ENERGY AUDIT

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

Sustainability study

RENEWAL AUDIT REPORT

Studied for

Rama University

Rama City, G.T. Road Mandhana,

Kanpur,

Uttar Pradesh, Pin- 209217

Studied in the capacity of

Accredited and Certified

Green Building Professional

Prabhat Ranjan

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Studied by

Greenvio Solutions

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Valid till **31 December 2024**

Background reference image Janko Ferlic on pexels

Disclaimer

The Audit Team has prepared this report for **Rama University** located at *Rama City, GT Road Mandhana, Kanpur, Uttar Pradesh, Pin- 209217* 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 a 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 Institute. 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 while 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. 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 incapacity of an Accredited & Certified Green Building Professional with extensive experience.

Ar. Nahida Abdulla

Greenvio Solutions

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Acknowledgment

The Audit Assessment Team thanks the **Rama University, Uttar 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.**

We are also thankful for **Institute Taskforce** who have collected the data required**.**

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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Contents

1. Introduction

1.1 Statements of the Institution

1.1.1 Vision

To emerge as a Global Premier University in imparting education of international standards, to build superior professionals with strong work ethics and to empower the world with futuristic minds, through excellence in research and innovation.

1.1.2 Mission

- To promote national and international collaboration for industry academia integration to achieve top most position in global hierarchy
- To create a scientific, challenging, transparent and sustainable environment/curriculum ideal for research, innovation, entrepreneurship and consultancy
- To nurture talent and creativity, committed to serve people, society and nation at large
- To inculcate strong morals, values & ethics to build socially committed and spiritually inspired personalities
- To empower and uplift each section of society through education and to contribute back to the environment by adapting and promoting eco-friendly practices

1.2 Timeline of activities for research

As the Institute had undergone a renewal for Academic year 2022-2023, process was:

- Allotment and Initiation by the Institute
- Process discussion with team
- Data submitted by Institute
- Verification of the files

2. 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 2019-2020 and 2021-2022.**

2.1 Compliance study

The compliance study is focused on photographic documentation done during the site visit on 11 January 2024

Plate 1: On-site investigation of the premises

The spaces documented for the compliance study include the following:

2.1.1 Wiring

Plate 2: Exposed wiring study

Observation: The exposed wirings in the internal spaces

Inference: *The study suggests that:*

- *The **wirings are exposed and needs concealing** with proper fabrication*
- *There should be **a stabilizer** for this space*
- *Additional, **UPS and power backup** should be provided*
- *Given the current space and its usage, safety precautions such as signages, **fire sand bucket** should be places to avoid any fire accident*

2.1.2 Nomenclature

Plate 3: Switchboards study

Observation: Seems like an electrical circuit issue took place, this was a common feature in more than one space, and thus there are two evidences displayed above

Inference: *The study suggests that:*

- *Switchboards in every space should be **numbered as SB1, SB2 etc.** (Where SB stands for switchboard and 1/ 2/ 3 stands for numbers in the particular space)*
- *Similarly, the main boards or relevant boards should be demarcated appropriately as **MB1, MB2 etc. or Electrical duct, Fire duct etc.***
- *The **buttons should be named** as per usage such as lights/ fans/ appliance or any other use*
- ***As there has been an electrical circuit problem, there should be a walk-through audit to identify each and every switchboard that has a similar issue and undertake immediate replacement***

2.1.3 Demarcation

Plate 4: Electrical duct and backup

Observation: The spaces and facilities are not demarcated

Inference: *The study suggests that:*

- *These areas should be demarcated as **'Danger Zone'** with safety precautions such as signages, **fire balls/ sand bucket** should be places to avoid any fire accident*
- *The facilities should be named as per their usage (As per reference image below)*

