
- Inference study reference image

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

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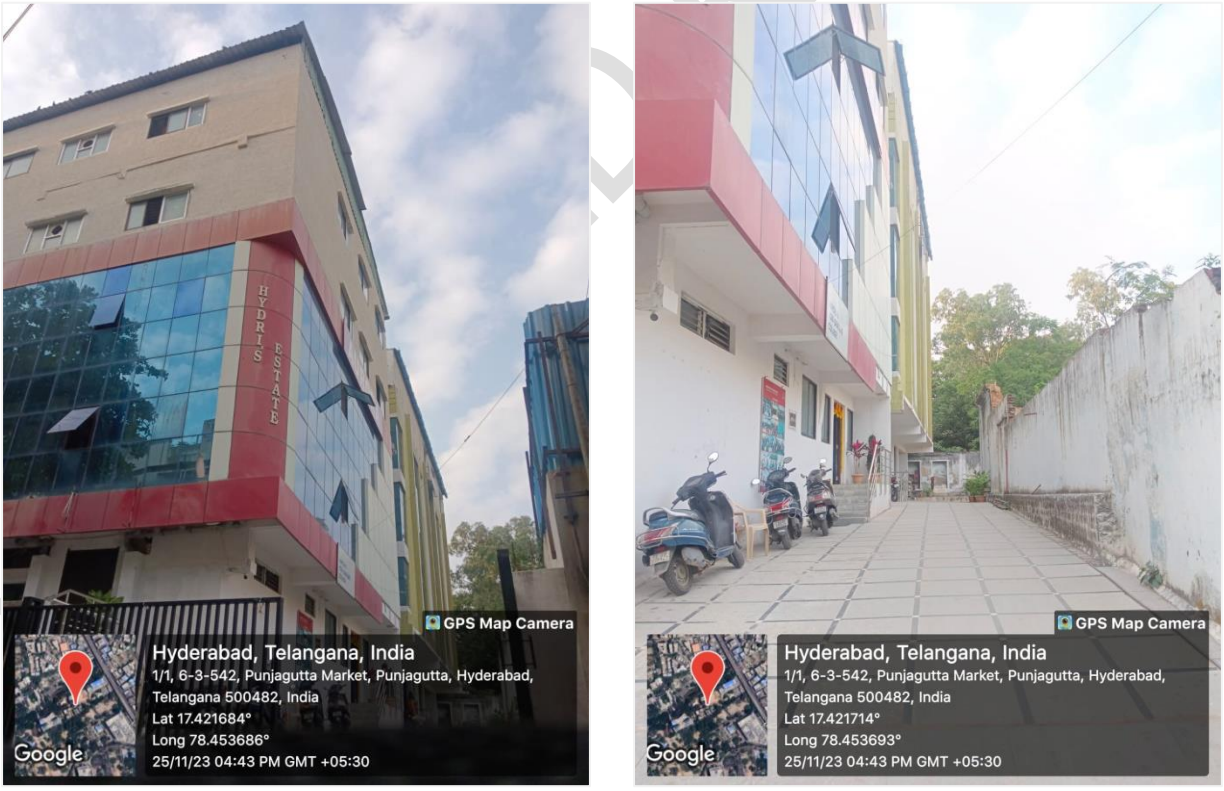

Plate 2: The facades of the campus

5. Documentation

5.1 Open Spaces

Since the campus is located in, urban vicinity there is lack of dedicated open space.

5.2 Flora audit

A flora survey to identify the total numbers of plants and trees documented below:

S. No.	Plant name	Type	Nos.	Planted by
1	*Mango Tree*	Tree	1	Staff
2	*Ashoka Trees*	Tree	3	Staff
3	*Badam*	Tree	1	Students
4	*Coconut Lagoon Tree*	Tree	1	Students
5	*Areca Palm*	Tree	6	Staff and Students
6	*Dragon Tree*	Herb, shrub and climbers	2	Staff
7	*Indian Aloe*	Herb, shrub and climbers	2	Staff
8	*Singapore Graveyard*	Herb, shrub and climbers	2	Staff
9	*Norfolk Island Pine*	Herb, shrub and climbers	2	Staff
10	*Moneywort*	Herb, shrub and climbers	2	Staff
11	*Goat Weed*	Herb, shrub and climbers	2	Staff
12	*Glory Of Garden*	Herb, shrub and climbers	5	Staff and Students
13	*Trumpet Creeper*	Herb, shrub and climbers	4	Staff
14	*Camellia*	Herb, shrub and climbers	3	Staff and Students
15	*Blue Lily*	Herb, shrub and climbers	4	Staff and Students
16	*Ti Plant*	Herb, shrub and climbers	4	Staff and Students
17	*Dieffenbachia Seguine*	Herb, shrub and climbers	3	Staff and Students

