GREEN AUDIT REPORT
CONSULTATION REPORT

Arvindbabu Deshmukh Mahavidyalaya
Bharsingi, Pin – 441305, Nagpur
India

PREPARED BY

EMPIRICAL EXERGY PRIVATE LIMITED

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Year: 2020-21

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ACKNOWLEDGEMENT

Empirical Exergy Private Limited (EEPL), Indore takes this opportunity to appreciate & thank the management of **Arvindbabu Deshmukh Mahavidyalaya Bharsingi, Nagpur** for giving us an opportunity to conduct green audit for the college.

We are indeed touched by the helpful attitude and co-operation of all faculties and technical staff, who rendered their valuable assistance and co-operation the course of study.

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Rajesh Kumar Singadiya

(Director)

M.Tech (Energy Management), PhD (Research Scholar)
Accredited Energy Auditor [AEA-0284]
Certified Energy Auditor [CEA-7271]
(BEE, Ministry of Power, Govt. of India)
Empanelled Energy Auditor with MPUVN, Bhopal M.P.
Lead Auditor ISO50001:2011 [EnMS] from FICCI, Delhi
Certified Water Auditor (NPC, Govt of India)
Charted Engineer [M-1699118], The Institution of Engineers (India)
Member of ISHRAE [58150]

EXECUTIVE SUMMARY

Green Audit is the most efficient way to identify the strength and weakness of environmentally sustainable practices and to find a way to solve problem. The executive summary of the Green Audit report furnished in this section briefly gives the identified green intiative taken by college and further recommendation for green campus, solid waste management and their impact on carbon foot print in the campus.

GREEN INITIATIVE TAKEN BY THE COLLEGE

CAMPAIGN OF PLANTATION AND GREEN CAMPUS:

❖ College has around **667** no of plant & trees in the campus. Its good initiative taken by management for green campus under the campaign of plantation. **It's APPRECIABLE.**

10 KWp SOLAR PHOTOVOLTAIC ROOFTOP INSTALLATION:

❖ College has 10 KWp solar photovoltaic roof top grid connected system installed on college building. Solar unit generation from June-2020 to July- 2021 by the system is 6,350 units. **It is about 66.14 % of total Energy consumption of the college.**

Solar Unit Generation (July 2020-June-2021)	Grid Unit Consumption (July 2020-June-2021)	Total Unit Consumption (Solar+Grid)	RE Share (%) Year 2020-21
6350	3250	9,600	**66.14%**

↓ Every year college conduct tree plantation activity in college premises, which help to keep campus green.

↓ Proper care has been taken of the plants in premises especially in the season of summer.

↓ College made MOU for the management of E-waste through which yearly E-waste has been managed.

↓ College made MOU for the management of Solid waste, through which management of solid waste done properly

Solid waste Management

- **Waste collection system**
  - ❖ College has three No's dustbin systems for different type of waste generated by different activity of the campus.
  - ❖ There are total 39 no. of dustbin in college campus .the details of list of dustbin has provided in chapter-5.

Recommendation for Improvement

- **Recommendation for Herbal & medicinal plants:**
  - ❖ List of recommended of herbal & medicinal plant in annexure list. College management can be purchase above recommended plants in future plantation.
- **SOLID WASTE MANAGEMENT:**

Adopt 5 no's. Dustbin systems:

- ❖ College has three No's dustbin for different type of waste generated by different activity in the campus.The basic principle of good waste management practice is based on the concept of 3Rs, namely, reduce, recycle, and reuse. All the degradable and non-degradable waste material are collected and processed in environmentally friendly way in the College campus.
- ❖ It is recommended to adopt 5 no's dustbin systems for collection of different type of waste material.

Organic converter for kitchen waste:

- ❖ There is good potential to install organic converter for kitchen waste. The output of the organic converter is good manure for plant.

- **QR CODE SYSTEM ON TREE: -**

  While the world seems to be going digital, people lack the time to read books and process the information they contain. Hence, College can be provided QR codes on the trees for its information and to exploit the rapidly growing platform for a unique purpose.

- **AIR MONITORING SYSTEM: -**

  Installation of **"Cloud based (IoT based) Air Quality monitoring system in the Campus"** to monitor air quality index for college campus.

CHAPTER-1
INTRODUCTION

1.1 About College

Arvindbabu Deshmukh College of Arts, Science and Commerce also well known as AD College, was established in 1986. In its journey during the past 35 years it has grown in strength from 75 students from its inception to a total strength of 2000 students today. Also there are 1300 students studying in YCMOU through this college. Under the affiliation of Rashtrasant Tukadoji Maharaj University of Nagpur. College offers undergraduate and post graduates programs like B.A., B.Com. From 1986 and later in 2008 B.Sc. and M.A. have been started. The college is also identified as community college under scheme of UGC and running a skill oriented diploma course in Welding and Fabrication. Beside that the college also runs as-on courses like Fashion designing and Communicative English. Listed in first top ten for the graduation course in mass media. College having units such as N.S.S. of 250 students, college awarded with best college for N.S.S. by R.T.M.N.U., Nagpur. College having very active sport department. Every year students are performed at National, State, University level and received Gold, Silver and bronze medal. Our college organized International, National, State and University level Conferences, Seminars and Workshops in various subjects. College is popular for its cultural, sports and drama activities and infrastructural facilities.

Fig 1.1 – Satellites Image of college from Google map

VISION

To become a centre of quality education by promoting high academic and social pursuit and competencies of students of rural region for all round development

MISSION

- To impart higher education for all round development of students of rural area and provide them an opportunity to made them competent for development in society
- The priority of the institution is to bring academic excellence along with personality development to compete with the rest of the world.
- The institution is located in the remote area so maximum students belong to backward communities and socio – economically weaker section so provide them opportunity to make themselves competent.
- To provide opportunity in future by providing them quality education, skilled base programme, competitive examination guidance, sports facility etc.

Name of Department:

The following details of department in given below,

Sr. No.	Name of Teaching Departments
1	Department of Marathi
2	Department of English
3	Department of History
4	Department of Political science
5	Department of Economics
6	Department of Music
7	Department of Home-economics
8	Department of Chemistry
9	Department of Botany
10	Department of Zoology
11	Department of Physics
12	Department of Mathematics
13	Department of Commerce

Sr. No.	Floor	Department
1.	Ground floor	Administration office, Principal cabin, Classrooms
2.	First floor	Examination cell, IQAC room, Classrooms, Computer lab
3.	Second Floor	Science Laboratory, Audio visual hall, classroom, Girls common room
4.	Third floor	Classrooms, Boys common room
5.	Indoor stadium area	Indoor stadium, gymnasium, college canteen,
6.	Girls hostel	Hostel rooms, Canteen, warden room
7.	Playground	Playground, Basketball court, parking

Fig. - College campus

1.2 About College Infrastructure:

The college is spread over 5807.379 M^2 plenty of open space and sports area interspersed within academic buildings. The details of various department and building are given below:

Table1.1 :- Name of the various Building in the college

Sr. No.	Building	Department
1.	Main Building	3033.115 Sq. M.
2.	Indoor	1176. 15 Sq. M.
3.	Hostel	1458.114 Sq. M.
4.	Canteen	140 Sq. M.

