

ENERGY AUDIT

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

Sustainability study

AUDIT REPORT

Studied for

**St. Aloysius College
(Autonomous)**

1, Ahilya Bai Marg, Pentinaka Chowk, Sadar,
Jabalpur, Madhya Pradesh, India 482001

Studied in the capacity of

Accredited and Certified GBP



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Disclaimer

The Audit Team has prepared this report for the **St. Aloysius College (Autonomous)** located 1, Ahilya Bai Marg, Pentinaka Chowk, Sadar, Jabalpur, Madhya Pradesh, India 482001 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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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

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Acknowledgement

The Audit Assessment Team extends its appreciation to the **St. Aloysius College (Autonomous), Madhya 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 extended are due to everyone from the Management.

Our heartfelt thanks are extended to the Chairperson of the entire process **Dr. Fr. G Vazhan Arasu** (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. Siby Samuel**, IQAC Coordinator and Teachers - **Dr. Poonam Pendke, Dr. Sonali Nigum, Dr. Zarin Bakesh, Dr. Laxmikant Pandey**
- Non-teaching staff member – **Mr. Rajender Prasad and Mr. Vineeth M. Menon** (Office)
- Admin staff member – **Dr. Ben Anton Rose**, Vice-Principal; **Fr. Pradeep Rodriguez**, Administrator

Sustainable Academe

Brand of Greenvio Solutions, Palghar District, Maharashtra- 401208

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1. Introduction

1.1 About statements of the Institute

1.1.1 Vision

The Institute proposes "To qualify quality through qualitative escalation of the entire framework of the institution."

1.1.2 Mission

The Institute adheres and focuses:

- To provide for consistent quality up gradation of academic and administrative functioning of the institution
- To provide for a participative academic environment to decipher supreme quality education
- To lay a yardstick in the field of teaching-learning culture with quality enhancement
- To embark on qualitative research, training and consultancy

1.1.3 Aim

The College has formulated the following aim to achieve its mission "To facilitate use of ICT, skill-development, development of global competencies, and ultimately to make the learners enhance their potential to be of service to self and society."

1.2 Assessment of the Institute

1.2.1 Affiliations

The courses provided by the College have received their affiliation through **Rani Durgawati Vishwa Vidhyalaya**, Jabalpur, Madhya Pradesh

1.2.2 Certification

The College has received the following Certifications

- ⇒ **AISHE** – The All India Survey of Higher Education code is C-33354
- ⇒ **NIRF** – Participated and received rank in National Institutional Ranking Framework

1.2.3 Recognitions

The College has achieved the following recognitions:

- ⇒ **Autonomous Status** - The College was conferred Autonomous status by the University Grants Commission (UGC).
- ⇒ **Recognition of UGC** – The College has been recognized under section [2 \(f\) and 12\(b\) of the UGC Act, 1956](#) by University Grants Commission, New Delhi.
- ⇒ National Council for Teacher Education (NCTE), New Delhi

1.2.4 Accreditation

The College is accredited by National Assessment & Accreditation Council (NAAC).

2. Overview

2.1 Summarised Populace analysis for 2023-2024

2.1.1 Students data

The data (shared by the Institute) shows there were **5,530 students**.

2.1.2 Staff data

S. No.	Type	Male	Female	Total
1	Admin staff	03	00	03
2	Teaching staff	32	83	115
3	Non-Teaching staff	32	10	42
Total Staff Members		67	93	160

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

The staff data shows the Institute premises had **160 Staff Members**.

2.2 Summarised Populace analysis for 2022-2023

2.2.1 Students data

The data (shared by the Institute) shows there were **5,505 students**.

2.2.2 Staff data

S. No.	Type	Male	Female	Total
1	Admin staff	02	00	02
2	Teaching staff	32	83	115
3	Non-Teaching staff	30	10	40
Total Staff Members		64	93	157

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

The staff data shows the Institute premises had **157 Staff Members**.

3. Research

3.1 Campus area

The **site spread over 10.52 acres of land covering 88,387 sq. ft. of built-up area.**

3.2 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.

3.3 Analysis of the Green Building Study Audit

The procedure included detailed verification as follows:

- Investigation
- Technical
- Observations
- Inferences

3.4 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.

