

# ENERGY AUDIT

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

Sustainability study

## AUDIT REPORT

Studied for

**Dolphin (PG) Institute of  
Biomedical and Natural Sciences**

VPO Manduwala, Chakrata Road,  
Dehradun – 248007,  
Uttarakhand, India

Studied in the capacity of

Accredited and Certified GBP



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# Disclaimer

The Audit Team has prepared this report for the **Dolphin (PG) Institute of Biomedical and Natural Sciences** located at VPO Manduwala, Chakrata Road, Dehradun – 248007, Uttarakhand, 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.

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**Ar. Nahida Abdulla**

**Greenvio Solutions**

*Developing Healthy and Sustainable Environments*

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## Acknowledgement

The Audit Assessment Team extends its appreciation to the **Dolphin (PG) Institute of Biomedical and Natural Sciences, Uttarakhand** 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.

Our heartfelt thanks extended to Chairperson of entire process **Dr. Shailja Pant**, (Principal) for the valuable inputs.

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

- Teaching members – **Dr. Shruti Shama**
- Non-teaching staff members – **Mr. Gaurav Bhatia**

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

### **Sustainable Academe**

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# 1. Introduction

## 1.1 About the Institute

### 1.1.1 Vision

The Institute proposes "To create an educated and ethical society by imparting quality education with holistic development and empowering the youth to achieve global competence."

### 1.1.2 Mission

The College adheres and focuses towards:

- To empower youth with academic excellence
- Maintain high standards in extracurricular activities
- Holistic development of the youth
- To provide Skill based education with entrepreneurship proficiency
- Research and Innovation
- To serve humanity as socially responsible global citizens

**The Institute's department portfolio includes:**



**Plate 1: Department portfolio of the campus**

## 1.2 Assessment of the Institute

### 1.2.1 Affiliations

The courses provided by the College have received their affiliation through the **H.N.B. Garhwal Central University**, Srinagar, Garhwal, Uttarakhand

### 1.2.2 Recognitions

The College has achieved:

- Recognition under section [2 \(f\) of the UGC Act, 1956](#) by University Grants Commission, New Delhi
- Approval of [National Council for Teacher Education \(NCTE\)](#), New Delhi
- Approval of [Govt. of Uttarakhand, Indian Association of Physiotherapists \(IAP\)](#)



## 2. Overview

### 2.1 Summarised Populace analysis for 2021-2022

#### 2.1.1 Students data

The data (shared by the Institute) shows there were **2,315 students**.

#### 2.1.2 Staff data

S. No.	Type	Male	Female	Total
1	Admin staff	108	46	154
2	Teaching staff	47	32	79
3	Non-Teaching staff	18	01	19
<b>Total Staff Members</b>		<b>173</b>	<b>79</b>	<b>252</b>

*Table 1: Staff data of the Institution for 2021-2022*

The staff data shows the Institute premises **252 Staff Members**.

### 2.2 Summarised Populace analysis for 2022-2023

#### 2.2.1 Students data

The data (shared by the Institute) shows there were **2,021 students**.

#### 2.2.2 Staff data

S. No.	Type	Male	Female	Total
1	Admin staff	106	46	152
2	Teaching staff	44	31	75
3	Non-Teaching staff	17	01	18
<b>Total Staff Members</b>		<b>167</b>	<b>78</b>	<b>245</b>

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

The staff data shows the Institute premises **245 Staff Members**.

## 3. Research

### 3.1 About the Green Building Study

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

The procedure included detailed verification as follows:

- ➔ Investigation
- ➔ Technical
- ➔ Observations
- ➔ Inferences

### 3.3 Strategy adopted for Green Building Study

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 Site Area

The Institute spread over **4.172 acres** of land with multiple blocks and landscape areas comprising of **15,36,021.86 sq. ft.** built-up area.

### 3.5 Establishment

The Institute established and began its operations in **2002**.

### 3.6 Operation and Maintenance of the premises

The Institution is open from **Monday to Saturday between 09:30 to 16:30 hours**.



