

ENERGY AUDIT

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

Sustainability study
AUDIT REPORT

Studied for
Nagpur Institute of Technology

Survey no.13/2,Katol Road,
Near Fetri,mahurzari,
Nagpur,Maharashtra-441501, India

Studied in the capacity of
Accredited and Certified GBP



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Disclaimer

The Audit Team has prepared this report for the **Nagpur Institute of Technology** located Survey no.13/2, Katol Road, Near Fetri, Mahurzari, Nagpur, Maharashtra-441501, 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

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Acknowledgement

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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.A.Y.Deshmukh** (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 – **Mr. Amit M Kharwade** (Assistant Professor) and **Mr. R.D Khorgade** (Assistant Professor)
- Non-teaching staff member – **Mr.N.Khode** and **Mr.Kiran Sawarkar**
- Admin staff member – **Mr. Sandip Kale**, (Registrar) and **Mr.R.Khobe** (Assistant Registrar)

Sustainable Academe

Brand of Greenvio Solutions, Palghar District, Maharashtra- 401208

Contents

| | |
|--|-----------|
| Disclaimer | 1 |
| Acknowledgement..... | 2 |
| Contents | 3 |
| 1. Introduction | 4 |
| 2. Overview about college | 5 |
| 3. Research..... | 6 |
| 4. Investigation | 7 |
| 5. Documentation..... | 9 |
| 6. Inferences | 16 |
| 7. Compilation | 21 |

1. Introduction

1.1 About statements of the Institute

1.1.1 Vision

The Institute proposes "Service to Society by creating Technical & Skilled manpower through Value based Technical Education."

1.1.2 Mission

The Institute adheres and focuses:

- To provide quality technical education to meet the requirements of industries and society
- To equip students with need based technical skills through continual improvements in Teaching Learning processes and research activities
- To inculcate ethical values for overall holistic development of students

1.2 Assessment of the Institute

1.2.1 Affiliations

The courses provided by the College have received their affiliation through **RTMNU ,Nagpur**

1.2.2 Certification

The College has received the following Certifications

- **AISHE** – The All India Survey of Higher Education code is C-18725
- **ISO** – Certification for 9001:2015 Quality Management System

1.2.3 Approval

The courses provided by the College are approved by:

- **All India Council for Technical Education (AICTE), New Delhi**
- **Directorate of Technical Education (DTE), Maharashtra**

2. Overview about College

Nagpur Institute of Technology is a brand name in Central India for conveying Quality Education that gathers International Standards. It is one of the rapid budding technological institutes of elevated status in the region and is one of the **Top Engineering Colleges in Nagpur**. This institute is very well known for its farsighted management, full-fledged and marked guidance, superior enthusiastic faculty, and state of art infrastructure, towering academic principles, stringent academic restraint, outstanding co-curricular and extracurricular bustles and much endowed scholars. The college places exceptional and unique prominence interrelated to the expansion of the students such as all round persona progress, option of international revelation at UG echelon, temperament and proficiency edifice, industrial training and industrial projects. Nagpur Institute of Technology was established in 2008 and is a self-financed institution affiliated to RTM Nagpur University and approved by All Indian Council for Technical Education (AICTE), New Delhi and Government of Maharashtra and Directorate of Technical Education (DTE), Mumbai.

3. Research

3.1 Campus area

The **site spread over 10 acres of land covering 1,43,946 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

Observation: Given the scale of the campus, the nos. of panels are quite insufficient.



Plate 2: Solar street light in the premises

Observation: The nos. of solar street lights seem to be insufficient.



Plate 3: Main electricity generation areas in the premises

Observation: There are no safety measures adopted by the Institute for these area, appropriate demarcation with fencing and a signboard that reads out as „ DANGER ZONE“ is a pre-requisite for this area. Furthermore, technical details about the facility should be displayed included last maintenance date.



