PowerTech Energy Solutions
Conserve to Consume

Energy & Green Audit Report
of
Pravara Rural Education Society's Arts, Commerce, Science and Computer Science College, Ashvi. Ahmednagar

PRAVARA RURAL EDUCATION SOCIETY'S
ARTS, COMMERCE, SCIENCE
& COMPUTER SCIENCE COLLEGE
ASHVI KD.

Prepared By
PowerTech Energy Solutions
(A MEDA Empanelled Class A Category Consultancy Firm)

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Date of Audit: 15 Feb 2024
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ENERGY & GREEN AUDIT COMPLETION CERTIFICATE

This is to certify that the following facility has carried out Energy & Green Audit for the academic year of 2022-23 as per guidelines laid down by the Bureau of Energy Efficiency (BEE), Ministry of Power. Govt. of India

Name of the Installation	Pravara Rural Education Society's Arts, Commerce, Science and Computer Science College, Ashvi. Ahmednagar
Details of Facilities Audited	Main college building including laboratories, libraries, Classroom, etc.
Date of Energy and Green Audit	15 February 2024
Name of Certified Energy Auditor & Certification Number	Mr. Swapnil Gaikwad - EA 20121
Name of ISO 50001 Lead Auditor & Certification Number (Certification by Accreditation Body – TUV Nord)	Mr. Atul Kakad 35258395 - 07
Empanelment No (With Maharashtra Energy Development Agency, Govt. of Maharashtra)	MEDA/ECN/2022-23/ Class- A/EA-31
Validity of the Certificate	14 February 2025

Signature of Auditor

Mr. Swapnil Gaikwad

1 Acknowledgment

PowerTech Energy Solutions extends gratitude to Pravara Rural Education Society's Arts, Commerce, Science and Computer Science College, Ashvi. Ahmadnagar extending us the opportunity to conduct the Energy, Green and Environmental Audit.

We are thankful to the professors & supporting staff of the college for their transparency & consistent support in sharing relevant information and for providing data about policies and projects along with their other valuable information. This report would have not been possible without their support.

The study team would like to acknowledge the following distinguished personnel's of college

- **Dr. Gholpa Suvarna Bhaskar – Principal**

2 About College

Arts, Commerce, Science & Computer Science College, Ashvi Kd. commenced its journey in 2001 with 12 teachers and 156 students and has flourished into an institution with 30 teachers and 677 students in 2018-19.

Located on 2.5 lush green acres on the banks of Pravara River in Sangamner Taluka in an otherwise hilly region, the institute is a permanent non-grant college with 50% girl students. Computers, LCD projectors, and laptops make urban standard infrastructure available in a rural setting for superior education. Moreover, roomy and well-endowed library, laboratories, and classrooms make learning a pleasurable experience. Vocational courses in the college promote employability and are highly sought after.

Right since its inception, the college has operated the Earn and Learn Scheme for the benefit of economically weak students, who are assigned duties in laboratories, libraries, garden office, and security. The institute also runs a Poor Boy's Fund and has one unit of NSS for achieving the lofty ideal of national integration.

2.1 Mission

To inculcate moral values and the spirit of fair competition, which make students academically sound and socially conscience to become responsible.

2.2 Vision

To provide higher educational avenues to develop overall personality of the students in rural and economically weaker classes.

2.3 Goal

- To achieve academic excellence in higher education.
- To bring higher educational opportunities within the reach of girls and the under privileged section of society.
- To inculcate value based education to empower the youth for development of the nation.
- To develop the overall personality of students by providing ample exposure in co-curricular and extracurricular activities.
- To develop organic connections between educational institution and society for socio-economic and cultural transformation

3 Energy Audit

An energy audit is an inspection, survey and analysis of energy flows, for energy conservation in a building, process or system to reduce the amount of energy input into the system without negatively affecting the output(s). In commercial and industrial real estate, an energy audit is the first step in identifying opportunities to reduce energy expense and carbon footprints.