## 4. Evidence



*Plate 2: Investigation of the systems and facilities*



*Plate 3: Seminar on subject related to Sustainability for the stakeholders*

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

## 5. Documentation

### 5.1 Sources of energy consumption

#### 5.1.1 Primary sources of energy consumption

- ➔ **Electrical (Metered)** – Light, Fans, Equipments, Pumps comprise these sources.
- ➔ **Alternate sources of energy** – There are rooftop solar panels in college campus and one sensor based light facility

#### 5.1.2 Secondary sources of energy consumption

The existing sources are documented below:

S. No.	Name	Nos.
1	Batteries	12
2	Gas cylinders	29
3	Generator	4
4	Inverters	6
5	Servo Stabilizer	2
6	UPS	4

*Table 3: Details of secondary sources of energy consumption*

The observation related to above information states that the current sources and their available nos. are fine.

## 5.2 Actual electrical consumption as per bills

The information shared documented below:

Electricity bills analysis (College Campus)						
S. No.	Month	Year	Amount	(A) Total units consumed	(B) Solar units generated	(C = A-B) Gross units consumed after deduction
<b>Academic year 2021-22</b>						
1	June	2021	49,975	7,486	5,450	2,036
2	July	2021	66,886	9,320	5,582	3,738
3	August	2021	70,670	10,402	4,091	6,311
4	September	2021	73,962	10,560	4,562	5,998
5	October	2021	52,918	8,230	4,826	2,899
6	November	2021	47,866	8,160	5,331	4,465
7	December	2021	76,324	11,064	3,695	6,854
8	January	2022	1,00,325	14,238	4,210	10,033
9	February	2022	66,133	9,780	4,205	4,220
10	March	2022	36,744	7,272	5,560	3,688
11	April	2022	97,176	14,162	3,584	10,402
12	May	2022	92,645	13,354	3,760	9,594
<b>Academic year 2022-23</b>						
13	June	2022	94,312	13,754	3,757	9,997
14	July	2022	1,16,406	16,708	3,349	13,359
15	August	2022	91,332	13,124	3,780	9,344
16	September	2022	1,00,180	14,358	3,650	10,708
17	October	2022	92,391	11,516	3,430	8,086
18	November	2022	80,478	10,650	3,520	7,130
19	December	2022	1,00,707	13,292	3,606	9,686
20	January	2023	96,045	12,124	3,702	8,422
21	February	2023	72,449	9,262	3,853	5,409
22	March	2023	59,789	9,812	5,230	4,582
23	April	2023	50,615	7,814	5,150	2,664
24	May	2023	76,752	11,318	5,540	5,778

Table 4: Details of the electricity bills consumption



### The observation related to above information states:

- ⇒ The **total amount** spent in past two years is **Rs. 18,63,080/-**
- ⇒ The **average amount** spent every month are **Rs. 77,628/-**
- ⇒ The **total units** consumed in past two years **~ 2,67,760 units (Electrical + solar)**
- ⇒ The **average units** consumed every month are **~ 11,157 units (Electrical + solar)**
- ⇒ The **total units** consumed in past two years is **~ 1,03,423 units (Only solar)**
- ⇒ The **average units** consumed every month are **~ 4,309 units (Only solar)**
- ⇒ **Alternate source of energy is available in form of rooftop solar panels in the campus facility only.**
- ⇒ **Percentage of energy met by alternate (solar (renewable)) source is 39%**



*Plate 4: Net metering system in the premises*



*Plate 5: Assessment of the rooftop solar panels in the premises*

 	
PLANT NAME	DOLPHIN EDUCATIONAL SOCIETY OF INDIA
CAPACITY	100KW
LOCATION	MANDUWALA NEAR SUDDOWALA, CHAKRATA ROAD, DEHRADUN, UTTARAKHAND -208007
TYPE OF RENEWABLE ENERGY SYSTEM	ROOFTOP SOLAR PHOTOVOLTAIC POWR PLANT
DATE OF COMMISSIONING	20-12-2017
FINANCIAL ASSISTANCE FROM	SOLAR ENERGY CORPORATION OF INDIA (SECI)
BIDDER NAME	BOOND ENGINEERING & DEVELOPMENT PVT. LTD.
OFFICE ADDRESS	406, NDM-1 ,B-BLOCK, NSP,PITAMPURA NEW DELHI-110034