Fig.-Some pics of College campus

1.3 Master Plan of Campus:-
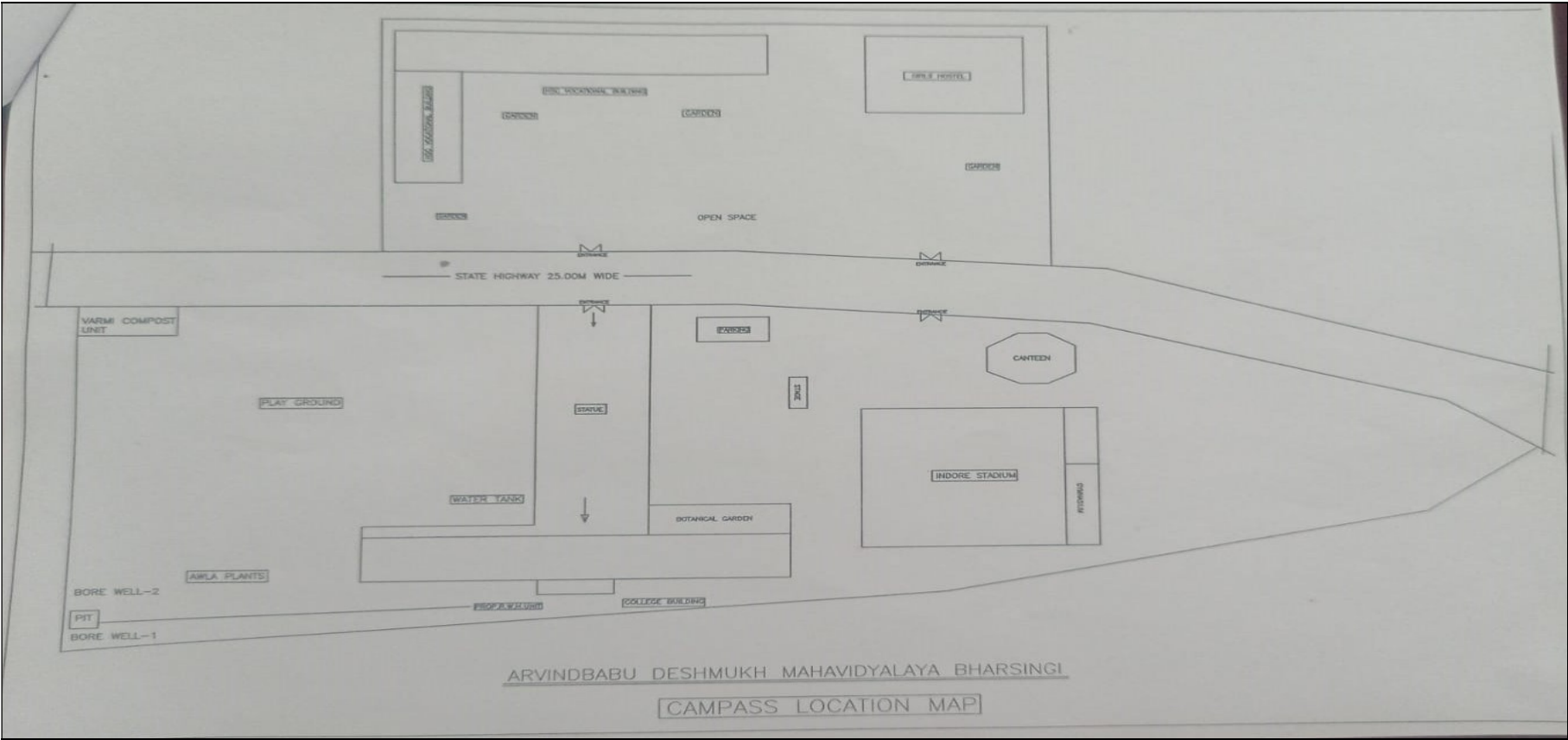
Fig.-1.2 College Layout of Various Buildings

1.4 Green Monitoring Committee

NAAC Re-accredited with 'B'" Grade
VSPM Academy of Higher Education

Dr. Prakash Pawar
Officiating Principal

ARVINDBABU DESHMUKH MAHAVIDYALAYA
BHARSINGI, Dist. Nagpur - 441305

Ref.No. : ADM/2022/117

Date 12/02

Energy, Environment & Green audit committee

Energy, Environment & Green audit committee consist of following members.

Sr. No.	Name	Designation
1.	Dr. P. D. Pawar	Chairperson
2.	Dr. M.M. Varma	Convener
3.	Dr. S. B. Thakare	Member
4.	Dr. S. P. Gudadhe	Member
5.	Dr. A. R. Gharpure	Member
6.	Dr. A. L. Gadre	Member
7.	Dr. S. R. Bansod	Member
8.	Mr. S. R. Sinkar	Member
9.	Mr. B. B. Madhavi	Member
10.	Mr. C.B. Barapatre	Administrative Member

This committee working period is for 03 year up to June 2024 and after that committee will be reconstructed.

Off. Principal
Arvindbabu Deshmukh Mahavidyalaya,
Bharsingi Dist. Nagpur

e-mail : admv_bharsingi@rediffmail.com   website : www.adm.edu.in, Ph : 07105-233533, 233330

1.5 Integrated Energy, Environment & Green Policy

STD : 07105

Ph : 233329

NAAC Re-accredited with 'B'" Grade

VSPM Academy of Higher Education

ARVINDBABU DESHMUKH MAHAVIDYALAYA

Dr. Prakash Pawar
Officiating Principal

BHARSINGI, Dist. Nagpur - 441305
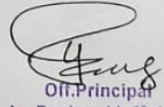
Ref.No. : ADM/2022/117

Date 12/02/202

Integrated Energy, Environment & Green Policy

Management of our institution is committed to go green for making our nation to Atma-Nirbhar (Self-Sustainable) in area of energy and environment.

