Empirical Exergy Private Limited

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www.eeplgroups.com, email:-eempirical18@gmail.com
CIN No: U74999MP2018PTC045751

Ref No: EEPL/2022-23/GREEN/004 **Date: - 20-05-2022**

GREEN AUDIT CERTIFICATE

This is certified that Empirical Exergy Private Limited (EEPL) Indore M.P. has conducted a green audit at **Mewar University, Chittorgarh (Rajasthan)** for the academic year 2021-22, and the audit report has been submitted.

We avail this opportunity to express our deep and sincere gratitude to the management for their wholehearted support and co-operations during the green audit.

This certificate is being issued based on the Green Audit conducted by EEPL.

For- **Empirical Exergy Private Limited**

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]

GREEN AUDIT REPORT

CONSULTATION REPORT

MEWAR UNIVERSITY

Gangrar Chittorgarh (Rajasthan)

PREPARED BY

EMPIRICAL EXERGY PRIVATE LIMITED

Flat No. 201, OM Apartment,214 Indrapuri Colony,
Bhawarkuan,Indore – 452 001 (M. P.), India
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(2021-22)

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ACKNOWLEDGEMENT

Empirical Exergy Private Limited (EEPL), Indore (M.P) takes this opportunity to appreciate & thank the management of **Mewar University Gangrar Chittorgarh for** allowing us to conduct the green audit for the university.

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 during the study.

Rajesh Kumar Singadiya

(Director)

M.Tech (Energy Management), PhD (Research Scholar)
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ENERGY IS LIFE
BEE
CONSERVE IT

BUREAU OF ENERGY EFFICIENCY

Examination Registration No.: EA- 7271

Accreditation Registration No.: AEA-284

Certificate of Accreditation

This is to certify that Mr./Ms. Shri. Rajesh Kumar Singadiya having its trade/registered office at ..... has been given accreditation as accredited energy auditor. The certificate shall be effective from 9th day of May, 2018

The certificate is subject to the provisions of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

This certificate shall be valid until it is cancelled under regulation 9 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

On cancellation, the certificate of accreditation shall be surrendered to the Bureau within fifteen days from the date of receipt of order of cancellation.

Your name has been entered at AEA No. 284 in the register of list of accredited energy auditors. Your name shall be liable to be struck out on the grounds specified in regulation 8 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

Given under the seal of the Bureau of Energy Efficiency, Ministry of Power, this 5th day of October, 2018

Secretary,
Bureau of Energy Efficiency
New Delhi

Green Monitoring Committee.

OFFICE OF THE REGISTRAR
MEWAR UNIVERSITY, CHITTORGARH (RAJ.).

No. MU/RO/Admin/2022/1450 Dated : 4/5/2022

OFFICE ORDER

Reconstitution of Green, Environment & Energy Auditing Committee

Green Audit, Environment Audit & Energy Audit Committee is reconstituted to conduct the necessary audit in due course. Members of the Audit Committee are mentioned below:

S. No.	Name	Designation	Committee Role
1	Dr. Y. Sudershan	Professor & Dean, Department of Agriculture	Co-Ordinator
2	Mr. Rakesh Kumar Singadiya	Director, Empirical Exergy Pvt. Ltd.	External Auditor
3	Dr. Neelu Jain	Associate Professor, Department of Agriculture	Internal Auditor
4	Dr. Satish Kumar Ameta	Asst. Professor, Department of Life Science	Internal Auditor
5	Mr. Deepak Kumar Joshi	Asst. Professor, Department of Electrical Engg.	Internal Auditor
6	Dr. Mohd. Ashid	Asst. Professor, Department of Chemistry	Member
7	Ms. Nirma Kumari Sharma	Asst. Professor, Department of Electrical Engg.	Member
8	Mr. Suraj Kumhar	Asst. Professor, Department of Electrical Engg	Member
9	Mr. H. Widhani	OSD	Member
10	Mr. Narendra Kumar Ved	Non-Teaching Staff	Member
11	Ms. Sanchita Karnik	Non-Teaching Staff	Member

Registrar
Mewar University
Gangrar, (Chittorgarh)