*Plate 6: Solar power project details*

### **Inference about the observation states:**

- ⇒ *The study suggests that there could be a display stating 'Danger zone' and watch your steps as this area is quite risky to access being very small. If possible the parapet height (Image one above) can be increased.*
- ⇒ *The study suggests that there could be an awareness poster displaying detail about the renewable energy, mode incorporated, energy produced and utilised for sensitization of the stakeholders.*

Electricity bills analysis (Girls Hostel)						
S. No.	Month	Year	Amount	(A) Total units consumed	(B) Solar units generated	(C = A-B) Gross units consumed after deduction
<b>Academic year 2021-22</b>						
1	June	2021	29,060	1,898	0	1,898
2	July	2021	36,777	2,402	0	2,402
3	August	2021	26,227	3,440	0	3,440
4	September	2021	30,566	4,180	0	4,180
5	October	2021	48,703	6,900	0	6,900
6	November	2021	47,663	6,880	0	6,880
7	December	2021	60,818	8,800	0	8,800
8	January	2022	66,451	9,820	0	9,820
9	February	2022	59,631	8,700	0	8,700
10	March	2022	56,001	8,360	0	8,360
11	April	2022	62,697	9,250	0	9,250
12	May	2022	59,500	8,524	0	8,524
<b>Academic year 2022-23</b>						
13	June	2022	58,210	8,436	0	8,436
14	July	2022	54,722	7,780	0	7,780
15	August	2022	50,328	7,080	0	7,080
16	September	2022	58,920	7,540	0	7,540
17	October	2022	51,133	6,540	0	6,540
18	November	2022	53,198	6,820	0	6,820
19	December	2022	63,536	8,100	0	8,100
20	January	2023	63,782	8,140	0	8,140
21	February	2023	53,827	6,805	0	6,805
22	March	2023	51,239	6,548	0	6,548
23	April	2023	54,649	6,967	0	6,967
24	May	2023	52,680	6,724	0	6,724

*Table 5: Details of the electricity bills consumption*

### The observation related to above information states:

- The **total amount** spent is ~**Rs. 12,50,318/-**
- The **total units** consumed is ~ **1,66,634 units (Electrical), NO SOLAR**



Electricity bills analysis (Boys Hostel)						
S. No.	Month	Year	Amount	(A) Total units consumed	(B) Solar units generated	(C = A-B) Gross units consumed after deduction
<b>Academic year 2021-22</b>						
1	June	2021	7,580	1,126	0	1,126
2	July	2021	8,301	1,202	0	1,202
3	August	2021	11,599	1,713	0	1,713
4	September	2021	20,205	3,109	0	3,109
5	October	2021	27,542	4,193	0	4,193
6	November	2021	27,685	3,979	0	3,979
7	December	2021	39,039	5,704	0	5,704
8	January	2022	36,606	5,488	0	5,488
9	February	2022	35,551	5,438	0	5,438
10	March	2022	35,066	5,358	0	5,358
11	April	2022	36,626	5,592	0	5,592
12	May	2022	39,197	5,924	0	5,924
<b>Academic year 2022-23</b>						
13	June	2022	34,788	5,306	0	5,306
14	July	2022	31,361	4,677	0	4,677
15	August	2022	29,345	4,262	0	4,262
16	September	2022	34,781	4,864	0	4,864
17	October	2022	26,563	3,403	0	3,403
18	November	2022	33,672	4,478	0	4,478
19	December	2022	38,982	5,183	0	5,183
20	January	2023	36,680	4,877	0	4,877
21	February	2023	32,763	4,422	0	4,422
22	March	2023	33,817	4,480	0	4,480
23	April	2023	34,912	4,650	0	4,650
24	May	2023	32,517	4,351	0	4,351