Our emphasis is to:-

- Ensure continuous enhancement in our energy and water conservation and usage.
- Continuous monitoring the energy consumption pattern through periodic reviews and using latest informative system.
- Procure and use energy efficient equipment's and products.
- Create awareness regarding necessity of energy conservation and making environment pollution free to all the stakeholders by arranging awareness activity such as seminar, webinar, rallies and guest lectures etc.
- Carry out regular energy, environment and green audit by certified auditors to identify the areas for improvement.

Off.Principal
Arvindbabu Deshmukh Mahavidyalaya,
Bharsingi Dist. Nagpur

e-mail : admv_bharsingi@rediffmail.com   website : www.adm.edu.in, Ph : 07105-233533, 233330

1. 6 The Audit Team

The study team constituted of the following senior technical executives from **Empirical Exergy Private Limited,**

- Mr. Rajesh Kumar Singadiya, [Director & Accredited Energy Auditor , AEA-0284]
- Mr. Rakesh Pathak, [Director]
- Mrs. Laxmi Raikwar Singadiya,[Energy Engineer]
- Mr. Lokesh Kumar Verma, [Project Engineer]
- Mr. Ajay Nahra, [Site Engineer]

1.7 About Green Auditing

Eco campus is concepts implemented in many educational institutions, all over the world to make them sustainable because of their mass resource utilization and waste discharge in to the environment.

Green audit means to identify opportunities to sustainable development practices, enhance environmental quality, improve health, hygiene and safety, reduce liabilities achieve values of virtue. Green audit also provides a basis for calculating the economic benefits of resource conservation projects by establishing the current rates of resource use and their associated costs.

Green auditing of college enables to assess the life style, action and its impact on the environment. This green audit was mainly focused on greening indicators like utilisation of green energy (solar energy) and optimum use of secondary energy sources (petrol and diesel) in the College campus, vegetation, and carbon foot print of the campus etc. The aim of green auditing is to help the institution to apply sustainable development practices and to set examples before the community and young learners.

1.8 Objectives of Green Auditing

The general objective of green audit is to prepare a baseline report on Plant &Trees, Alternative energy sources (solar energy), measures to mitigate resource wastage and improve sustainable practices.

The specific objectives are:

- To inculcate values of sustainable development practices through green audit mechanism.
- Providing a database for corrective actions and future plans.

To identify the gap areas and suggest recommendations to improve the green campus status of the College.

1.9 Target Areas of Green Auditing

Green audit forms part of a resource management process. Although they are individual events, the real value of green audit is the fact that they are carried out, at defined intervals, and their results can illustrate improvement or change over time. Target areas included in this green auditing is plant trees, green energy and carbon foot print.

CHAPTER- 2
GREEN CAMPUS & SUSTAINABLE DEVELOPMENT

2.1 Green Audit

In the survey, focus has been given on assessment of present status of diversity in form of plants, in college campus and efforts made by the College authorities for nature conservation. Campus is located in the vicinity of approximately more than 667 trees/ medicinal herbs/ ornamental plants. The detail is given below:

Fig- 2.1 Green Campus of College

2.2 Details of Name of Tree/Plant with Quantity in College Campus

Table -2.1 Details of Name of Tree/Plant with Quantity in College Campus

Sr.No.	Name of Tree/Plant	Quantity
1	Abies sp.	3
2	Abrusprecatorius	2
3	Acacia leucophloea	3
4	Acasianilotica	3
5	Acoruscalamus	1
6	Agave sp.	5
7	Allium ursinum	1
8	Alstoniascholaris	2
9	Amomumsubulatum	1
10	Annonasquamosa	3
11	Argeria nervosa	1
12	Averrhoecarambola	1
13	Azadirachtaindica	43
14	Bamboo sp.	9
15	Bixaoreliana	1
16	Bougainvillea glabra	16
17	Buteamonosperma	3
18	Caesalpiniabonduc	1
19	Calatropisprocera	2
20	Canna sp.	1
21	Carissa carandas	6
22	Cassia fistula	2
23	Chamaecostuscuspidatus	1
24	Cinnamomumverum	1
25	Citrus lemon	1
26	Couropitaguianensis	1
27	Cycas sp.	6
28	Delonixregia	1
29	Dhatura alba	6
30	Eichhorniacrassipes	7
31	Equisetum	1
32	Euphorbia milli	15
33	Ficuscarica	1

34	Ficuselastica	2
35	Ficus sp.1	24
36	Ficus sp.2	9
37	Gymnemasylvestre	1
38	Holopteleaintegrifolia	1
39	Hydrilla sp.	1
40	Ixora sp.	17
41	Jasmine	9
42	Jatrophaintegerrima	1
43	Justiciaadhatoda	2
44	Lantana camara	25
45	Lawsoniainermis	70
46	Lily	4
47	Madhukaindica	2
48	Marsilea sp.	5
49	Mesuaferrea	1
50	Moringaoleifera	7
51	Murrayakoenigii	1
52	Musa sp.	1
53	Myristicafragrans	1
54	Neolamarkiakadamba	2
55	Nerium sp.	10
56	Ocimumtenuiflorum	1
57	Oroxylumindicum	1
58	Palm sp.	5
59	Passiflorafoetida	1
60	Passifloraincarnata	1
61	Phyllanthusemblica	34
62	Piper longum	1
63	Pisonia alba	1
64	Pistiastratiotes	25
65	Pithocelobiumdulci	1
66	Plumaria alba	7
67	Polyalthialongifolia	48
68	Pongamiapinnata	19
69	Premnaintegrifolia	1
70	Prunusdulcis	12
71	Psidiumguajava	1
72	Pterocarpussantalinus	1

73	Putranjivaroxburgii	1
74	Roses varieties	16
75	Royal Palm sp.	12
76	Santalum album	3
77	Saracaasoka	1
78	Sciziziumcumini	1
79	Tecomastans	2
80	Tectonagrandis	55
81	Thevetiaperuviana	5
82	Thuja sp.	54
83	Zizipuszuzuba	10

2.3 Some photograph of Green Campus in College

Fig.2.2 - Some photograph of college green campus

2.4 CO$_2$ Sequestration calculation: Based on list of tree & plant in the campus CO$_2$ Sequestration is calculated in table 2.2.