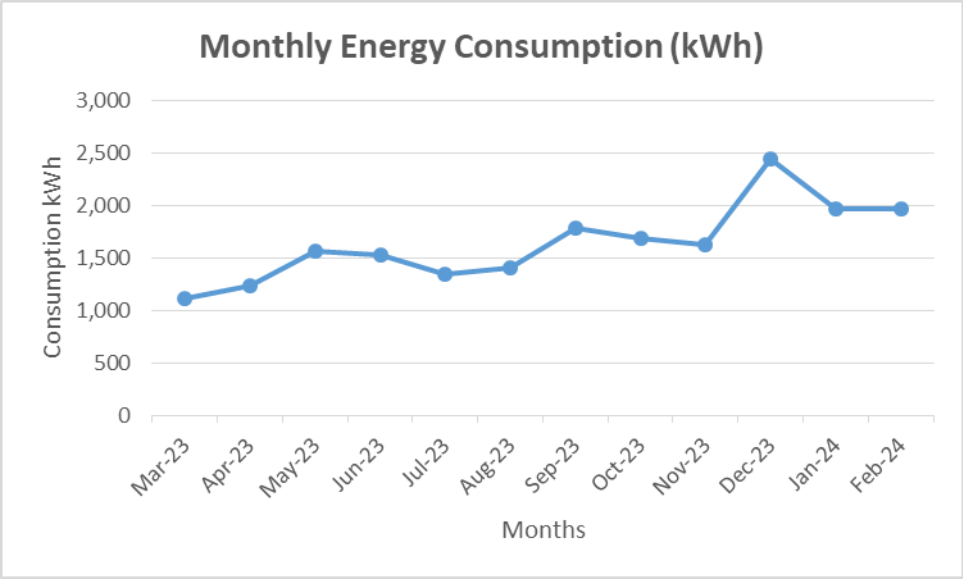
3.1 Electricity Bill Analysis

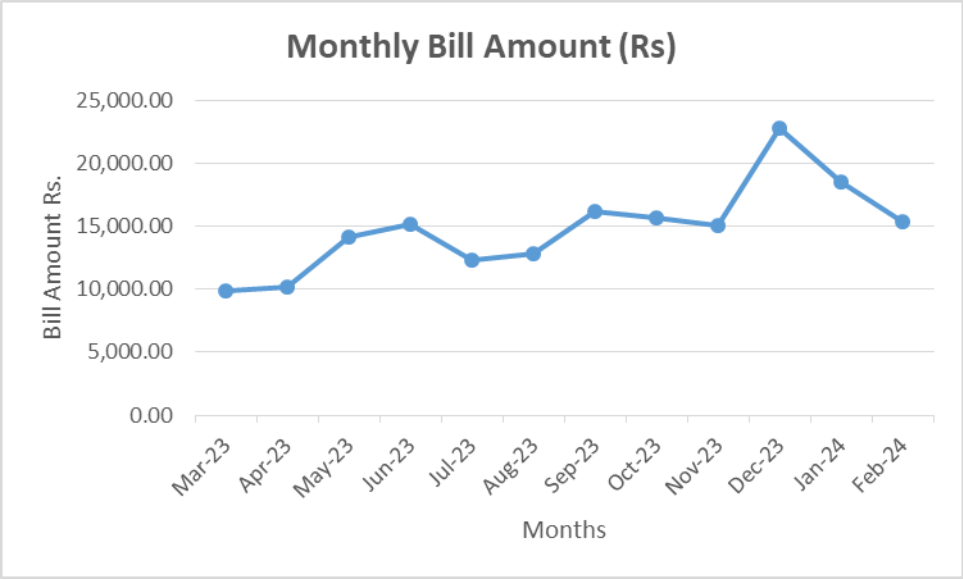
At present, one electricity meter is there for all campus

Bill analysis for consumer number **155240011771** shown below

Bill Months	Consumption kWh	Bill Amount	Per Unit Charges
Feb-24	1,970	15,390.00	7.81
Jan-24	1,970	18,480.00	9.38
Dec-23	2,437	22,770.00	9.34
Nov-23	1,627	15,060.00	9.26
Oct-23	1,689	15,620.00	9.25
Sep-23	1,783	16,140.00	9.05
Aug-23	1,408	12,860.00	9.13
Jul-23	1,343	12,280.00	9.14
Jun-23	1,531	15,160.00	9.90
May-23	1,558	14,170.00	9.09
Apr-23	1,228	10,180.00	8.29
Mar-23	1,115	9,850.00	8.83
Average	1,638	14,830	9

Below graph shows the total units consumption per month and total bill (Rs.) per month.





3.2 Observations

- Average units consumption per month is around **1638 kWh**
- Maximum units consumption is **2437 kWh** in month of **Dec 23**
- Average bill (Rs.) per month is around **14830 Rs.**
- Maximum bill (Rs.) is **22770 Rs.** In month of **Dec 23**