*Table 6: Details of the electricity bills consumption*

### The observation related to above information states:

- ⇒ The **total amount** spent is ~**Rs. 7,25,178/-**
- ⇒ The **total units** consumed is ~ **1,03,779 units (Electrical), NO SOLAR**



### 5.3 Investigation of certain features



*Plate 7: Wiring study of the site*

*The study suggests that in some areas the wirings were exposed and overloaded, these areas could be fabricated and loads could be distributed evenly through multiple switchboards.*



*Plate 8: Air conditioning and panel study of the site*

*The study suggests that:*

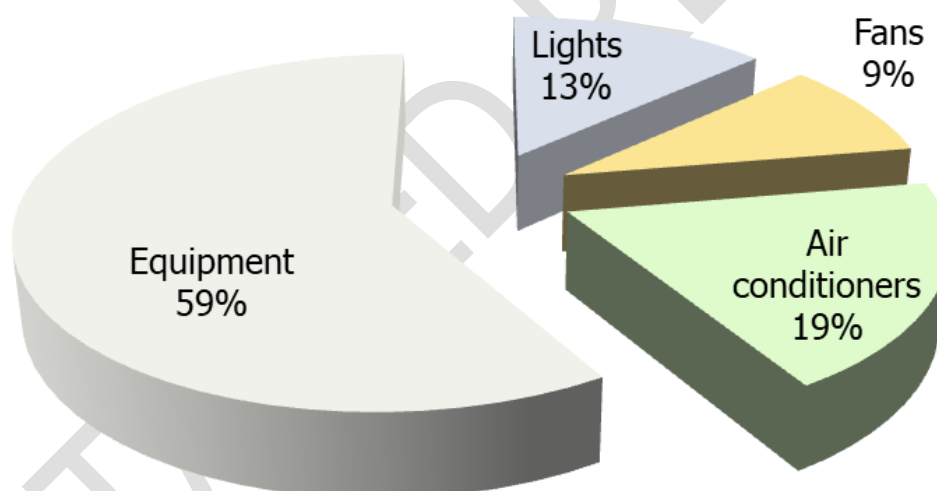
- *Outdoor units of the air conditioners shall be covered with a temporary shade to keep the direct sunlight access under control as this may lead to increase in the cooling-electrical load*
- *The electrical meter in ground floor areas specially close to water coolers should be covered with 'Danger zone' display and sand buckets close by*

## 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 is 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 59% whereas the air conditioners consume 19% while the lights consume 13% and the fans consume 9% each of the total calculated electrical energy.

## 5.5 Lights

### 5.5.1 Types of lights based on the numbers

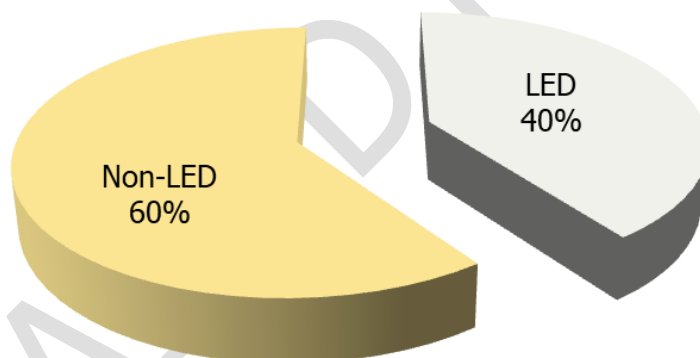
There are **2,065 lights on the premises**; the following table shows the various types of lights on the premises.

S. No.	Type	Nos.
1	<b>LED lights</b> ( <i>Energy efficient appliance</i> )	1,289
2	<b>Non-LED lights</b> ( <i>Non-Energy efficient appliance</i> )	776

*Table 7: 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 **1,42,076 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 **Non-LED lights consume 60%** whereas the **LED lights consume 40%** of the total power consumed by lights.