Plate 4: Fire extinguisher in the premises

Observation: There are no „PASS boards“ displayed for ease of stakeholder to use the system

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 is **one solar panel and solar street light system** 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 | 8 |
| 2 | Inverters | 2 |
| 3 | Batteries | 124 |

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) | | | | | | |
| 1 | June | 2022 | 2,25,663 | 15,751 | 0 | 15,751 |
| 2 | July | 2022 | 1,58,672 | 9,970 | 0 | 9,970 |
| 3 | August | 2022 | 1,56,962 | 9,817 | 0 | 9,817 |

| | | | | | | |
|--------------------------------|-----------|------|----------|--------|---|--------|
| 4 | September | 2022 | 1,99,641 | 13,493 | 0 | 13,493 |
| 5 | October | 2022 | 1,67,412 | 10,703 | 0 | 10,703 |
| 6 | November | 2022 | 1,86,218 | 9,572 | 0 | 9,572 |
| 7 | December | 2022 | 8,97,384 | 10,781 | 0 | 10,781 |
| 8 | January | 2023 | 1,89,559 | 9,850 | 0 | 9,850 |
| 9 | February | 2023 | 2,04,859 | 10,960 | 0 | 10,960 |
| 10 | March | 2023 | 2,49,295 | 14,148 | 0 | 14,148 |
| 11 | April | 2023 | 2,70,866 | 15,014 | 0 | 15,014 |
| 12 | May | 2023 | 3,01,203 | 17,560 | 0 | 17,560 |
| Academic year 2 2023-24 | | | | | | |
| 13 | June | 2023 | 2,86,156 | 16,413 | 0 | 16,413 |
| 14 | July | 2023 | 2,30,481 | 12,359 | 0 | 12,359 |
| 15 | August | 2023 | 2,61,219 | 14,601 | 0 | 14,601 |
| 16 | September | 2023 | 2,84,719 | 16,021 | 0 | 16,021 |
| 17 | October | 2023 | 2,94,814 | 16,735 | 0 | 16,735 |
| 18 | November | 2023 | 2,02,257 | 9,950 | 0 | 9,950 |
| 19 | December | 2023 | 2,04,978 | 10,128 | 0 | 10,128 |
| 20 | January | 2024 | 2,17,967 | 11,032 | 0 | 11,032 |

Table 4: Details of the electrical consumption

The observation related to above information states:

- The **total amount** spent in past two years is **Rs. 51,90,325/-**
- The **average amount** spent every month are **Rs. 2,59,516/-**
- The **total units** consumed in past two years ~ **2,54,858 units (Electrical)**
- The **average units** consumed every month are ~ **12,743 units (Electrical)**

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.

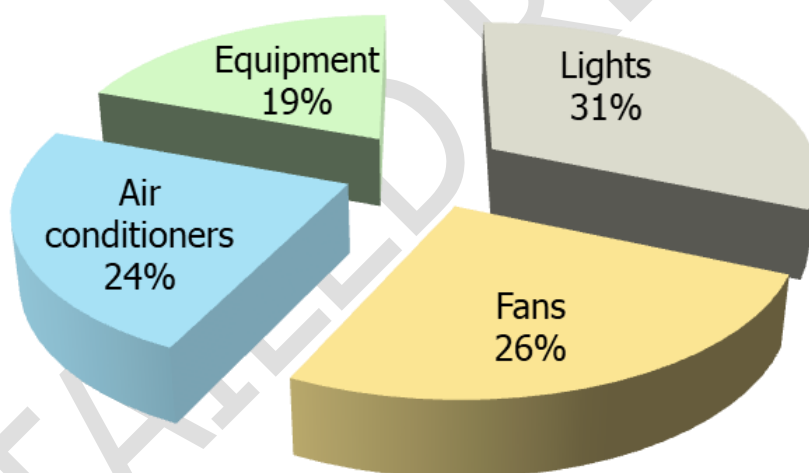


Figure 1: Summary of the calculated electrical consumption as per inventory

The above graph shows that lights consume 31% whereas the fans consume 26% while the air conditioners consume 24% and the equipment consume 19% of the total calculated electrical energy.

5.5 Lights

5.5.1 Types of lights based on the numbers

There are **727 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) | 123 |
| 2 | Non-LED lights (Non-Energy efficient appliance) | 565 |

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 **62,216 kWh** of energy.