Copy to:
1. PS to Hon'ble Chairperson for Kind information.
2. PS to President/Pro President for kind information.
3. Deans/Directors/CoE for Information.
4. All HoDs for information.
5. Concerned Committee Members
6. Coordinator, IQAC Cell.
7. Admission/Accounts/Examination/Stores/IT Support/Library/
8. Wardens/Maint.I-C/Receptionist

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 & Electrical Expert]
- **Dr. Suresh Kumar Soni** [Certified Energy Auditor & Energy Expert]
- **Mr. Sachin Kumawat** [Sr. Project Engineer]
- **Mr. Lokesh Kumar Varma** [Project Engineer]
- **Mr. Mohit Malviya** [Fire saftey Engineer]
- **Mr. Aakash Kumawat** [Site Engineer]
- **Mr. Ajay Nahra,** [Sr. Accountant & admin]

EXECUTIVE SUMMARY

Green Initiative Taken by University

- **CAMPAIGN OF PLANTATION AND GREEN CAMPUS:**

  University has around **1685** trees on campus. It's a good initiative taken by management for a green campus under the campaign of a plantation. **It's APPRECIABLE.**

- **480 KWp SOLAR PHOTOVOLTAIC ROOFTOP INSTALLATION:**
  - University has a 480 KWp solar photovoltaic rooftop grid-connected system installed on most of the buildings. Total unit generation from Sep-2018 to March- 2022 is **22,87,354** units. The solar unit generated for the year 2021-22 is 6,32,850 units. It is more than 50 % of the total unit consumption of the university campus.
  - **The total CO_2 reduction is 596.652-ton CO_2e** up from Sep-2018 to March- 2022 It is a big contribution 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.

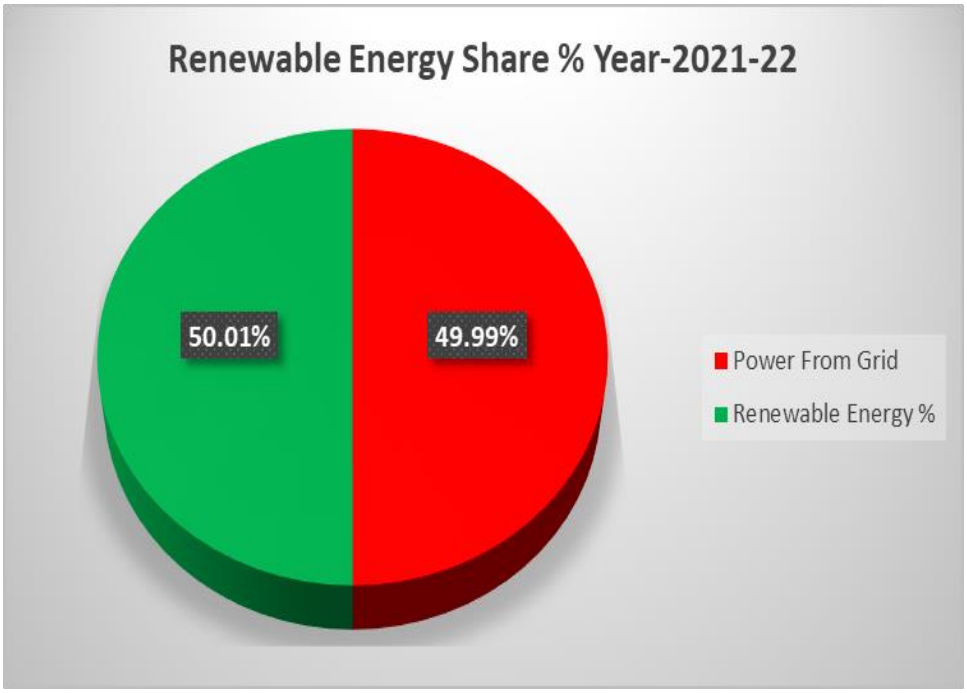


Figure 1.1: - Share of renewable energy sources

- **Vermicompost unit:** University has installed 05 no of vermicompost pit **It's appreciable**. All type of agricultural waste decomposes in the pit and prepare good quality environmentally-friendly manure is formed from the compost It is to be used for agricultural purposes on the university campus.