Table 4: Details of the Flora in the premises

At present there are 47 numbers of plantations in the premises. All of these are planted by the on various occasions and some have grown naturally.

5.3 Fauna audit

Hyderabad as a city known to be one of greenest metros in the country. This feature adds to the fact of having innumerable green cover those invites varieties of fauna in and around the city. The campus being located in the heart of the city does not have many types of fauna but general birds, insects that coexist.

5.4 Noise Audit

- The Campus is located close to Irram Manzil Metro Station (just 5 mins walking distance) and the city connecting road.
- However, because the orientation and location of the building is in the interiors the stakeholders feel no direct noise pollution.
- Additionally, there are residential and commercial buildings surrounding the campus and no industrial buildings are located nearby.
- This too benefits in keeping the external noise levels under control.
- On a macro level the Institute surrounded by academic buildings and minimal residential blocks **thus, there is a peaceful and noise free arena observed inside the premises.**

5.5 Carbon Footprint Audit

5.5.1 Eco-friendly Commuting Practices

- The site is located in an urban locality.
- However, the city is very well connected through metros, bus etc. that is public transport.
- ***Irram Manzil*** metro is just five mins walking from the campus and thus majority of students commute using the facility. The faculties even after having their own vehicles prefer to use the metro for commuting back and forth to the premises.
- **This highlights less dependence of private mode of transport leading to reduced carbon emissions inside the premises.**
- Overall, the carbon footprint is well under control.

5.5.2 Heat Island Reduction

The campus is located in an urban area of Hyderabad. The Govt. of Telangana has adopted a Cool roof Policy in May 2022 through which substantial measures taken to paint the rooftops of the city buildings to keep the surrounding temperature cool.

Being located in the same city that has initiated this measure the Campus can take measures such as cool roof and increased green cover on vertical façade of the campus to keep the external temperatures under control.

5.5.3 Outdoor Light Pollution Study

The Institute compound lights are not upward looking thus, these do not cause light pollution.

5.6 Fire Safety

Fire and life safety are an important consideration of the National Building Code 2016. This aspect is touched upon as part of this study in the capacity of an Architect registered with the Council of Architecture. As part of the research, fire safety audit was considered from the 'Building systems' perspective. *At present, the following are available in the premises.*

- Fire extinguisher
- Open staircase without any barriers and free of storage or combustible material.
- Fire hydrant cabinet (FHC)

6. Suggestions

The following suggestions are section-wise recommendations and are supposed to be **executed within the next 2.5 years from the date of the Report submission.** The Institute can execute a plan after discussion with Project Head.

6.1 Site beautification

- **Bird house/ Feeders -** At appropriate locations there can be provisions for drinking water and some grains for birds as they visit the site much frequently.

- **Garden development -** The existing open space should be designed as an Architectural landscape - *Scientific nameplates and QR codes* – The team should undertake a project to have name plates with QR codes on every plant of the premises.

6.2 Heat island reduction

- **Cool rooftops** - The Terrace rooftops should be painted with Cooltop – reflective materials to reflect the harsh sunrays and reduce the heat absorption in the top most floor and surrounding areas of the building.