Table: 2.2 - CO$_2$ Sequestered by the trees having age between 05 to 15 Years

Sr. no	Common Name	Average Diameter (25 to 100) in cm	AGB	BGB	Total	Carbon Storage	Amount of CO$_2$Sequestered	No of Tree	Total Amount of CO$_2$ Sequestered	Annually CO$_2$ Sequestered amount
1	Abies sp.	75	3248.258	487.24	3735.50	1867.748	6847.164	3	6354168.56	86663.51
2	Abrusprecatorius	60	1994.490	299.17	2293.66	1146.832	4204.285	2	475084.23	6479.60
3	Acacia leucophloea	50	1328.370	199.26	1527.63	763.813	2800.138	3	1089253.50	14856.16
4	Acasianilotica	50	1328.370	199.26	1527.63	763.813	2800.138	3	1327265.19	18102.36
5	Acoruscalamus	40	798.030	119.70	917.73	458.867	1682.207	1	334759.26	4565.73
6	Agave sp.	55	1644.458	246.67	1891.13	945.563	3466.434	5	121325.20	1654.74
7	Allium ursinum	40	798.030	119.70	917.73	458.867	1682.207	1	72334.92	986.56
8	Alstoniascholaris	65	2378.468	356.77	2735.24	1367.619	5013.691	2	65177.98	888.95
9	Amomumsubulatum	30	403.470	60.52	463.99	231.995	850.495	1	83348.47	1136.78
10	Annonasquamosa	30	403.470	60.52	463.99	231.995	850.495	3	74843.52	1020.78
11	Argeria nervosa	30	403.470	60.52	463.99	231.995	850.495	1	73993.03	1009.18
12	Averrhoecarambola	35	583.778	87.57	671.34	335.672	1230.574	1	35686.64	486.72
13	Azadirachtaindica	45	1046.228	156.93	1203.16	601.581	2205.395	43	430052.08	5865.41
14	Bamboo sp.	50	1328.370	199.26	1527.63	763.813	2800.138	9	84004.13	1145.72
15	Bixaoreliana	36	623.912	93.59	717.50	358.750	1315.176	1	36824.93	502.25
16	Bougainvillea glabra	35	583.778	87.57	671.34	335.672	1230.574	16	15997.46	218.19
17	Buteamonosperma	45	1046.228	156.93	1203.16	601.581	2205.395	3	165404.64	2255.93
18	Caesalpiniabonduc	60	1994.490	299.17	2293.66	1146.832	4204.285	1	2358603.99	32168.63
19	Calatropisprocera	45	1046.228	156.93	1203.16	601.581	2205.395	2	381533.38	5203.67
20	Canna sp.	40	798.030	119.70	917.73	458.867	1682.207	1	713255.91	9727.99

21	Carissa carandas	30	403.470	60.52	463.99	231.995	850.495	6	425247.29	5799.88
22	Cassia fistula	65	2378.468	356.77	2735.24	1367.619	5013.691	2	1644490.51	22428.95
23	Chamaecostuscuspidatus	65	2378.468	356.77	2735.24	1367.619	5013.691	1	265725.60	3624.19
24	Cinnamomumverum	25	257.108	38.57	295.67	147.837	541.970	1	39021.82	532.21
25	Citrus lemon	35	583.778	87.57	671.34	335.672	1230.574	1	6152.87	83.92
26	Couropitaguianensis	36	623.912	93.59	717.50	358.750	1315.176	1	24988.35	340.81
27	Cycas sp.	30	403.470	60.52	463.99	231.995	850.495	6	53581.16	730.79
28	Delonixregia	27	311.579	46.74	358.32	179.158	656.793	1	132015.43	1800.54
29	Dhatura alba	28	340.852	51.13	391.98	195.990	718.498	6	3592.49	49.00
30	Eichhorniacrassipes	30	403.470	60.52	463.99	231.995	850.495	7	68039.57	927.98
31	Equisetum	54	1578.524	236.78	1815.30	907.652	3327.451	1	36601.96	499.21
32	Euphorbia milli	35	583.778	87.57	671.34	335.672	1230.574	15	57836.97	788.83
33	Ficuscarica	37	665.405	99.81	765.22	382.608	1402.641	1	115016.54	1568.69
34	Ficuselastica	45	1046.228	156.93	1203.16	601.581	2205.395	2	22053.95	300.79
35	Ficus sp.1	15	66.218	9.93	76.15	38.075	139.583	24	15493.73	211.32
36	Ficus sp.2	26	283.664	42.55	326.21	163.107	597.950	9	52619.63	717.67
37	Gymnemasylvestre	75	3248.258	487.24	3735.50	1867.748	6847.164	1	1013380.33	13821.34
38	Holopteleaintegrifolia	45	1046.228	156.93	1203.16	601.581	2205.395	1	15437.77	210.55
39	Hydrilla sp.	30	403.470	60.52	463.99	231.995	850.495	1	227932.55	3108.74
40	Ixora sp.	30	403.470	60.52	463.99	231.995	850.495	17	91853.42	1252.77
41	Jasmine	50	1328.370	199.26	1527.63	763.813	2800.138	9	74843.52	1020.78
42	Jatrophaintegerrima	50	1328.370	199.26	1527.63	763.813	2800.138	1	73993.03	1009.18
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46	Lily	65	2378.468	356.77	2735.24	1367.619	5013.691	4	36824.93	502.25
47	Madhukaindica	30	403.470	60.52	463.99	231.995	850.495	2	15997.46	218.19
48	Marsilea sp.	30	403.470	60.52	463.99	231.995	850.495	5	165404.64	2255.93
49	Mesuaferrea	30	403.470	60.52	463.99	231.995	850.495	1	2358603.99	32168.63
50	Moringaoleifera	35	583.778	87.57	671.34	335.672	1230.574	7	381533.38	5203.67
51	Murrayakoenigii	45	1046.228	156.93	1203.16	601.581	2205.395	1	713255.91	9727.99
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56	Ocimumtenuiflorum	60	1994.490	299.17	2293.66	1146.832	4204.285	1	6152.87	83.92
57	Oroxylumindicum	45	1046.228	156.93	1203.16	601.581	2205.395	1	24988.35	340.81
58	Palm sp.	40	798.030	119.70	917.73	458.867	1682.207	5	53581.16	730.79
59	Passiflorafoetida	30	403.470	60.52	463.99	231.995	850.495	1	132015.43	1800.54
60	Passifloraincarnata	65	2378.468	356.77	2735.24	1367.619	5013.691	1	3592.49	49.00
61	Phyllanthusemblica	65	2378.468	356.77	2735.24	1367.619	5013.691	34	68039.57	927.98
62	Piper longum	25	257.108	38.57	295.67	147.837	541.970	1	36601.96	499.21
63	Pisonia alba	35	583.778	87.57	671.34	335.672	1230.574	1	57836.97	788.83
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66	Plumaria alba	27	311.579	46.74	358.32	179.158	656.793	7	15493.73	211.32
67	Polyalthialongifolia	28	340.852	51.13	391.98	195.990	718.498	48	52619.63	717.67
68	Pongamiapinnata	30	403.470	60.52	463.99	231.995	850.495	19	1013380.33	13821.34