4. Investigation



Plate 1: Rooftop solar panels in the premises



Plate 2: Solar street light in the premises



Plate 3: Sensor based light in the washroom



Plate 4: Team working towards the data compilation



Plate 5: Fire hose reel and extinguisher in the premises

5. Documentation

Section 1 – Energy management

5.1 Primary sources of energy consumption

- ➔ **Electrical (Metered)** – Light, Fans, Equipments, Pumps comprise these sources.
- ➔ **Alternate sources of energy consumption**– There are **120 nos. of solar panels, certain solar street lights and five sensor based lights** available.

5.2 Secondary sources of energy consumption

The premise uses following facilities as backup for administrative purposes. The details of the existing sources are documented below:

S. No.	Name	Nos.
1	UPS	3
2	Batteries	28
3	Gas cylinders	5
4	Induction stove	1

Table 3: Details of secondary sources of energy consumption

5.3 Actual electrical consumption as per bills

The information shared for the meter available in the premises.

S. No.	Month	Year	Amount	(A) Total units consumed	(B) Solar units generated	(C = A-B) Gross units consumed after deduction
Academic year 1 (2022-2023)						
A	July - June	2022-23	10,97,882	40,78,54,700	0	40,78,54,700
Academic year 2 2023-24						
B	July- January	2023-24	4,17,733	20,10,22,200	20,10,21,062	1,138

Table 4: Details of the electrical consumption

The observation related to above information states:

- ⇒ The **total amount** spent in past two years is **Rs. 4,17,733/-**
- ⇒ The **average amount** spent every month are **Rs. 23,207/-**
- ⇒ The **total units** consumed in past two years ~ **20,10,22,200 units (Electrical + solar)**
- ⇒ The **average units** consumed every month are ~ **1,11,67,900 units (Electrical + solar)**
- ⇒ The **total units** consumed in past two years is ~ **20,10,21,062 units (Only solar)**
- ⇒ The **average units** consumed every month are ~ **1,11,67,837 units (Only solar)**
- ⇒ **Percentage of energy met by alternate (solar (renewable)) source is (approx.) 99%**

DETAILED REPORT

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.

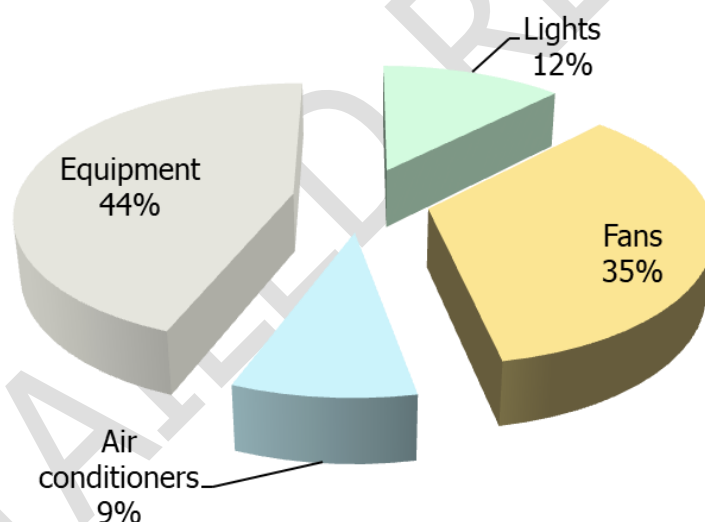


Figure 1: Summary of the calculated electrical consumption as per inventory

The above graph shows that equipment consume 44% whereas the fans consume 35% while the lights consume 12% and the air conditioners consume 9% of the total calculated electrical energy.

5.5 Lights

5.5.1 Types of lights based on the numbers

There are **1,263 lights on the premises**; the following table shows the various types of lights on the premises.

S. No.	Type	Nos.
1	LED lights (<i>Energy efficient appliance</i>)	597
2	Non-LED lights (<i>Non-Energy efficient appliance</i>)	542
3	CFL lights (<i>Non-Energy efficient appliance</i>)	70
4	Tungsten filament lights (<i>Non-Energy efficient appliance</i>)	54

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 **91,522 kWh** of energy.