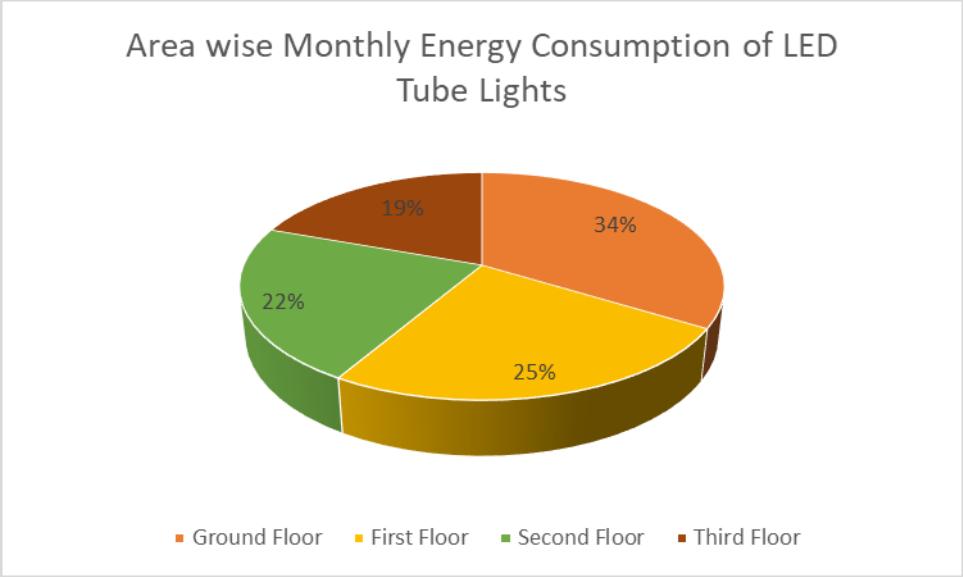
3.3 Connected Load List – LED Tubes

Sr. No.	Floor	Location	Light Type	Qty	Usage factor	Wattage	Daily consumption(kWh)	Monthly Working Days	Monthly consumption(kWh)
1	Ground Floor	Office	LED Tube	7	1	20	0.8	24	20
2	Ground Floor	Principal Cabin	LED Tube	3	1	20	0.4	24	9
3	Ground Floor	Store Room Pantry	LED Tube	2	1	20	0.2	24	6
4	Ground Floor	Staff Room	LED Tube	3	1	20	0.4	24	9
5	Ground Floor	IQAC Office	LED Tube	4	1	20	0.5	24	12
6	Ground Floor	Gymkhana	LED Tube	4	1	20	0.5	24	12
7	Ground Floor	Chemistry LAB	LED Tube	6	1	20	0.7	24	17
8	Ground Floor	NSS Cell, Alumni-Placement Cell, Reservation Cell, Ladies Common Room	LED Tube	7	1	20	0.8	24	20
9	Ground Floor	Computer Lab.	LED Tube	2	1	20	0.2	24	6
10	Ground Floor	Toilet	LED Tube	2	1	20	0.2	24	6
11	Ground Floor	Health Center	LED Tube	1	1	20	0.1	24	3
12	Ground Floor	Passage	LED Tube	11	1	20	1.3	24	32
13	1st Floor	Commerce Dept.	LED Tube	3	1	20	0.4	24	9
14	1st Floor	Physical Chemistry LAB	LED Tube	4	1	20	0.5	24	12

Sr. No.	Floor	Location	Light Type	Qty	Usage factor	Wattage	Daily consumption(kWh)	Monthly Working Days	Monthly consumption(kWh)
15	1st Floor	Seminar Hall	LED Tube	8	1	20	1.0	24	23
16	1st Floor	Class F-1	LED Tube	4	1	20	0.5	24	12
17	1st Floor	Class F-2	LED Tube	4	1	20	0.5	24	12
18	1st Floor	Library	LED Tube	10	1	20	1.2	24	29
19	1st Floor	Staircase	LED Tube	5	1	20	0.6	24	14
20	2nd Floor	Class Room & Language Lab	LED Tube	3	1	20	0.4	24	9
21	2nd Floor	Exam Dept.	LED Tube	1	1	20	0.1	24	3
22	2nd Floor	Zoology Lab.	LED Tube	7	1	20	0.8	24	20
23	2nd Floor	Class Room S-1	LED Tube	4	1	20	0.5	24	12
24	2nd Floor	Class Room S-2	LED Tube	5	1	20	0.6	24	14
25	2nd Floor	Class Room S-3	LED Tube	3	1	20	0.4	24	9
26	2nd Floor	Class Room S-4	LED Tube	3	1	20	0.4	24	9
27	2nd Floor	Physics LAB	LED Tube	5	1	20	0.6	24	14
28	2nd Floor	Passage	LED Tube	3	1	20	0.4	24	9
29	3rd Floor	Art Dept.	LED Tube	4	1	20	0.5	24	12
30	3rd Floor	Botany Lab	LED Tube	4	1	20	0.5	24	12

Sr. No.	Floor	Location	Light Type	Qty	Usage factor	Wattage	Daily consumption(kWh)	Monthly Working Days	Monthly consumption(kWh)
31	3rd Floor	Carrier Katta Cell	LED Tube	2	1	20	0.2	24	6
32	3rd Floor	Boys Common Room	LED Tube	2	1	20	0.2	24	6
33	3rd Floor	T-1	LED Tube	4	1	20	0.5	24	12
34	3rd Floor	T-2	LED Tube	4	1	20	0.5	24	12
35	3rd Floor	T-3	LED Tube	4	1	20	0.5	24	12
36	3rd Floor	Department of Geography	LED Tube	4	1	20	0.5	24	12
37	3rd Floor	Passage	LED Tube	2	1	20	0.2	24	6
Total				**154**					**444**

With the help of pie chart area wise monthly energy consumption of LED tube lights is shown below.