69	Premnaintegrifolia	54	1578.524	236.78	1815.30	907.652	3327.451	1	15437.77	210.55
70	Prunusdulcis	35	583.778	87.57	671.34	335.672	1230.574	12	3592.49	49.00
71	Psidiumguajava	37	665.405	99.81	765.22	382.608	1402.641	1	68039.57	927.98
72	Pterocarpussantalinus	45	1046.228	156.93	1203.16	601.581	2205.395	1	36601.96	499.21
73	Putranjivaroxburgii	15	66.218	9.93	76.15	38.075	139.583	1	57836.97	788.83
74	Roses varieties	26	283.664	42.55	326.21	163.107	597.950	16	115016.54	1568.69
75	Royal Palm sp.	75	3248.258	487.24	3735.50	1867.748	6847.164	12	22053.95	300.79
76	Santalum album	45	1046.228	156.93	1203.16	601.581	2205.395	3	15493.73	211.32
77	Saracaasoka	45	1046.228	156.93	1203.16	601.581	1230.574	1	52619.63	717.67
78	Sciziziumcumini	50	1328.370	199.26	1527.63	763.813	2205.395	1	1013380.33	13821.34
79	Tecomastans	36	623.912	93.59	717.50	358.750	2800.138	2	15437.77	210.55
80	Tectonagrandis	35	583.778	87.57	671.34	335.672	1315.176	55	227932.55	3108.74
81	Thevetiaperuviana	45	1046.228	156.93	1203.16	601.581	1230.574	5	6152.87	83.92
82	Thuja sp.	60	1994.490	299.17	2293.66	1146.832	2205.395	54	24988.35	340.81
83	Zizipuszuzuba	45	1046.228	156.93	1203.16	601.581	4204.285	10	53581.16	730.79
	Total							**Total=667**	**25902299.99**	**353277.41**

College has **667 trees** in the campus. This is good initiative taken by management for green campus under the campaign of plantation. **It's**

APPRECIABLE

CHAPTER- 3

GREEN ENERGY AND SUSTAINABLE DEVELOPMENT

3.1 Grid Connected Solar Photovoltaic System (10 KWp)

There is 10 KWp solar photovoltaic roof top grid connected systems installed on college building. System details are given below:

Table 3.1 Solar plant detailed

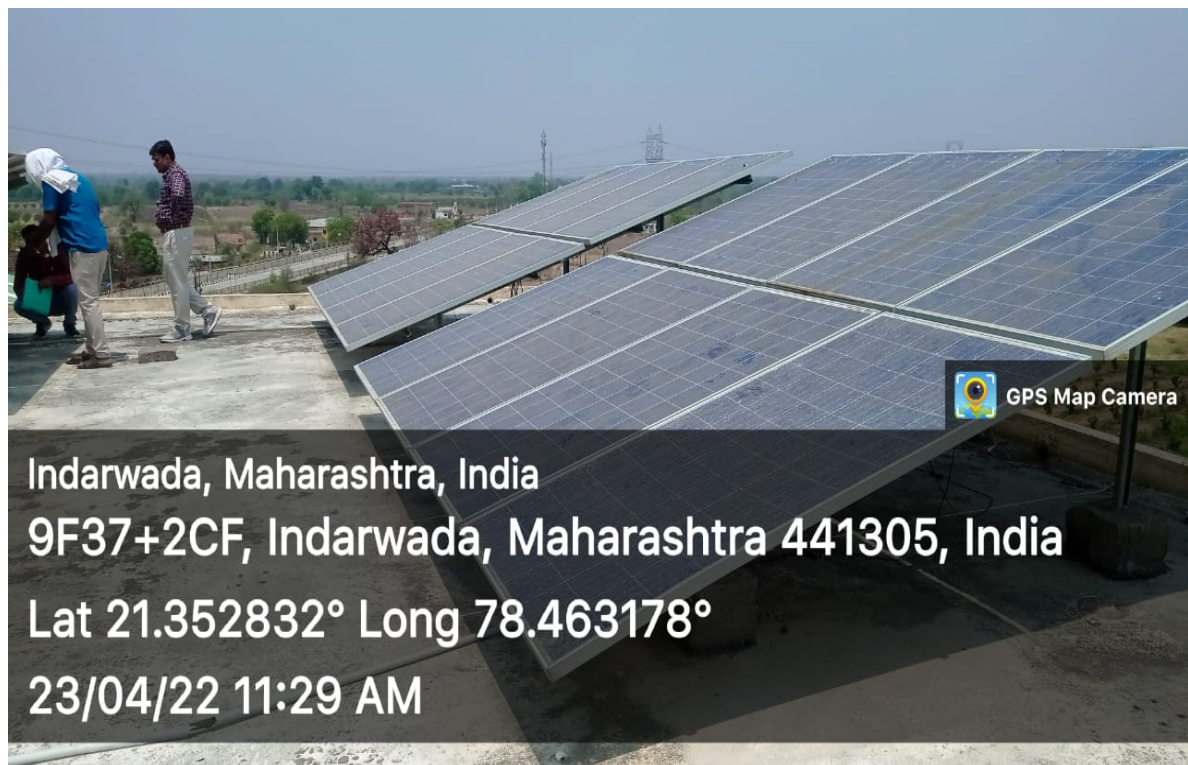| Sr. No	Description	Technical Specification
1	Plant Information	
1.1	Plant capacity	10KWp
1.2	Locations	College building
2	PV Panel Details	
2.1	Make	Gurukrupa Solar Trd.Corp.
2.2	Panel Type	Poly-crystalline
2.3	Panel Wattage	315 Wp
2.4	No of PV Panels	32
2.5	Total Capacity	10 KWp

Figure 3.1 Solar Power Plant (10 KWp)