The analysis of the types of Lights on-premises shows **Non-LED lights consume 90%** whereas the **LED lights consume 10%** of the total power consumed by lights.

5.6 Fans

5.6.1 Types of fans based on the numbers

There are **462 fans** on the premises as follows:

| S. No. | Type | Nos. |
|--------|--------------|------|
| 1 | Ceiling fans | 433 |
| 2 | Exhaust fans | 29 |

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 **50,736 kWh** of the energy.

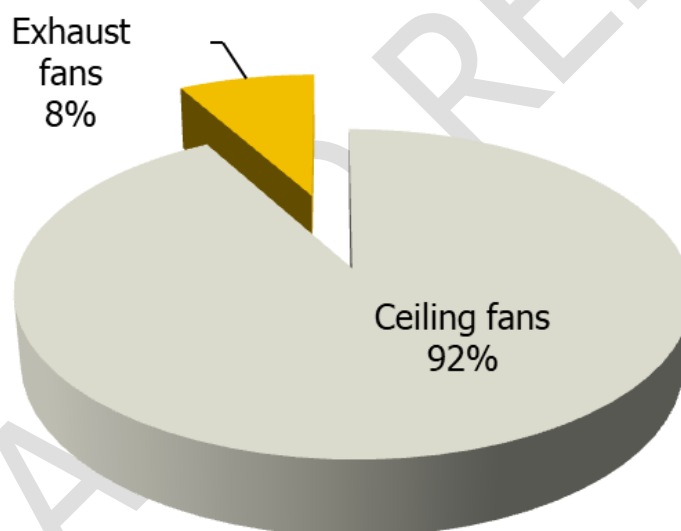


Figure 3: Types of fans based on power consumption

The above analysis shows that the **Ceiling fans consume 92%** whereas the **exhaust fans consume 8%** of total power consumed by fans.

5.7 Air conditioners

5.7.1 Types of air conditioners based on the numbers

There are **10 air conditioners** on the entire premises.

5.7.2 Building-wise consumption analysis

The energy consumption of air conditioners is **46,508 kWh** of energy.

5.8 Equipment

5.8.1 Types of Equipment

There are **23 nos. of equipment** in the Educational sector.

5.8.2 Types of equipment as per their energy contribution

The energy consumption of equipment is **38,460 kWh** of energy.