Reference suggestions 1: Zoning the spaces/ facilities as per their usage

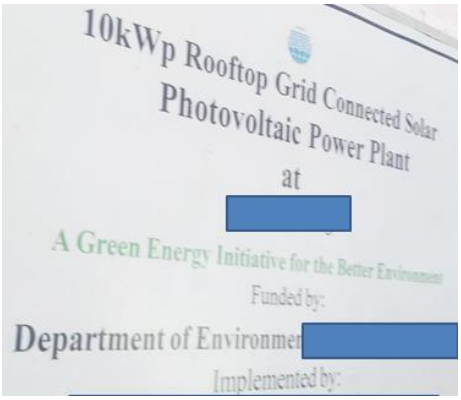
2.1.4 Alternate source of energy consumption

Plate 5: Alternate source of energy consumption

Observation: The maintenance of the space is not undertaken

Inference: *The study suggests that:*

- *The terrace flooring should be painted in **'Cooltop'** every two years*
- *The area should be demarcated as **'Solar zone'** with a manual about the system functioning process, its benefits etc.*
- *The **maintenance details** should be **reflected digitally, physically on an annual basis***
- *There should be a **display board** (as below) in the entrance of the premises, in addition to this board the manuals etc. will help in stakeholder sensitization*



Reference suggestions 2: Sample about display board

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2.1.5 Skylight areas in the premises

Plate 6: Skylight areas in he premises

Observation: The skylights as courtyard spaces acts as light wells and ventilation pockets

Inference: *The study suggests that:*

- *The rooftop areas are not maintained*
- ***Once in a month rooftop cleaning is required***
- *The **junction of the rooftops too require fabrication***

2.1.6 Coding

Plate 7: Electrical ducts (Earthing pits) and electrical room

Observation: The pits and areas are not coded

Inference: *The study suggests that:*

- *The **earthing pits should be colour coded in brown colour** and numbered, a display board could mention their usage and last maintenance date*
- *The space such as should be demarcated as **'Danger zone'** with avoidance of any general public in the space*
- *On a similar note the **water harvesting pits can be colour coded as 'blue'** while the **service pits/ ducts as 'grey'** and the **fire ducts/ pits as 'red'***

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2.2 Compliance status

The details of compliance are analysed on previous year Report (Academic year 2021-2022)

S. No.	Recommendation Title	Compliance Status
1.	Renewable energy	Not suggested but Institute has received excellent results as per study by Internal team
2.	MoU w.r.t Green Building initiatives of Campus	Undertaken

Table 1: Details of the compliance study

The Institute has undertaken initiative of installing energy efficient appliance in the form of LED Lights; the Vice Chancellors Secretariat is the main block with majority of lights being LED

Plate 8: LED lights in the premises

2.2 Compliance comparative study

The information for the new nos. of electrical appliances and their power consumption is documented below.

- **Lights – Source of electrical usage**

The data shows there are **1,074 LED lights contributing to 25,132 kWh of energy.**

- **Fans – Source of electrical usage**
  - The data shows there are **588 nos. of Ceiling fans contributing to 49,686 kWh of energy**
  - **Whereas the two nos. of exhaust fans contribute 195 kWh of energy**

- **Air conditioners – Source of electrical usage**

Since the total numbers are extensive bulk replacement is not recommended. Whenever the appliances are not in working conditions they are suggested to be replaced and this has been in practice as well.

2.3 Compliance technical study

The internal team has studied, collected, and documented the following data:

S. No	Month	Year	Amount	(A) Total units consumed	(B) Solar units generated	(C = A-B) Gross units consumed after deduction
			Meter 1			
1	June	2021	23,22,015	2,25,380		
2	July	2021	35,58,242	3,33,575	36,295	2,97,280
3	August	2021	35,90,808	3,30,275	36,840	2,93,435
4	September	2021	31,07,939	2,85,630	32,685	2,52,945
5	October	2021	24,74,762	2,25,370	43,250	1,82,120
6	November	2021	10,82,060	87,315	14,230	73,085
7	December	2021	18,73,745	1,72,870		
8	January	2022	18,73,746	2,36,135	28,640	2,07,495
9	February	2022	17,65,295	1,61,150	39,025	1,22,125
10	March	2022	19,41,699	1,75,620	48,845	1,26,775
11	April	2022	45,63,032	4,03,680	49,055	3,54,625
12	May	2022	58,22,846	5,20,720	47,250	4,73,470
13	June	2022	56,50,558	5,28,680	44,230	4,84,450
14	July	2022	57,11,772	5,13,570	40,465	4,73,105
15	August	2022	43,47,206	4,31,900	36,175	3,95,725
16	September	2022	44,53,197	4,11,980	43,040	3,68,940
17	October	2022	25,65,962	2,33,610	37,845	1,95,765
18	November	2022	17,94,124	1,48,050	35,605	1,12,445
19	December	2022	23,18,270	2,12,430	33,640	1,78,790
20	[illegible]	2023	32,23,547	3,13,540	24,170	2,89,370

21	February	2023	19,38,799	1,70,040	43,090	1,26,950
22	March	2023	19,29,260	1,69,190	47,305	1,21,885
23	April	2023	35,17,570	3,41,130	46,650	2,94,480
24	May	2023	42,76,242	4,20,580	54,560	3,66,020
				Meter 2		
25	June	2021	4,05,863	32,862		32,862
26	July	2021	6,78,137	62,262	16,880	45,382
27	August	2021	5,12,152	44,360		44,360
28	September	2021	4,60,773	38,802	14,780	24,022
29	October	2021	4,79,206	40,796	19,940	20,856
30	November	2021	4,33,189	35,818	32,815	3,003
31	December	2021	4,32,431	35,736	13,260	22,476
32	January	2022	5,97,088	53,548	12,480	41,068
33	February	2022	3,84,446	29,916	17,120	12,796
34	March	2022	4,34,889	36,004	19,820	16,184
35	April	2022	6,33,028	56,124	20,760	35,364
36	May	2022	6,35,548	55,356	16,820	38,536
37	June	2022	8,38,507	78,252	13,300	64,952
38	July	2022	8,12,875	73,552	15,760	57,792
39	August	2022	5,95,211	52,662	15,930	36,732
40	September	2022	7,08,420	66,376	18,780	47,596
41	October	2022	5,65,642	51,612	16,180	35,432
42	November	2022	2,95,711	37,376	15,510	21,866
43	December	2022	4,35,580	36,592	16,080	20,512
44	January	2023	7,84,705	72,716	11,290	61,426

45	February	2023	3,51,122	27,592	18,640	8,952
46	March	2023	4,72,123	41,156	20,430	20,726
47	April	2023	6,05,878	55,112	20,770	34,342
48	May	2023	8,78,380	82,640	22,970	59,670

Table 2: Soar unit consumption study

The observation related to above information states:

- The **total amount** spent in past two years is **~Rs. 8,91,33,600/-**
- The **average amount** spent every month is **~Rs. 18,56,950/-**
- The **total units** consumed in past two years is **~ 82,49,642 units (Combined for Electrical + solar)**
- The **average units** consumed every month are **~ 1,71,868 units (Combined for Electrical + solar)**
- The **total units** consumed in past two years is **~ 12,53,205 units (Only solar)**
- The **average units** consumed every month are **~ 26,108 units (Only solar)**
- **Alternate source of energy is available in form of rooftop solar panels**
- **The percentage of energy met by alternate (solar (renewable)) is 15%**

Inference about the observation states:

- The rooftop panels were assessed and they are not well maintained.
- Additionally, ***certain awareness posters in and around campus will be beneficial.***

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3. Observations

3.1 Investigative suggestions

The following suggestions can be implemented ***in next one year***. The Institute can execute a plan after discussion with Project Head.

Certain aspects noted below in red font should be upgraded as per the convenience of the Institute; these are common to the site and can be considered for entire premises wherever there are similar areas.