3.4 Connected Load List – Ceiling Fans

Sr. No.	Building	Location	Fan Type	Wattage	Total Qty	Daily Consumption (kWh)	Monthly Working Days	Monthly Consumption (kWh)
1	Ground Floor	Office	Ceiling fan	75w	5	11.25	24	270
2	Ground Floor	Principle Cabin	Ceiling fan	75w	2	1.8	24	43.2
3	Ground Floor	Staff Room	Ceiling fan	75w	2	1.8	24	43.2
4	Ground Floor	Chemistry Lab	Ceiling fan	75w	3	4.05	24	97.2
5	Ground Floor	IQAC	Ceiling fan	75w	2	1.8	24	43.2
6	Ground Floor	Gymkhana	Ceiling fan	75w	2	1.8	24	43.2
7	Ground Floor	Store+ Pantry	Ceiling fan	75w	2	1.8	24	43.2
8	Ground Floor	Computer Lab	Ceiling fan	75w	2	1.8	24	43.2
9	1st Floor	Commerce	Ceiling fan	75w	3	4.05	24	97.2
10	1st Floor	Physical chemistry Lab	Ceiling fan	75w	4	7.2	24	172.8
11	1st Floor	Seminar Hall	Ceiling fan	75w	10	45	24	1080
12	1st Floor	Library	Ceiling fan	75w	6	16.2	24	388.8
13	1st Floor	Class F-1	Ceiling fan	75w	4	7.2	24	172.8
14	1st Floor	Class F-2	Ceiling fan	75w	4	7.2	24	172.8
15	2nd Floor	Class & language Lab.	Ceiling fan	75w	4	7.2	24	172.8
16	2nd Floor	Zoology Dept. S2	Ceiling fan	75w	5	11.25	24	270

Sr. No.	Building	Location	Fan Type	Wattage	Total Qty	Daily Consumption (kWh)	Monthly Working Days	Monthly Consumption (kWh)
17	2nd Floor	Physics LAB F-7	Ceiling fan	75w	3	4.05	24	97.2
18	2nd Floor	Exam. Dept.	Ceiling fan	75w	1	0.45	24	10.8
19	2nd Floor	Class Room S-1	Ceiling fan	75w	3	4.05	24	97.2
20	2nd Floor	Class Room S-2	Ceiling fan	75w	3	4.05	24	97.2
21	2nd Floor	Class Room S-3	Ceiling fan	75w	4	7.2	24	172.8
22	2nd Floor	Class Room S-4	Ceiling fan	75w	4	7.2	24	172.8
23	3rd Floor	Art Dept.	Ceiling fan	75w	5	11.25	24	270
24	3rd Floor	Botany Lab	Ceiling fan	75w	5	11.25	24	270
25	3rd Floor	Department of Geography	Ceiling fan	75w	3	4.05	24	97.2
26	3rd Floor	Carrier Katta	Ceiling fan	75w	1	0.45	24	10.8
27	3rd Floor	Boys common Room	Ceiling fan	75w	1	0.45	24	10.8
28	3rd Floor	Class Room T-1	Ceiling fan	75w	4	7.2	24	172.8
29	3rd Floor	Class Room T-2	Ceiling fan	75w	3	4.05	24	97.2
30	3rd Floor	Class Room T-3	Ceiling fan	75w	4	7.2	24	172.8
Total-					**104**	**204.3**		**4903.2**

3.5 Connected Load List – Wall Mounted and Exhaust Fans

Sr. No.	Floor	Location	Type of Load	Qty	Wattage (kW)	Hours of usage	No of Days in a month	Monthly consumption (kWh)
1	Ground Floor	Gymkhana	Wall Mounted Fan	1	75.0	6	24	10.8
2	Ground Floor	Office	Wall Mounted Fan	2	75.0	6	24	21.6
3	Ground Floor	Chemistry Lab	Exhaust Fan	4	75.0	6	24	43.2
4	Ground Floor	Toilet	Exhaust Fan	1	75.0	6	24	10.8
5	Ground Floor	Physical Chemistry Lab.	Exhaust Fan	1	75.0	6	24	10.8
6	Ground Floor	NSS Cell, Alumni-Placement Cell, Reservation Cell, Ladies Common Room	Wall Mounted Fan	5	75.0	6	24	54
Total				**14**				**151.2**

3.6 Connected Load List – Inverters

Sr No	Floor	Location	Utility	Rating (VA)	Total Quantity
1	Ground Floor	Office	Inverter	1600	1
2	Ground Floor	Office	Inverter	150	1
3	Ground Floor	Physical Chemistry LAB	Inverter	150	1
4	Ground Floor	Exam Dept	Inverter	150	1