Table 3.2 Detailed of Solar Unit Generation from Jul-2020 to Jun-2021

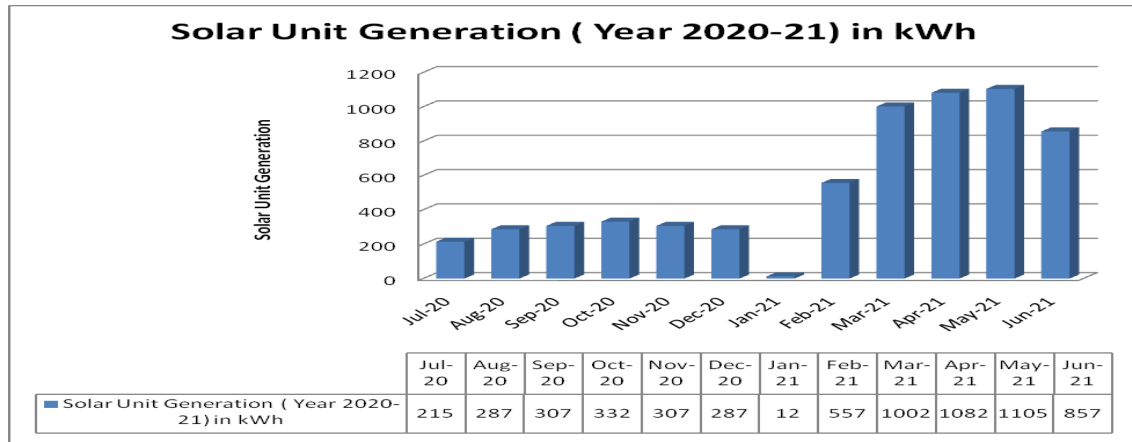| Sr.No.	Month	Unit Generation (Year 2020-21) in kWh
1	Jul-20	215
2	Aug-20	287
3	Sep-20	307
4	Oct-20	332
5	Nov-20	307
6	Dec-20	287
7	Jan-21	12
8	Feb-21	557
9	Mar-21	1002
10	Apr-21	1082
11	May-21	1105
12	Jun-21	857
	Total	**6,350**

Figure: - 3.2 Graphical presentation of Solar unit generation

Table 3.3 - The total CO_2 reduction from solar power generation unit

Sr. No	Parameter	Value	Unit	Emission Factor kg CO_2e/kWh	Emission ton CO_2e/year
1	Solar Units 2020-21	6,350	kWh	0.91	5.77
			Total		**5.77**

The total CO_2 reduction is **5.77 -ton CO2e/year** as up Jul-2020 to Jun-2021. It is big contribution for toward CO_2 emission reduction. (Reference: Central Electricity Authority (CEA) Baseline Carbon Dioxide Emission database http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/database_11.zip) Electricity Purchased from the grid.

Chapter-04
Carbon Foot print

4.1 About carbon foot print.

Climate change is one of the greatest challenges facing nations, governments, institutions, business and mankind today. The total amount of greenhouse gases produced to directly and indirectly support human activities, usually expressed in equivalent tons of carbon dioxide (CO_2).

Carbon footprint is a measure of the impact your activities have on the amount of carbon dioxide (CO_2) produced through the burning of fossil fuels and is expressed as a weight of CO_2 emissions produced in tonnes.

We focus on consumption in each of our five major categories: housing, travel, food, products and services. In addition to these we also estimate the share of national emissions over which we have little control, government purchases and capital investment.

For simplicity and clarity all our calculations follow one basic method. We multiply a use input by an emissions factor to calculate each footprint. All use inputs are per individual and include things like fuel use, distance, calorie consumption and expenditure. Working out your inputs is a matter of estimating them from your home, travel, diet and spending behaviour.

Although working out you inputs can take some investigation on your part the much more challenging aspect of carbon calculations is estimating the appropriate emissions factor to use in your calculation. Where possible you want this emissions factor to account for as much of the relevant life cycle as possible.
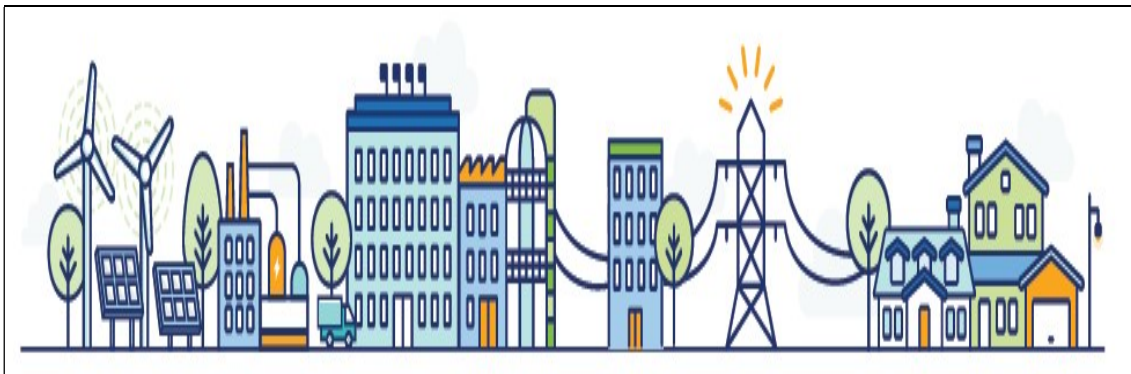
We all have a carbon footprint...

Fig.-4.1 About carbon foot print

4.2 Methodology and Scope

The carbon footprint gives a general overview of the College greenhouse gas emissions, converted into CO_2 -equivalents and it is based on reported data from internal and external systems.

The purposes of the carbon indicators are to measure the carbon intensity per unit of product, in addition to showing environmental transparency towards external stakeholders.

The carbon footprint reporting approach undertaken in this study follows the guidelines and principles set out in the "Greenhouse Gas Protocol Corporate Accounting and Reporting Standard" (hereafter referred to as the GHG Protocol) developed by the Greenhouse Gas Protocol Initiative and international standard for the quantification and reporting of greenhouse gas emissions -ISO 14064.

This is the most widely used and accepted methodology for conducting corporate carbon footprints. The study has assessed carbon emissions from the College Campus. This involves accounting for, and reporting on, the GHG emissions from all those activities for which the company is directly responsible.
The items quantified in this study are as classified under the ISO 14064 standards:

The report calculates the greenhouse gas emissions from the College. This includes electricity, as well as emission associated with diesel consumption in the institute vehicle. The emission associated with air travel, waste generation, administration, and marketing related activities has been excluded from the current study. Emissions from business activities are generally classified as scope 1, 2 or 3 areas classified under the ISO 14064 standards.

4.3 Carbon emission from electricity

Direct emissions factors are widely published and show the number of emissions produced by power stations in order to produce an average kilowatt-hour within that grid region

Unlike with other energy sources the carbon intensity of electricity varies greatly depending on how it is produced and transmitted. For most of us, the electricity we use comes from the grid and is produced from a wide variety of sources. Although working out the carbon intensity of this mix is difficult, most of the work is generally done for us.