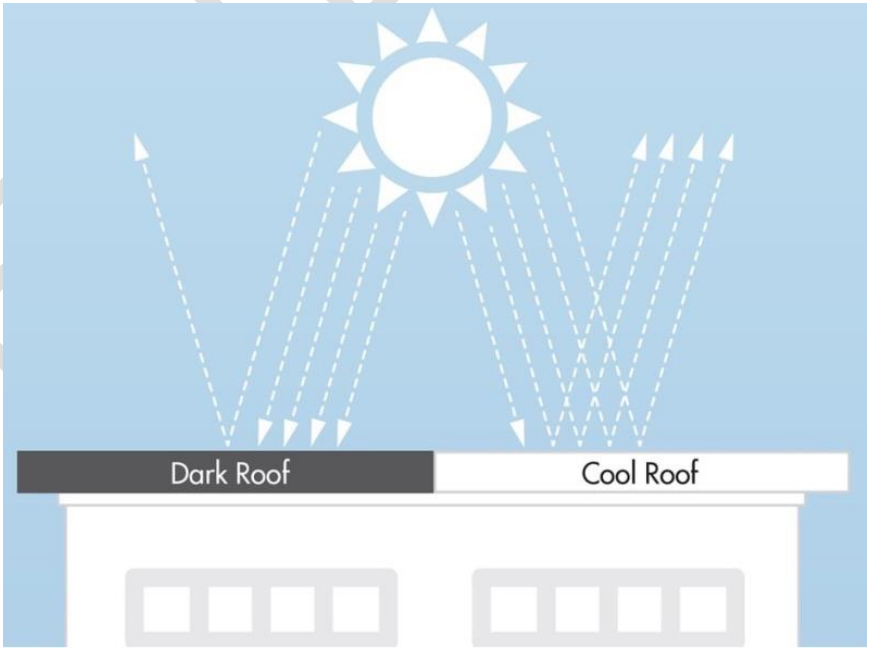

Plate 3: Cool roof comparative analysis (For reference purpose only)

Source: Image by https://www.gaf.com/en-us/blog/six-truths-about-cool-roofs-281474980105387

- **Green wall** - The outdoor walls in areas could be modified as 'Green walls' to keep external temperatures under control. This is applicable based on the parameters of light, shade, wind, temperature, structural ability and rainfall. Know more https://green-walls.co.uk/blog/5-key-considerations-when-designing-a-green-wall/

Plate 4: Green roof (For reference purpose only)

Source: Image by https://www.geoplastglobal.com/en/solutions/green/outdoor-green-wall/

6.3 Life safety

- **Mandate fire extinguisher in spaces** - One fire extinguisher should mandatorily be there in every space which has an air conditioner/ gas cylinder.

- **Awareness** - Fire layouts in immediate spaces outside the lift, on the staircase landing, signages mentioning 'Do not use lift in case of fire' additionally fire exit signages, boards should be put up at all possible locations.

- **Sensitization programs** - Regular seminars/ webinars by experts such as Architects, Govt. Fire department on subjects related to fire and life safety should be organized and the outputs should be adopted and documented.

6.4 Pollution Control

- **Bicycles as a gift -** As an appreciation gesture maybe the student's toppers/ staff best performers can be awarded a bicycle occasionally.

- **Avoid using plastic in premise -** There should be a provision for a ban on the use of plastic bags or products on the Premise.

- **Paperless technologies for offices -** The Institute can go technology-friendly and go paperless in the functioning of premises to a certain extent maybe not fully.

- **Plant more radiation absorbing plants -** The following flora halps in redcuing the harmful effects to a cetain extent, the Institute can develop a radiation free zone and take to planting these through potted plants or permanent planting:

    a. Spider plant
    b. Rubber plant
    c. Asparagus fern
    d. Snake plant
    e. Nelumbo nucifera (Includes colourful flowers)
    f. Cactus
    g. Areca palm
    h. Mustard green
    i. Betel
    j. Aloe vera
    k. Sprengers asparagus
    l. Fiddle fig

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.

- Uniform Plumbing Code – India, 2008
- IGBC Green Existing Buildings – Operation & Maintenance (O&M) Rating system, Pilot version, Abridged Reference Guide, April 2013
- IGBC Green Landscape Rating system, March 2013
- BOMA Canada Waste Auditing Guide, Best Environmental Standards, BOMA BEST – Canada
- Used only for understanding Universal design - Universal accessibility Guidelines for Pedestrian, Non-motorizes vehicle and Public Transport Infrastructure – Report guidelines by Samarthyam (National centre for Accessible Environments) – an initiative supported by Shakti Sustainable Energy Foundation.
- Reference images for suggestions:
  - https://www.gaf.com/en-us/blog/six-truths-about-cool-roofs-281474980105387
  - https://earthbound.report/2021/07/14/5-ways-to-reduce-the-urban-heat-island-effect/