- **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

- **General safety aspects**
  - Rubber flooring in the laboratories to avoid an electric shock.
  - Introduce *'PASS' information board* about how to use Fire extinguisher and *'FIRE ZONE' display board* where safety equipments are kept.

4. Inferences

4.1 Section-wise suggestions

The following suggestions are to be considered as a ***first priority*** to **be executed within the next 1.5 to 2.5 years from the date of the Report submission.**

4.1.1 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.

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.

4.2 General suggestions

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

Note: Geothermal mode of energy consumption should be explored

4.2.1 Alternatives to increase renewable energy

4.2.1.1 Solar farms

This option can be explored with due discussion with the surrounding and adjacent farmland owners. This will serve as a noble project and will provide dual benefits to farm land and Institute w.r.t to electricity bill power reduction.

Reference suggestions 3: Solar farm concept for the Institute (For reference purpose only)
Source: Image by Zsuzsa Bóka from Pixabay

4.2.1.2 Solar tree

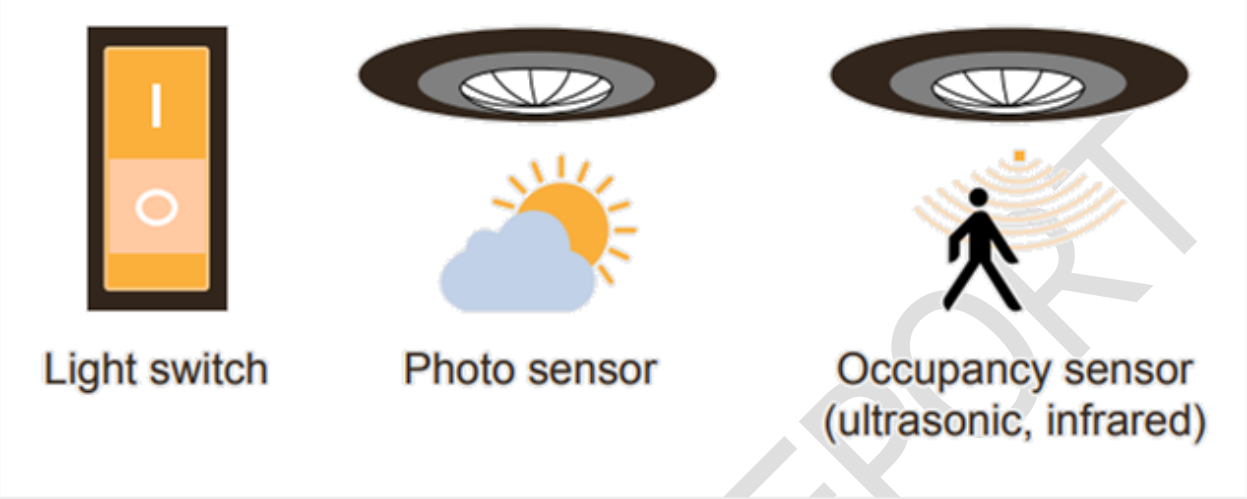
Since there is availability of space; the solar trees can be installed in multiple places as they will provide dual benefits of aesthetic and energy reduction.

Reference suggestions 4: Solar tree concept for the Institute (For reference purpose only)
Source: https://timesofindia.indiatimes.com/india/cmeri-installed-the-worlds-largest-solar-tree-at-durgapur/articleshow/77856790.cms

4.2.2 Alternatives towards Smart premises mechanisms

4.2.2.1 Facility management systems, controls

(Includes electromechanical systems – Electrical, Water)



Reference suggestions 5: Understanding the lighting concepts

Source: https://seors.unfccc.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 fare as lighting systems are considered. The suggestions 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 Power Electronics control of the Foyer notice board lighting.
- Installation of intelligent lighting controller will help in controlling the lighting energy.
- Use of photo sensor switch for street light controlling helps in conserving the lighting energy.

4.2.2.2 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.

Reference suggestions 6: 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/

5. Compilation

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
- 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/

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