3.7 Energy Saving Measures

Replacement of conventional ceiling fans with energy efficient ceiling fans

Parameter	Unit	Value
Present fan type		Conventional ceiling fan
Present wattage of ceiling fans	watt	75
Total no.of fans installed	Nos.	104
Present load of ceiling fans	kW	34.05
Present monthly energy consumption of ceiling fans	kWh	730.35
Recommended fan type		Energy Efficient BLDC fan
New Estimated wattage of fan	watt	40
Estimated load of ceiling fan	kW	18.16
Power saving	kW	15.89
% Savings	%	47%
New Estimated monthly energy consumption	kWh	390
Estimated annual energy savings	kWh	4090
Estimated annual carbon emission reduction	Tons	3.3
Estimated annual monetary savings	Rs	74333
Estimated investment for 1 fan	Rs	3500
Estimated total investment	Rs	1180400

4 Awareness of Renewable Energy

College has been taking efforts to create the awareness of solar energy among the students and in nearby villages. Department of Physics organized Same Activities to promote the benefits of solar energy.

Following are the some images showing initiative taken by college to create the awareness of renewable energy such as solar, biogas etc.

Requirements of NAAC

4.1 Alternative Energy Initiative

4.1.1 Percentage of lighting power requirement met through LED bulbs

= (Lighting power requirement met through LED bulbs / Total lighting power requirement) X 100

= (154/154) X 100

= **100 %**

4.1.2 Percentage of lighting power requirement met through renewable energy sources

= (Lighting power required met through renewable sources / Total lighting power requirement) X 100

= (0 / 19659) X 100

= **0 %**

5 Green Audit

Green audit was initiated with the beginning of 1970s with the motive of inspecting the work conducted within the organizations whose exercises can cause risk to the health of inhabitants and the environment. It exposes the authenticity of the proclamations made by multinational companies, armies and national governments with the concern of health issues as the consequences of environmental pollution. It is the duty of organizations to carry out the Green Audits of their ongoing processes for various reasons such as; to make sure whether they are performing in accordance with relevant rules and regulations, to improve the procedures and ability of materials, to analyze the potential duties and to determine a way which can lower the cost and add to the revenue. Through Green Audit, one gets a direction as how to improve the condition of environment and there are various factors that have determined the growth of carrying out Green Audit. Some of the incidents like Bhopal Gas Tragedy (Bhopal; 1984), Chernobyl Catastrophe (Ukraine; 1986) and Exxon-Valdez Oil Spill (Alaska; 1989) have cautioned the industries that setting corporate strategies for environmental security elements have no meaning until they are implemented.

Green Audit is assigned to the Criteria 7 of NAAC, National Assessment and Accreditation Council which is a self-governing organization of India that declares the institutions as Grade a, Grade B or Grade C according to the scores assigned at the time of accreditation.

The intention of organizing Green Audit is to upgrade the environment condition in and around the institutes, colleges, companies and other organizations. It is carried out with the aid of performing tasks like waste management, energy saving and others to turn into a better environmental friendly institute.

5.1 Goals of Green Audit

- The objective of carrying out Green Audit is securing the environment and cut down the threats posed to human health.
- To make sure that rules and regulations are taken care of
- To avoid the interruptions in environment that are more difficult to handle and their correction requires high cost.
- To suggest the best protocols for adding to sustainable development

5.2 Benefits of Green Audit

- It would help to shield the environment
- Recognize the cost saving methods through waste minimizing and managing
- Point out the prevailing and forthcoming complications
- Authenticate conformity with the implemented laws
- Empower the organizations to frame a better environmental performance

- It portrays a good image of a company which helps building better relationships with the group of stakeholders
- Enhance the alertness for environmental guidelines and duties

6 Initiatives by College

6.1 Tree Plantation

Tree-planting is the process of transplanting tree seedlings, generally for forestry, land reclamation, or landscaping purpose. It differs from the transplantation of larger trees in arboriculture, and from the lower cost but slower and less reliable distribution of tree seeds.

In silviculture the activity is known as reforestation, or afforestation, depending on whether the area being planted has or has not recently been forested. It involves planting seedlings over an area of land where the forest has been harvested or damaged by fire, disease or human activity. Tree planting is carried out in many different parts of the world, and strategies may differ widely across nations and regions and among individual reforestation companies. Tree planting is grounded in forest science, and if performed properly can result in the successful regeneration of a deforested area. Reforestation is the commercial logging industry's answer to the large-scale destruction of old growth forests, but a planted forest rarely replicates the biodiversity and complexity of a natural forest.

Because trees remove carbon dioxide from the air as they grow, tree planting can be used as agro engineering technique to remove $CO_2$from the atmosphere. Desert greening projects are also motivated by improved biodiversity and reclamation of natural water systems, but also improved economy and social welfare due to increased number of jobs in farming and forestry.