RECOMMENDATION: -

SOLID WASTE MANAGEMENT:

- 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 materials are collected and processed in an environmentally friendly way on the University campus.
- **Biodegradable and non-biodegradable:** Waste materials are collected with help of different colored three dustbin systems on the campus.
- **Organic converter:** - There is good potential for the installation of an organic converter in the university for all types of kitchen and vegetable waste generated from the guesthouse, and the hostel's mess. Recommended organic converters with capacity are attached in **Quotation in annexure-01**

CHAPTER-1
INTRODUCTION

1.1 About University

Mewar University is an autonomous body set up by the Government of Rajasthan through Act. No. 4 of 2009 passed by the Rajasthan Legislative Assembly (Government of Rajasthan). The University is recognized by the UGC u/s 2(f) of UGC Act with powers to confer degrees u/s 22(1) of the UGC Act, 1956 vide their letter no. F.9-15/2009(CPP-I) dated 30th March 2009. This is the only private and self-financed University in Rajasthan which is also approved by the UGC u/s 12B of the UGC Act vide their letter No. F.9-15/2009 (CPP-I/PU) dated15th October 2018. The University is also NAAC accredited.

Mewar University has never affiliated with any institution, nor has the University ever set up any study center in any part of the country other than its main campus at Gangrar in Chittorgarh (Rajasthan).

Mewar University is promoted by the Mewar Education Society (MES). It is controlled by a Board of Management, constituted by the MES, which is headed by Chairperson Shri Ashok Kumar Gadiya, a great visionary, educationist, and nationalist, who translated his ideas and dreams of promoting higher education into reality by setting up institutes of learning in various subjects. In no time, he has carved out a niche for himself as an educationist, who believes in the inculcation of values through education in the young generation.

The group, under the able leadership of Dr.Ashok Kumar Gadiya and the active support and association of renowned academicians, experienced professionals, and technocrats, has established a chain of Institutes of higher education and learning:

- **Mewar Institute of Management**

  Mewar Institute of Management, Vasundhara, Ghaziabad (U.P.) [Approved by the UGC and affiliated with C.C.S. University, Meerut, conducting courses for B.B.A., M.B.A., B.C.A., M.C.S., M.I.S., B.Ed, B.Lib, and M.Sc. (Biotech)]

- **Mewar Law Institute**

  Mewar Law Institute, Vasundhara, Ghaziabad (U.P.) [Approved by the UGC, Bar Council of India and affiliated to C.C.S. University, Meerut, conducting courses for L.L.B. (3Yrs) & L.L.B. (5Yrs)]

- **Mewar Girls Business School**

  MewarGirls Business School, Vasundhara, Ghaziabad (U.P.) [Approved by the AICTE and affiliated to UP Tech University, Lucknow, conducting M.B.A. courses for Girls]

- **Mewar Girls College**

  MewarGirls College, Chittorgarh [Approved by Government of Rajasthan and affiliated to Mohan Lal Sukhadia University, Udaipur, conducting courses for M.I.B., B.Sc (Biotech.), B.B.M., B.C.A. & P.G.D.C.A.]

- **Mewar Girls Ayurved Nursing Centre**

  Mewar Girls Ayurved Nursing Centre, Chittorgarh [Approved by Government of Rajasthan and affiliated to Rajasthan Ayurved University, Jodhpur, conducting courses for Ayurved Nursing]

- **Mewar Girls Industrial Training Centre**

  Mewar Girls Industrial Training Centre, Chittorgarh [Approved by Government of India (NCVT) and Board of Technical Education, Jodhpur, (SCVT), conducting courses for Computer Operator and Programming Assistant, Interior Decoration, Fashion Designing, Dress Making, English Language Proficiency and Personality Development]

- **Mewar Girls College of Teachers Training**

  Mewar Girls College of Teachers Training, Chittorgarh [Approved by Government of India (NCTE) and affiliated to Mohan Lal Sukhadia University, Udaipur, conducting courses for B.Ed., N.T.T, S.T.C]

  These centers of learning exemplify the group's mission to promote quality technical and higher education. And as a result, the number of students has gone up considerably, and now it has more than 10,000 students on its campuses.