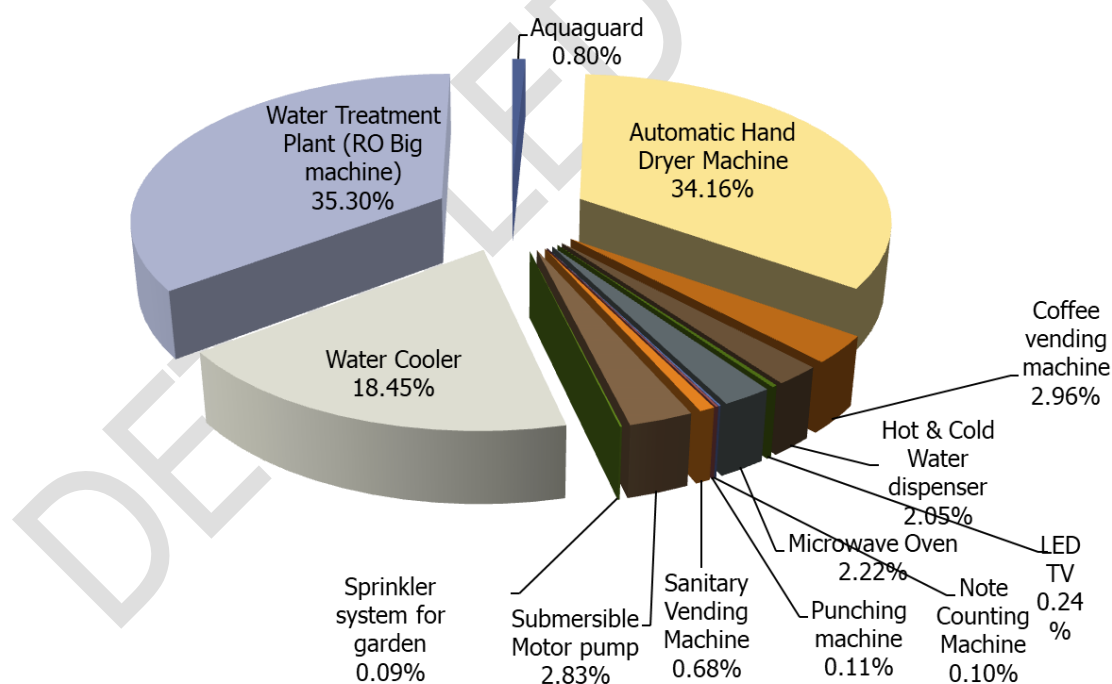


Figure 4: Energy consumed by types of equipment in the educational sector based on the usage study

Above summary shows that **water treatment plant (RO big machine) consumes more energy at 35.30%** while **automatic hand dryer machine consumes 34.16%** whereas **water cooler consumes 18.45%** & **submersible motor pump consumes 2.83%** 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

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

- ➔ ***The students should not be allowed to decorate the spaces that have electrical connections***

6. Inferences

The suggestion (inference) would act as a „PLAN OF ACTION“ to implement all the suggestions in a detailed manner. The same has been identified in two phases for a total duration of three years.

➔ Phase 1

- Duration: One year from the date of Report submission – Shared currently
- These are first hand suggestions
- They are easy and quick to implement
- They involve close very less or almost no expenses
- They can serve as a foundation for the entire plan of action

Section 1 - Energy management

➔ General practice

- The stakeholders should be educated to
 - i. Keep the lights on in the class room only when needed and unplug electrical devices when not in use.
 - ii. Electrical appliances consume energy even when you are not using them hence plugging something in only when needed can save electrical energy usage.
 - iii. At the time of locking the departments all fans, lights should be switched off.
 - iv. The students should be trained to switch off fans and lights when there is no need of them.
 - v. Staff should be trained to switch of lights and fans in their rooms when they leave the room.

➔ 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
- Conduct visits and monitoring by authority for check of appliances/ their working conditions/ energy usage etc. every fifteen to twenty days

➔ **Facilities intervention to reduce electrical load**

- Use white colored interiors and exterior façade to reflect light and
- Avoid dark colored interior and exterior façade, especially exterior façade
- Cover the inverters/ solar meters on the rooftop areas
- Demarcate the areas as „DANGER“ and do not allow any other stakeholder except the skilled or expertise staff member
- Cover the rooftop of outdoor air conditioner units to avoid any direct sun exposure on the top area as this may lead to increased electrical consumption and reduce the duration of quick cooling

➔ **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 - Energy generation

The Design interventions are excluded for the current study

Section 3 - 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 DRESS

Laboratory coat
Also wear shoes that are closed from all sides

Splash Goggles

Gloves

Face Shield

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 spattering

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

Wear safety glasses while heating in a laboratory

Keep the direction of the mouth of the test tube away from yourself and others.

Heat gently to avoid spattering

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.

Potassium and dry mineral oil

Absorbent material

Metal cans provide durable storage, are fire resistant and break resistant for several hazardous chemical.

FIRE EXTINGUISHERS

| CAUSE OF FIRE | TYPE OF FIRE EXTINGUISHER | | | | |
|---|---------------------------|--------------|----------------------------------|--------|-------------|
| | HALON | DRY CHEMICAL | CARBON DIOXIDE | POWDER | 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.
- Take back long hair.
- Do not wear loose sleeves.
- Do not wear shorts.
- Do not wear sandals.
- Do not wear contact lenses.
- 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.

Plate 5: Lab safety manual in the premises

➔ **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 are etc.
- Every user in this space should compulsorily jacket, helmet, gloves, boots while working and being a part of this space.

DETAILED REVIEW

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://ieeexplore.ieee.org/document/6779316>
- ➔ <https://www.murata.com/en-global/apps/industry/security/entranceandexitsystem>
- ➔ <https://www.energiguide.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