College has planted the trees campus area to make it more environments friendly. Below are the some records, photos which shows the

Following is the list of trees planted in college campus

Sr.No	Common Name	Botanical Name	Family	No. of Plants
1	Adulsa	Adathoda vesica	Acanthaceae	1
2	Aloe (Korphad)	Aloe Vera	Aloaceae	5
3	Amala	Phyllanthus emblica	Euphorbiaceous	1
4	Pimple	Ficus religiosa	Moraceae	1
5	Vad(Banyan tree)	Ficus urostigma	Moraceae	1
6	Birds Nest	Sansevieria trifasciata	Asparagaceae	Many

Sr.No	Common Name	Botanical Name	Family	No. of Plants
7	Acer palmatum	Acer palmatum	Sapindaceae	4
8	Butterfly(Summer lilac)	Buddleia davidii	Scrophulariaceae	1
9	Garden kiwi fruit	Actinidia chinensis	Actinidiaceae	2
10	Black locust	Robinia pseudoacacia	Fabaceae	7
11	European ash	Fraxinus excelsior	Oleaceae	1
12	Travel palm	Ravenala madagascariensis	Strelitziaceae	4
13	Garden Croton	Codiaeum varigatum	Euphorbiaceous	6
14	Bougainvillea	Bougainvillea spectabilis	Nyctoginaceae	3
15	Canna (Kardal)	Canna indica	Cannaceae	
16	Cape honey suckle	Tecomacapensis	Bignoniaceae	4
17	Tecoma stans	Tecoma stans	Bignoniaceae	9
18	Arjuna	Terminalia arjuna	Combretaceae	1
19	Copper Plant	Acalpha hispida	Euphorbiaceous	10
20	Ceasalpina (Shankasur)	CesalpinaPulcherima	Caesalpinaceae	2
21	Century plant	Agave americana	Agavaceae	5
22	Chapha (White Frangipani)	Plumeriarubra	Apocynaceae	4
23	Prunus(Cheri pulm)	Prunusavium	Rosaceae	8
24	Chiku	Mahilkarazapata	Sapotaceae	6
25	Coconut	Cocosnucifera	Arecaceae	11
26	Cascabela	Cascabela thevetia	Apocynaceae	Many
27	Bel	Aegle marmelos	Rutaceae	1
28	Crape Jasmin	Taberna emontanadivaricata	Apocynaceae	

Sr.No	Common Name	Botanical Name	Family	No. of Plants 1
29	Cycus	Cycusrevoluta	Cycadaceae	6
30	Dracaena	Dracaena fragrans	Agavaceae	12
31	Dracaena	Dracaena reflexa	Agavaceae	6
32	Duranda	Durantaerecta	Verbenaceae	Many
33	Eilconia (Palm)	Eilconia (Palm)		4
34	Fern	Nephrolepiscordifolia	Nephrolepidaceae	10
35	Garden croton	Codiaeumvariegatum	Euphorbiaceous	4
36	Cupressus	Cupressus arizonica	Cupressaceae	9
37	Christmas tree	Aracaria columnaris	Araucariaceae	3
38	Guava (Peru)	Psidiumguajava	Myrtaceae	1
39	Gulmohar	Delonixregia	Caesalpinaceae	5
40	Hibiscus (Jaswand)	Hibiscus rosasinensis	Malvaceae	6
41	Jamun	Syzygiumcumini	Myrtaceae	2
42	Jatropha	Jatropha integerrima	Euphorbiaceous	1
43	Jangali Aapta	Bauhinia racemosa	Caesalpinaceae	4
44	Krushnkamal (Blue passionflower)	Passifloracaerulea	Passifloraceae	1
45	Lady Palm	Lady palm	Arecaceae	5
46	Lemon	Citrus maxima	Rutaceae	2
47	Orange jessamine	Murraya paniculata	Rutaceae	2
48	Mango	Magniferaindica	Anacardiaceae	5
49	Star Jasmine	Trachelospermum jasminoides	Apocynaceae	1
50	Neem	Azadirectaindica	Meliaceae	6