  The group, continuing with its mission to provide higher and technical education to a larger section of people, has touched a new height by promoting and sponsoring Mewar University. The promoting body, with its honest efforts and unstinting dedication, has the conviction to build a strong partnership with the Government of Rajasthan for ensuring the spread of higher and technical education in the state.

  Mewar's culture, ethos, tradition, and values are so ingrained in its soil that it is bestowed with the magical powers to sprout prodigious talent and genius. Anyone groomed in this environment will undergo a steady transformation to blossom in life and imbibe the traits of greatness associated with this historical place.

VISION:-

To develop a center of excellence for technical, professional, and vocational education and research at par with national and international standards.

MISSION:-

To develop the framework for effectively conducting various educational and research programmes of the highest standards to produce confident, self-reliant, and responsible youth for society and outstanding professionals for government, industry, and business. The mission is to "**Reach the unreached**"

Objective:-

- Provide easy access to high-quality education in Management, Engineering, as well as other academic & professional fields to its students, irrespective of their caste, creed, age, gender, region, or country, at an affordable cost.
- To offer a conducive environment for pursuing research and vocational studies with a market-driven orientation.
- To expose students to new ideas, fresh vision, and pragmatic ambition, and enhance their competency in the ever-changing business environment.
- To provide a flexible choice-based credit system of education and dual-degree programmes while flexible adopting modes of delivery to suit students' requirements of learning.
- To prepare and assist students in improving their future prospects through career counseling and placement support, on-the-job training, industrial visits, presentations, and group discussions.
- To Promote and practice a convenient distance education concept in India and abroad.
- To spread job-oriented Skill Development education in rural and tribal areas

1.2 About Campus: -

Table 1.1 Details are the total build-up area given in the table:-

TOTAL GROUND COVERED. =20856.78 SQ.MT									
TOTAL OVERALL BUILT-UP ALL FLOORS AREA:- 76024.72 SQ.MT									
S.NO	BLOCK	FAR AREA				BUILT AREA			
		GROUND FLOOR AREA IN SQ.MT	FIRST FLOOR AREA IN SQ.MT	SECOND FLOOR AREA IN SQ.MT	THIRD FLOOR AREA IN SQ.MT	GROUND FLOOR AREA IN SQ.MT	FIRST FLOOR SQ.MT	SECOND FLOOR AREA IN SQ.MT	THIRD FLOOR AREA IN SQ.MT
1	ADMINISTRATIVE AND ACADEMIC BLOCK.	8890.84	8519.33	8675.24	8675.24	8966.05	9050.97	9206.74	9206.74
2	EDUCATION BLOCK	1062.08	1170.08	1062.08	1062.1	1193.08	1253.27	1126.29	1126.29
3	ENGINEERINGBLOCK	1979.9	11979.9	1979.9	0	2126.84	2093.74	2093.74	0
4	MEWAR HOSPITAL	1337.03	1337.03	0	0	1590.91	1590.91	0	0
5	BHAMASHAH HOSTEL	1382.11	1382.11	1382.11	1382.1	1601.64	1572.82	1572.82	1572.82
6	SANGA HOSTEL	1189.78	1189.78	1189.78	1189.8	1359.6	1341.62	1341.62	1341.62
7	KUMBHA HOSTEL	602.71	602.71	620.65	620.65	709.19	697.35	697.35	697.35
8	PRATAP HOSTEL	640.52	640.52	665.78	665.78	749.38	739.64	739.64	739.64

S.NO	BLOCK	FAR AREA				BUILT AREA			
		GROUND FLOOR AREA IN SQ.MT	FIRST FLOOR AREA IN SQ.MT	SECOND FLOOR AREA IN SQ.MT	THIRD FLOOR AREA IN SQ.MT	GROUND FLOOR AREA IN SQ.MT	FIRST FLOOR SQ.MT	SECOND FLOOR AREA IN SQ.MT	THIRD FLOOR AREA IN SQ.MT
9	PANNA DHAI HOSTEL	376.53	376.53	382.3	382.3	447.6	435.97	435.97	435.97
10	MEERA HOSTEL	323.13	323.13	323.13	323.13	386.87	381.68	381.68	381.68
11	GUEST HOUSE	229.94	223.58	223.58	223.58	295.78	258.82	258.82	258.82
12	STAFF QUARTERS(1 BHK)	285.11	285.11	285.11	285.11	367.6	362.67	362.67	362.67
13	STAFF QUARTER	276.99	276.99	276.99	276.99	353.84	349.18	349.18	349.18
14	ANNAPURNA MESS	613.7	0	0	0	708.4	0	0	0
	TOTAL	19190.37	28306.8	17066.65	15086.78	20856.78	20128.64	18566.52	16472.78