## 5.6 Fans

### 5.6.1 Types of fans based on the numbers

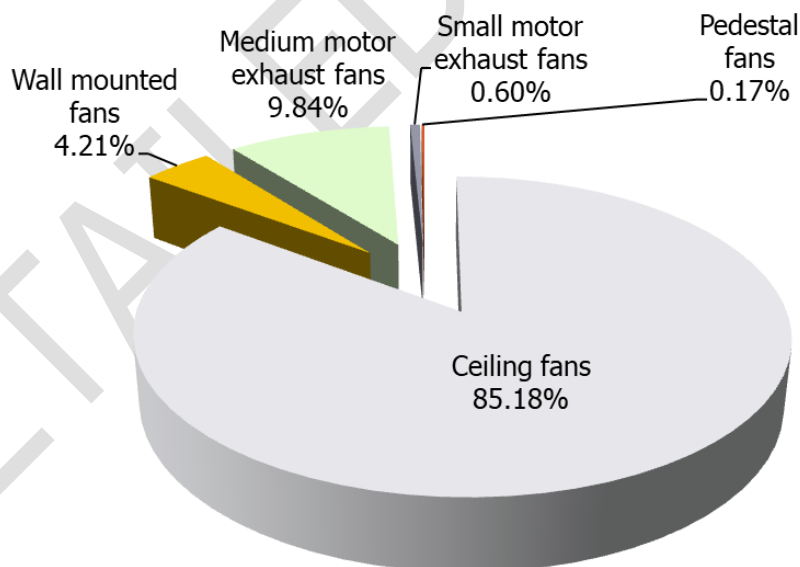
There are **1,013 fans** on the premises as follows:

S. No.	Type	Nos.
1	Ceiling fans	894
2	Wall mounted fans	53
3	Medium motor exhaust fans	59
4	Small motor exhaust fans	5
5	Pedestal fans	2

*Table 8: 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 **96,187 kWh** of the energy.



*Figure 3: Types of fans based on power consumption*

The above analysis shows that the **Ceiling fans consume 85.18%** whereas the **medium motor exhaust fans consume 9.84%** while the **wall-mounted fans consume 4.21%** whereas the **small motor exhaust fans consume 0.60%** and the **pedestal fans consume 0.17%** of total power consumed by fans.

## 5.7 Air conditioners

### 5.7.1 Types of air conditioners based on the numbers

There are **36 air conditioners** in the entire premises.

### 5.7.2 Building-wise consumption analysis

The energy consumption of air conditioners is **2,01,771 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.