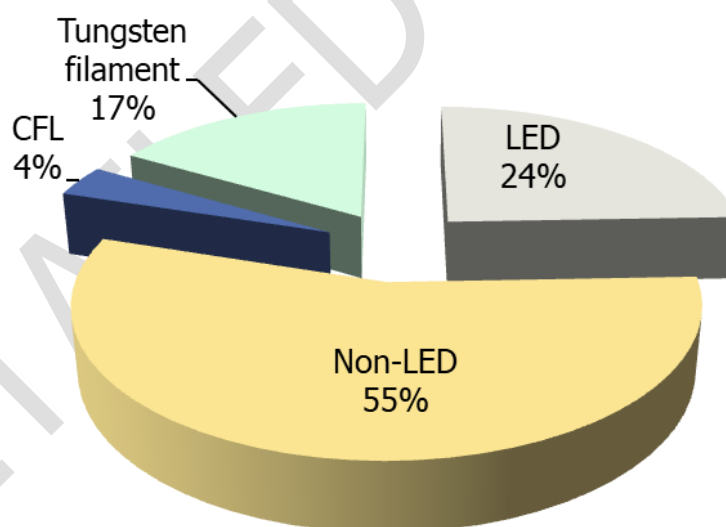


Figure 2: Energy consumed by types of lights in the premise based on the usage study

The analysis of the types of Lights on-premises shows **Non-LED lights consume 55%** whereas the **LED lights consume 24%** while the **Tungsten filament lights consume 17%** and the **CFL lights consume 4%** of the total power consumed by lights.

5.6 Fans

5.6.1 Types of fans based on the numbers

There are **2,144 fans** on the premises as follows:

S. No.	Type	Nos.
1	Ceiling fans	1,963
2	Exhaust fans	125
3	Wall mounted fans	56

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 **2,54,290 kWh** of the energy.

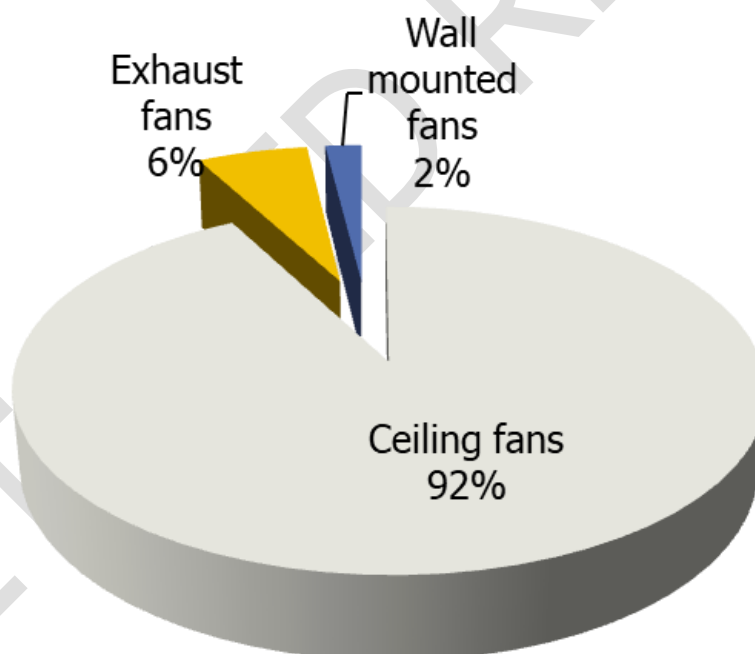


Figure 3: Types of fans based on power consumption

The above analysis shows that the **Ceiling fans consume 92%** whereas the **exhaust fans consume 6%** and the **wall-mounted fans consume 2%** of total power consumed by fans.

5.7 Air conditioners

5.7.1 Types of air conditioners based on the numbers

There are **32 air conditioners** on the entire premises.

5.7.2 Building-wise consumption analysis

The energy consumption of air conditioners is **65,378 kWh** of energy.

5.8 Equipment

5.8.1 Types of Equipment

There are **612 nos. of equipment** in the Educational sector.

5.8.2 Types of equipment as per their energy contribution

The energy consumption of equipment is **3,24,802 kWh** of energy.