Electricity used in the site is the significant contributors towards GHGs emission from the unit. Electricity used onsite is the most direct, and typically the most significant, a contributor to a unit's carbon footprint. Thus, using an average fuel mix of generating electricity, carbon dioxide intensity of electricity for national grid is assumed to be 0.9613 $KgCO_2$/Kwh

(Reference: Central Electricity Authority (CEA) Baseline Carbon Dioxide Emission database http://cea.nic.in/reports/others/thermal/tpece/cdm_co_2/database_11.zip) Electricity Purchased from the grid

Carbon emission from vehicles

In India, it is the third most CO_2 emitting sector, and within the transport sector, road transport contributed more than 90% of total CO_2 emissions (IEA, 2020; Ministry of Environment Forest and Climate Change, 2018)
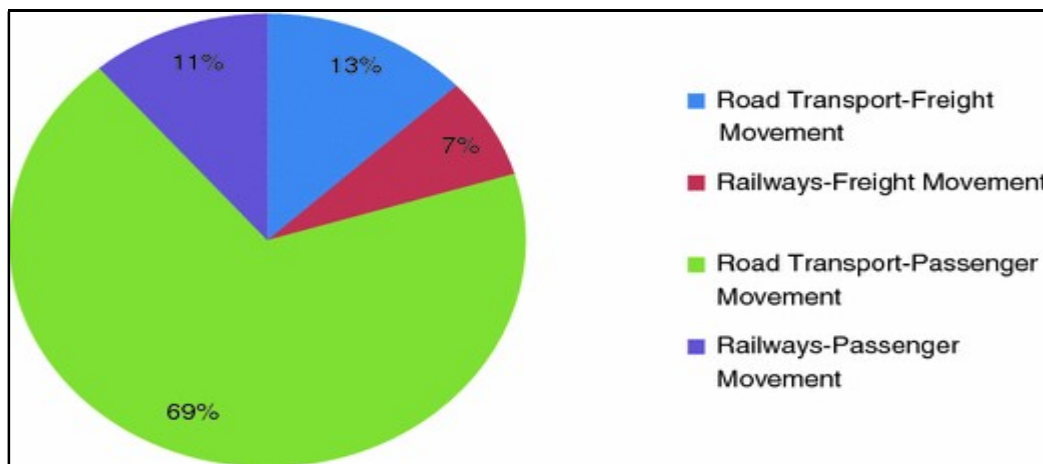
Transportation (29 percent of 2019 greenhouse gas emissions) – The transportation sector generates the largest share of greenhouse gas emissions. Greenhouse gas emissions from transportation primarily come from burning fossil fuel for our cars, trucks, ships, trains, and planes.

4.4 List of vehicles in college

We have also considered the total GHGs emission done by transportation facilities available in campus like Cars, Ambulance, and Buses etc. We consider the different type of vehicles which are operated on petrol and diesel fuels. Energy team was analysed following vehicles are movement for Campus.

4.5 Calculation of Carbon foot print in campus: -

As per discussion by concern department in the college and data provided by management 150 KM per day travel done by all vehicles.

Also, we have estimated value considered 250 bikes run per day approx. 1000 KM by other services like college staff, housekeeping staff, and other

Following details are given in table 4.2: -

Table 4.1 List of vehicle in college campus

Sr. No	Vehicle Type	Fuel type	Average Mileage (Per Litter)	Quantity
1	Car	Diesel	17	10
2	Bus	Diesel	13	1
3	Bike	Petrol	45	22

- ❖ CO_2 Emissions from a gallon of gasoline: 8,887 grams CO_2/ gallon
- ❖ CO_2 Emissions from a gallon of diesel: 10,180 grams CO_2/ gallon

(1 US Gallon = 3.7854 litters)

- ❖ CO_2 Emissions from a Littre of gasoline: 2347.95 grams CO_2/ Litter.
- ❖ CO_2 Emissions from a Littre of diesel: 2689.56 grams CO_2/ litter.

$$\text{Total CO}_2 \text{ Emissions} = \frac{\text{Co2 Per litter}}{\text{Average Mileage (Km/Littre)}} \times \text{Distance (in km)}$$

$$\text{Total CO}_2 \text{ Emissions} \quad \frac{2689.59}{17} \times 150 = \textbf{23,731.67 gram or 23.731Kg/day}$$

When Vehicle traveling in 320 Days in Year =

23.731×320 = 7593.92 Kg/year or **7.593 ton/year**

4.6 Carbon emission from DG sets: -

College has 1 no DG sets installed during the grid power failure. Total diesel consumption in a year in the table: -

Table -4.2 Carbon emissions from DG sets

Month & Year	Monthly Diesel consumption (Ltr per Month)	Monthly Running (Hrs)
Jul-20	1.2	0.30
Aug-20	1.2	0.30
Sep-20	1.2	0.30
Oct-20	6	2
Nov-20	9	4
Dec-20	9	4
Jan-21	14	6
Feb-21	12	5
Mar-21	3	1
Apr-21	3	1
May-21	4	1.5
Jun-21	3	1
	TOTAL = 66.6	**26.4**

Every litter of diesel fuel contain 10180 grams of pure carbon. in an average liquid hydrocarbon burning engine. It can be assumed that about 99 % of the fuel be Oxidize (It is assumed that somewhat less than 01 % will fail to fully oxidize and will be emitted as a particulate of unburned hydrocarbons instead of Co2.

Calculation of Total Co2 =

- ❖ CO^2 Emissions from a Littre of diesel: 2689.56 grams CO^2/ litter.
- ❖ Diesel consumption July-2020 to Jun-2021 = 66.6 Litter
- ❖ 66.6 x 2689 = 179,087 Kg. or 179.08 Ton/year

4.7 Other Emissions Excluded

This study did not evaluate the carbon sequestration potential of existing plantation activities and emission from the staff commuting, food supply, official flights, paper products, water supply, and waste disposal and recycling due to limited data availability. The current study identifies areas where data monitoring, recording and archiving need to be developed for enlarging the scope of mapping of GHGs emission in the future years. Accordingly, a set of tools and record keeping procedure will be developed for improving the quality of data collection for the next year carbon footprint studies.

Total Carbon Footprint generated   =   Carbon foot print by vehicle
By the campus   +
                                                                Carbon foot print by DG Sets.

Total Carbon Foot
 Print by campus: -   **7.593 + 179.08 = 181.67 tons/year**

CHAPTER- 5
WASTE MANAGEMENT

5.1 About Waste:

Human activities create waste, and it is the way these wastes are handled, stored, collected and disposed of, which can pose risks to the environment and to public health Waste management is important for an eco-friendly campus. In college different types of wastes are generated, its collection and management are very challenging.

Solid waste can be divided into three categories: bio-degradable, non-biodegradable and hazardous waste. A bio-degradable waste includes food wastes, canteen waste, wastes from toilets etc. Non-biodegradable wastes include what is usually thrown away in homes and schools such as plastic, tins and glass bottles etc. Hazardous waste is waste that is likely to be a threat to health or the environment like cleaning chemicals, acids and petrol.