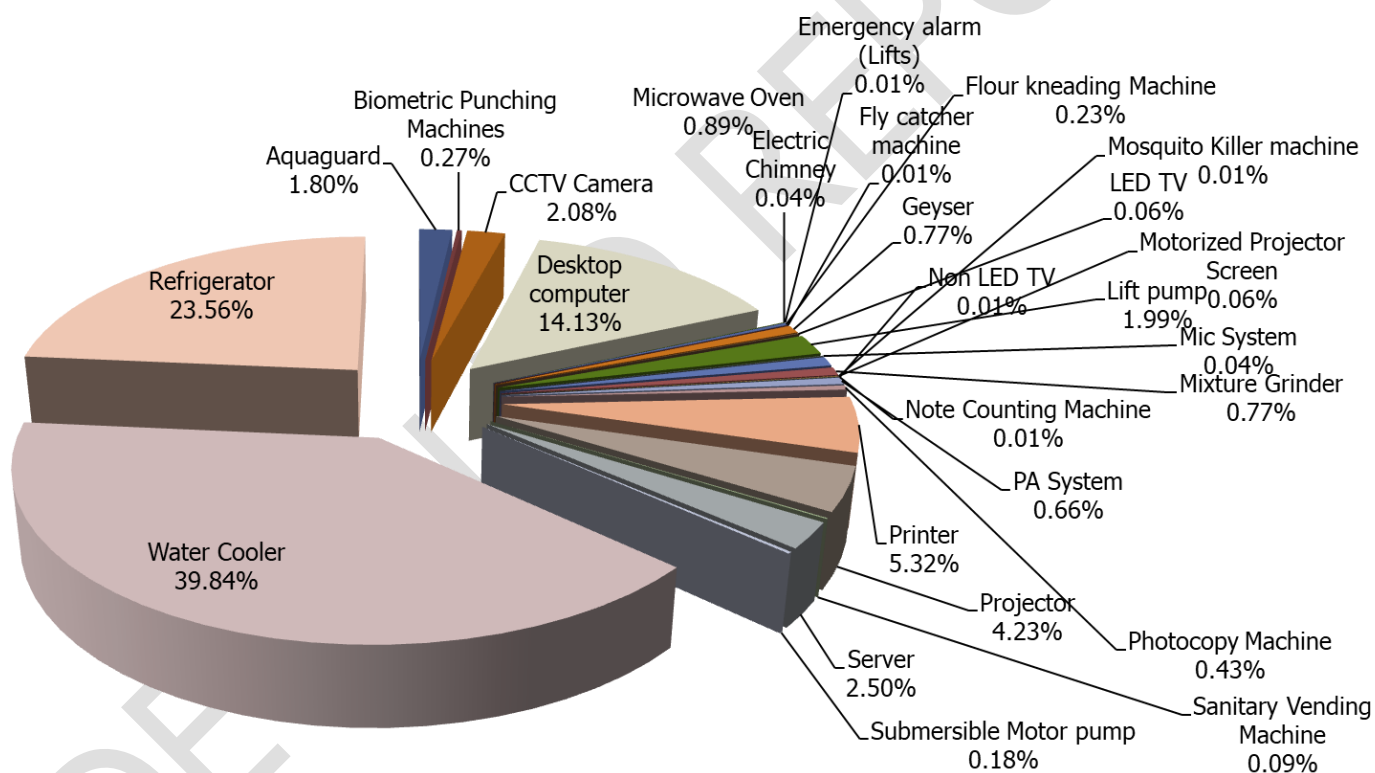
## 5.8 Equipment Study – Part 1 (Educational (General use) and the Residential spaces)

### 5.8.1 Types of Equipment

There are **865 nos. of equipment** in the Educational and Residential sector that use for general and residential sector on a daily basis.

### 5.8.2 Types of equipment as per their energy contribution

The energy consumption of equipment is **6,13,409 kWh** of energy.



**Figure 4: 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 39.84%** while the **refrigerator consumes 23.56%** whereas the **desktop computer consumes 14.13%** and the **printer consumes 5.32%** these are the maximum consumers as compared to other equipment.

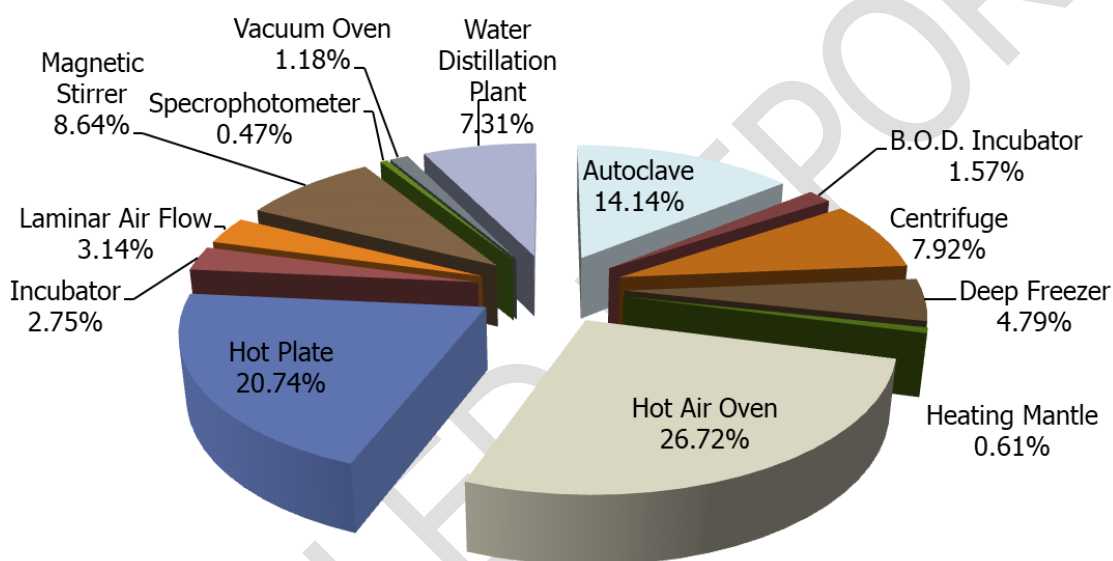
## 5.9 Equipment Study – Part 2 (Laboratory spaces)