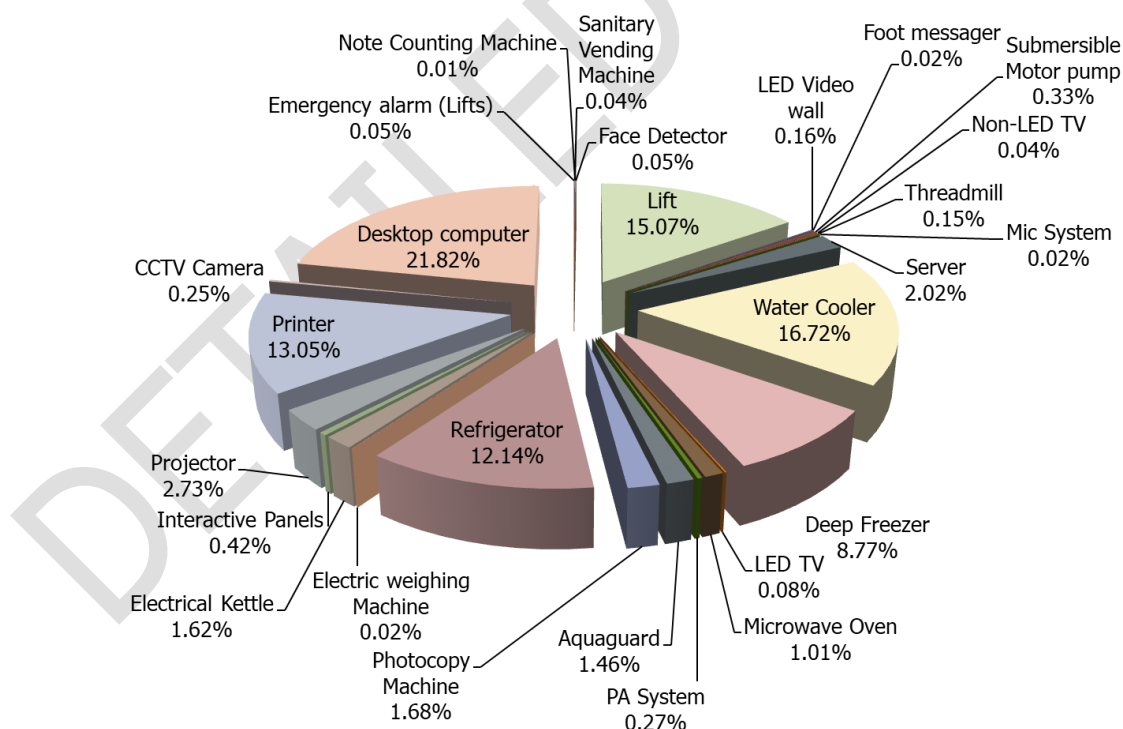


Figure 4: Energy consumed by types of equipment in the educational sector based on the usage study

Above summary shows that **desktop computer consumes more energy at 21.82%** while **water cooler consumes 16.75%** whereas **lift consumes 15.07%** & **refrigerator consumes 12.14%** these are maximum consumers as compared to other equipment.

Section 2 – Life safety management

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. All provisions documented below:

- **Fire extinguisher**
- **Fire hose reel**
- **One proposed fire water tank with a capacity of 20,000 litres**

The study suggests that the current practices are excellent, but there is scope for certain minor improvements such as

- *There should be a display board stating 'Students or staff members not allowed' on terrace or danger zone areas*
- *The students should not be allowed to decorate the spaces that have electrical connections*
- *There should be documentations of the switchboards and main boards such as SB1, MB1 further the switches should be documented appropriately.*
- *The study suggests that the floor should have a 'FIRE ESCAPE ROUTE LAYOUT' that highlights the position of stakeholders and nearest passage as well as staircase.*
- *There should be additional provisions in the LABORATORIES including:*
 - *Eye washers*
 - *First aid box*
 - *Display chart about the 'dos and don'ts, a workshop for stakeholders about fire and life safety*
 - *Rubber mats as an electrical safety measure*

6. Inferences

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.

Section 1 – Energy management

➔ 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

➔ 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 6: 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 R/R

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/>