Sr.No	Common Name	Botanical Name	Family	No. of Plants
51	Nerium(Kanher)	Neriumoliander	Appocynaceae	10
52	Cordyline	Cordylin efruticosa	Agavaceae	1
53	Caryota(Palm Tree)	Caryota maxima	Arecaceae	3
54	Panphuti	Bryophyllum pinnatum	Crassulaceae	10
55	Parijatak (Beauty Bush)	Kolkwitziaamabilis	Caprifoliaceae	4
56	Redbird Flower	Pedilanthustithymaloids	Euphorbiaceous	1
57	Rose	Rosa	Rosaceae	9
58	Rui (Calotropis)	Calotropisgigantia	Asclepidaceae	4
59	Sadaphuli (Magnolia)	Magnolia grandifora	Magnoliaceae	Many
60	Saptparni (White Cheese wood)	Alstoniascholaris	Apocynaceae	3
61	Shatavari (Asparagus fern)	Asparagus setaceus	Asparagaceae	3
62	Snake Plant	Sansevieriatrifasciata	Agavaceae	10
63	Spider Plant	Chlorophytumcomosum	Liliaceae	7
64	Starfruit	Averrhoacarambola	Oxalidaceae	1
65	Subabhul	Leucaenaleucocephala	Fabaceae	
66	Sugar apple(Sitaphal)	Annonasqumosa	Annonaceae	2
67	Swamp Mahogany	Eucalyptus robusta	Myrtaceae	2
68	Thuja	Paticladusoriantalis	Cupressaceae	2
69	Weeping fig	Ficus retusa	Moraceae	5
Total Plants				271


PLANT
NURSERY
Medicinal Plant Nursery
Shot on vivo S1
AI Triple Camera


BOTANICAL
GARDEN
Latitude: 19.516382
Longitude: 74.368692
Elevation: 564.2±16 m
Accuracy: 34.9 m
Time: 15-12-2023 10:04
Note: Botanical garden


Latitude: 19.516193
Longitude: 74.368662
Elevation: 563.09±8 m
Accuracy: 11.0 m
Time: 15-12-2023 10:09
Note: green campus

6.2 Vermiculture and Vermicomposting

6.2.1 Introduction

Earthworms have been on the Earth for over 20 million years. In this time they have faithfully done their part to keep the cycle of life continuously moving. Their purpose is simple but very important. They are nature's way of recycling organic nutrients from dead tissues back to living organisms. Many have recognized the value of these worms. Ancient civilizations, earthworms played in soil. "Earthworms are sacred." She recognized the important role the worms played in fertilizing

Charles Darwin was intrigued by the worms and studied them for 39 years. Referring to an earthworm, Darwin said, "It may be doubted whether there are many other animals in the world which have played so important a part in the history of the world." The earthworm is a natural resource of fertility and life.

Earthworms live in the soil and feed on decaying organic material. After digestion, the undigested material moves through the alimentary canal of the earthworm, a thin layer of oil is deposited on the **castings**. This layer erodes over a period of 2 months. So although the plant nutrients are immediately available, they are slowly released to last longer. The process in the alimentary canal of the earthworm transforms organic waste to natural fertilizer.

The chemical changes that organic wastes undergo include deodorizing and neutralizing. This means that the pH of the castings is 7 (neutral) and the castings are odourless. The worm castings also contain bacteria, so the process is continued in the soil, and microbiological activity is promoted.

Vermicomposting is the process of turning organic debris into worm castings. The worm castings are very important to the fertility of the soil. The castings contain high amounts of nitrogen, potassium, phosphorus, calcium, and magnesium. Castings contain: 5 times the available nitrogen, 7 times the available potash, and 1 ½ times more calcium than found in good topsoil. Several researchers have demonstrated that earthworm castings have excellent aeration, porosity, structure, drainage, and moisture-holding capacity. The content of the earthworm castings, along with the natural tillage by the worms burrowing action, enhances the permeability of water in the soil. Worm castings can hold close to nine times their weight in water "Vermiconversion," or using earthworms to convert waste into soil additives, has been done on a relatively small scale for some time. (4) A recommended rate of vermicomposting application is 15-20 percent

6.2.2 Objective

1. To determine the optimal vermicompost/soil admixture for growth of Eudrilus ugenae Ecological recycling of all wastes
2. Production of much needed biofertilisers
3. To provide valuable information for future initiatives at the local farmer.
4. To educate the students, staff, and faculty with regards to the benefits of composting

Suitable species:

The earthworm species (or **composting worms**) most often used are Red Wigglers (*Eisenia foetida* or *Eisenia andrei*), but *Lumbricus rubellus* (a.k.a. red earthworm or dilong (China)) are another breed of worm that can be used but adapt less well to the shallow compost bin than *Eisenia*. African nightcrawlers (*Eudrilus eugenae*) Belgian nightcrawlers. *Lumbricus terrestris* (a.k.a. nightcrawlers or common earthworm are not recommended as they burrow deeper than most compost These species are not the same worms that are found in ordinary soil or on pavement when the soil is flooded by water.

Small-scale vermicomposting is well-suited to turn kitchen waste into high-quality soil amendments, where space is limited. Worms can decompose organic matter without the additional human physical effort (turning the bin) that bin composting requires.

Composting worms which are detritivorous (eaters of trash), such as the red wiggler *Eisenia fetidae*, are epigeic (surface dwellers) together with symbiotic associated microbes are the ideal vectors for decomposing food waste. Common earthworms such as *Lumbricus terrestris* are anecic(deep burrowing) species and hence unsuitable for use in a closed system. Other soil species that contribute include insects, other worms and molds.