Unscientific management of these wastes such as dumping in pits or burning them may cause harmful discharge of contaminants into soil and water supplies, and produce greenhouse gases contributing to global climate change respectively. Special attention should be given to the handling and management of hazardous waste generated in the College. Bio-degradable waste can be effectively utilized for energy generation purposes through anaerobic digestion or can be converted to fertilizer by composting technology. Non-biodegradable waste can be utilized through recycling and reuse. Thus the minimization of solid waste is essential to a sustainable College. The auditor diagnoses the prevailing waste disposal policies and suggests the best way to combat the problems.

Table 5.1 Different types of waste generated in the College Campus.

Sr. No.	Types of Waste	Particulars
1	Solid wastes	Damaged furniture, paper waste, paper plates, food wastes etc
2	Plastic waste	Pen, Refill, Plastic water bottles and other plastic containers, wrappers etc
3	E-Waste	Computers, electrical and electronic parts etc
4	Glass waste	Broken glass wares from the labs etc
5	Chemical wastes	Laboratory waste etc
6	Bio-medical Waste	Sanitary Napkin etc

5.2 Waste management Practices adopted by the College

College is implemented **"Three dust Bin"** waste collection system. All kind of waste generated from various activity is collected.

Figure 5.1: - Waste collection bin in college campus

Recommendation:

It is recommended adopted 5 Bin Waste Collection System for collect different type of waste generated in college premises.

Fig. 5.2:   Recommended 5 Dust Bin waste collection System

5.3 Waste Collection Points:

Audit team also visited various departments, and find out waste generation area and waste collection points for further improvement.

Table: 5.2 Detailed of Waste collection Dust bin system in College Campus

Sr. No	Location/ Name of Building	Type of waste	Type of Colour	Quantity (no)
1	Admin Building	Solid	Blue	10
2	Admin Building	Semi solid	Yellow	5
3	Admin Building	Glass waste, e-waste	Green	5
4	Hostel Building	Solid	Blue	7
5	Hostel Building	Semi solid	Green	3
6	Indoor stadium	Solid	Yellow	7
7	Canteen	Solid	Blue	1
8	Canteen	Semi solid	Yellow	1

CHAPTER- 6
RECOMMENDATIONS AND SUGGESTIONS

6.1 QR Code Systems

While the world seems to be going digital, people lack the time to read books and process the information they contain. Hence, College can be provided QR codes on the trees for its information and to exploit the rapidly growing platform for a unique purpose.

Fig: 6.1 QR Code System for plants

These codes can give students all the information they need to know about the tree from its scientific name to its medicinal value. They only need to put their smart-phones to use. QR codes to them, making it easier for everybody to learn about a plant or a tree at the tip of their fingers," If any app generating a QR code, which is available for free on the online stores, can be used to avail the information of the trees.

Eco-restoration programmes

- Frame long-term eco-restoration programmes for replacing exotic Acacia plantations with indigenous trees and need of the hour is to frame a holistic campus development plan.

6.2 Other Suggestions

Some of the very important suggestions are: -

- Adopt the proposed Environmentally Responsible Purchasing Policy, and work towards creating and implementing a strategy to reduce the environmental impact of its purchasing decisions.
- Increase recycling education on campus.
- Increase Awareness of Environmentally Sustainable Development in College campus.
- Practice Institutional Ecology- Set an example of environmental responsibility by establishing institutional ecology policies and practices of resource conservation, recycling, waste reduction, and environmentally sound operations.
- Involve All Stakeholders- Encourage involvement of government, foundations, and industry in supporting interdisciplinary research, education, policy formation, and information exchange in environmentally sustainable development.
- Collaborate for Interdisciplinary Approaches- To develop interdisciplinary approaches to curricula, research initiatives, operations, and outreach activities that support an environmentally sustainable future.
- Increase reduces, reuse, and recycle education on campus.
- Develop a butterfly garden that arouses appreciation towards flora and fauna diversity.
- Name all the trees and plants (Plant DNA barcodes) with its common name and scientific name.
- Arrange training programmes on environmental management system and nature conservation.
- Renovation of cooking system in the canteen to save gas by installation solar water heater system with heat pump.
- Establish a procurement policy that is energy saving and eco-friendly.

ANNEXURE -I

<u>**Recommendation for Herbal & medicinal plants:**</u>

S.No.	Hindi Name	Botanical Name	Family
1	Asopalav	Polyalthia longifolia	Annonaceae
2	Gudhal	Hibiscus-rosa-sinensis	Malvaceae
3	Nandee	Ficus Benjamina	Moraceae
4	Bahera	Terminalia Bellirica	Combretaceae
5	Khirni	Manilkara hexandra	Sapotaceae
6	Kaner	Nerium indicum	Apocynaceae
7	Champa	Plumeria fragrance	Apocynaceae
8	Peepal	Ficus religiosa	Moraceae
9	Jackfruit	Artocarpus heterophyllus	Moraceae
10	Amla	Emblica officinalis	Euphorbiaceae
11	Bael	Aegle marmelos	Rutaceae
12	Amrood	Psidium guajava	Myrtaceae
13	Ghratkumari	Aloe barbadensis	Liliaceae
14	Nimbu	Citrus lemon	Rutaceae
15	Mogra	Jasminum sambac	Oleaceae
16	Parijaat	Nyctanthes arbor-tristis	Oleaceae
17	Aam	Mangifera indica	Anacardiaceous
18	Peela kaner	Thevetia nerifolia	Apocynaceae
19	Jaamun	Syzugium cumini	Myrtaceae
20	Kachnar	Bauhinia variegata	Fabaceae
21	Ratanjot	Jatropha curcas	Euphorbiaceae
22	Shewt ark	Calotropis procera	Asclepiadaceae
23	Drumstick	Moringa oleifera	Moringaceae
24	Neem	Azadirachta indica	Meliaceae
25	Arandi	Ricinus communis	Euphorbiaceae
26	Arjuna	Terminlia arjuna	Combretaceae
27	Putranjiva	Putranjiva roxburghii	Putranjivaceae
28	Anjeer	Ficus carica	Moraceae
29	Shikakai	Acacia concina	Fabaceae
30	Pila amaltas	Cassia glauca	Fabaceae
31	Nirgundi	Vitex negundo	Lemiaceae
32	Sheesham	Dalbergia sissoo	fabaceae
33	Dhawda/ Gumghatti	Anogeissus latifolia	Combrataceae
34	Paras peepal	Thespasia populina	Malvaceae
35	Kanak champa	Pterospermum acerifolium	Malvaceae
36	Maulshree	Mimusops alengi	Sapotaceae
37	Tendu	Diospyros melanoxylon	Ebanaceae

ANNEXURE -II

GREEN ACTICITIES BY COLEEGE MANAGEMENT IN COLLEGE CAMPUS