### 5.9.1 Types of Equipment

There are **441 (total) nos. of equipment** and out of these **99 nos. of appliances** that **consume major electricity** in the Educational sector.

### 5.9.2 Types of equipment as per their energy contribution

The energy consumption of equipment is **12,726 kWh** of energy.



*Figure 5: Energy consumed by types of equipment in the educational sector based on the usage study*

The above summary shows that the **hot air oven consumes more energy at 26.72%** while the **hot plate consumes 20.74%** whereas the **autoclave consumes 14.14%** and the **magnetic stirrer consumes 8.64%** these are the maximum consumers as compared to other equipment.

The total energy consumed by both parts is 6,26,135 kWh for 964 nos. of equipment in overall premises.



## 6. Suggestion

### 6.1 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.

#### ➔ 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 wear 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

## 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 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.

## 6.2.2 Alternatives towards Smart premises mechanisms

### Section 1 – 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.



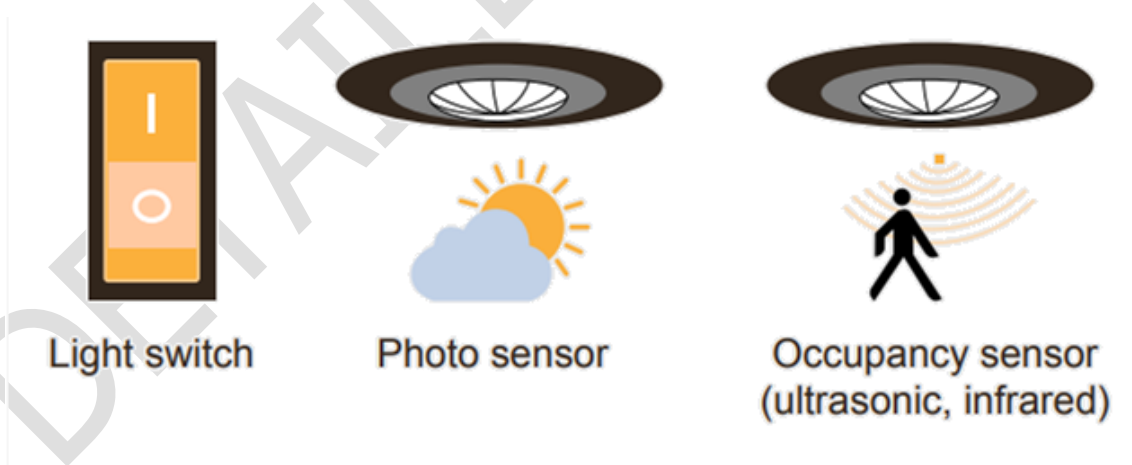
**Plate 9: Solar farm concept for the Institute (For reference purpose only)**

Image source: <https://housing.com/news/smart-gardening/>

Data source: <https://www.happysprout.com/inspiration/what-is-smart-gardening/>

### Section 2 – Facility management systems, controls

(Includes electromechanical systems – Electrical, Water)



**Plate 10: Understanding the lighting concepts**

Source: [https://seors.unfccc.int/applications/seors/attachments/get\\_attachment?code=NG125PFE4WHMWSYAK8TCAKIHMWX0F4QD](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 far as lighting systems are considered.

## 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](https://seors.unfccc.int/applications/seors/attachments/get_attachment?code=NG125PFE4WHMWSYAK8TCAKIHMWX0F4QD)