PIT SIZE - 8x3x2 feets

FILLING OF PIT:

1) At bottom 2-3 inches thick layer of any bio degradable matter use.

2) Over this layer 2-3 inches thick layer of partly digested cow dung is

put.

3) Prepared by spreading sand layer of 2-4 cm in height over which another layer of equal thickness of soil is added.

4) Water is added to the culture medium so as to hold 25-30% of moisture.

5) Sources of common organic materials are – decayed leaves, hay, straw, rice or wheat bran, vegetable wastes, cow dung, poultry droppings, biogas sludge etc.

6.2.3 Climate and temperature

The most common worms used in composting systems, redworms (*Eisenia foetida, Eisenia andrei,* and *Lumbricus rubellus*) *feed* most rapidly at temperatures of 15–25 °C (59-77 °F). They can survive at 10 °C (50 °F). Temperatures above 30 °C (86 °F) may harm them. This temperature range means that indoor vermicomposting with redworms is suitable in all but tropical climates. (Other worms like Perionyx excavatus are suitable for warmer climates. If a worm bin is kept outside, it should be placed in a sheltered position away from direct sunlight and insulated against frost in winter.

It is necessary to monitor the temperatures of large-scale bin systems (which can have high heat-retentive properties), as the feedstock's used can compost, heating up the worm bins as they decay and killing the worms.

6.2.4 Properties

Vermicompost has been shown to be richer in many nutrients than compost produced by other composting methods. It also has outperformed a commercial plant medium with nutrients added, but needed adjustment for magnesium and PH

Other studies have shown that the effects of home made, backyard, vermicomposting compared to municipal compost were lower in terms of soil microbial biomass soil microbial activity, and yields of a species of ryegrass.

Further, one study concluded that the differences between methods of composting were in large part due to the feedstock, and therefore no generalizations can be made between composts made from varying materials.

It is rich in microbial life which converts nutrients already present in the soil into plant-available forms.

Unlike other compost, worm castings also contain worm mucus which helps prevent nutrients from washing away with the first watering and holds moisture better than plain soil.

6.2.5 Benefits

Soil

- Improves its physical structure.
- Enriches soil with micro-organisms (adding enzymes such as phosphates and cellulose)
- Microbial activity in worm castings is 10 to 20 times higher than in the soil and organic matter that the worm ingests
- Attracts deep-burrowing earthworms already present in the soil
- Improves water holding capacity

Plant growth

- Enhances germination, plant growth, and crop yield
- Improves root growth and structure

- Enriches soil with micro-organisms.

- Bio wastes conversion reduces waste flow to landfills
- Elimination of bio wastes from the waste stream reduces contamination of other recyclables collected in a single bin (a common problem in communities practicing single-stream recycling.
- Creates low-skill jobs at local level
- Low capital investment and relatively simple technologies make vermicomposting practical for less-developed agricultural regions

Environmental

- Helps to close the "metabolic gap" through recycling waste on-site
- Large systems often use temperature control and mechanized harvesting, however other equipment is relatively simple and does not wear out quickly
- Production reduces greenhouse gas emissions such as methane and nitric oxide (produced in landfills or incinerators when not composted or through methane harvest)

6.2.6 Conclusion

The results of this study seem to indicate that an optimal vermicomposting/soil admixture is 15% earthworm castings.

Worms not only improve the soil, but when worms are used to compost, they also recycle waste products that could otherwise go to a land fill or harm the environment. Further study of this project could include using different species of plants in the vermicomposting .

An important conclusion of this project is that vermicomposting addresses the social, economic and environmental imperatives of sustainability.

6.3 Rain water harvesting

Last few years the climate change is emerging as foremost challenge and this refers to any change in climatic variables. Rainfall is the key climatic variable, which is highly erratic in nature and can have long-term inferences in respect of its quality and quantity of water. Most of the water resources are rapidly exploited without recharging as a result the scarcity is also rapidly increasing. So to tackle the water scarcity hazards, there is an urgent need to boost the ground water through suitable groundwater resources management. The management of ground water through artificial recharge of rain water by following roof top harvesting has now been accepted world-wide as a cost-effective method to boost ground water in areas having low rainfall and overexploitation without recharging ground water. Rain water harvesting is one of the oldest and easy techniques to collection and storage of rain water at surface or in sub-surface aquifers, before it is lost as surface run-off. The augmented resource can be harvested in the time of need. Since rainwater harvesting and artificial recharge can play a major role in providing sustainability to drinking water sources, such activities can be taken up on a large scale by local communities as various kinds of rainwater harvesting structures through ages have been proved to be quite useful to the society constructed in different parts of the country worldwide.

College has been taking efforts on taking such rain water harvesting activities. Department of Geography running a certificate course on Rain water harvesting.

Below are the some photographs of project