Satellite Image of Mewar university from Google map

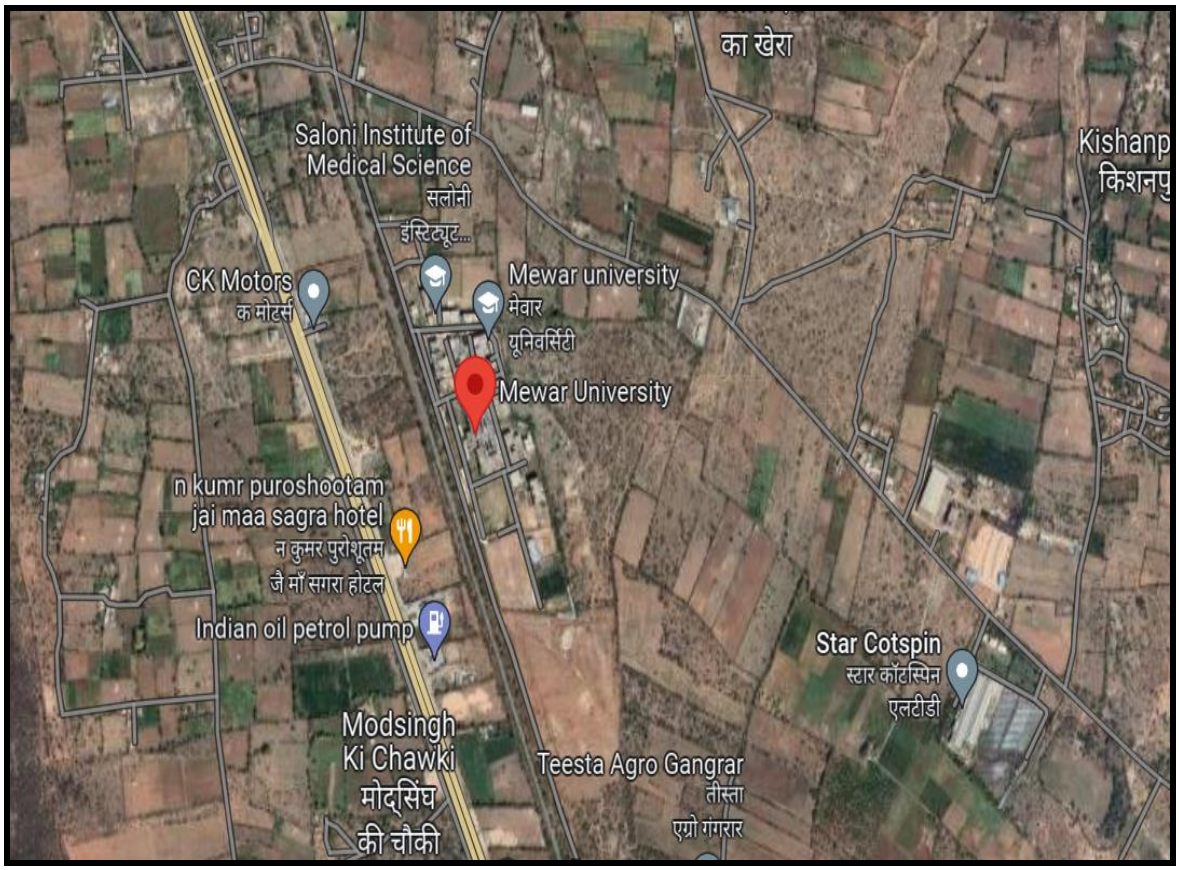
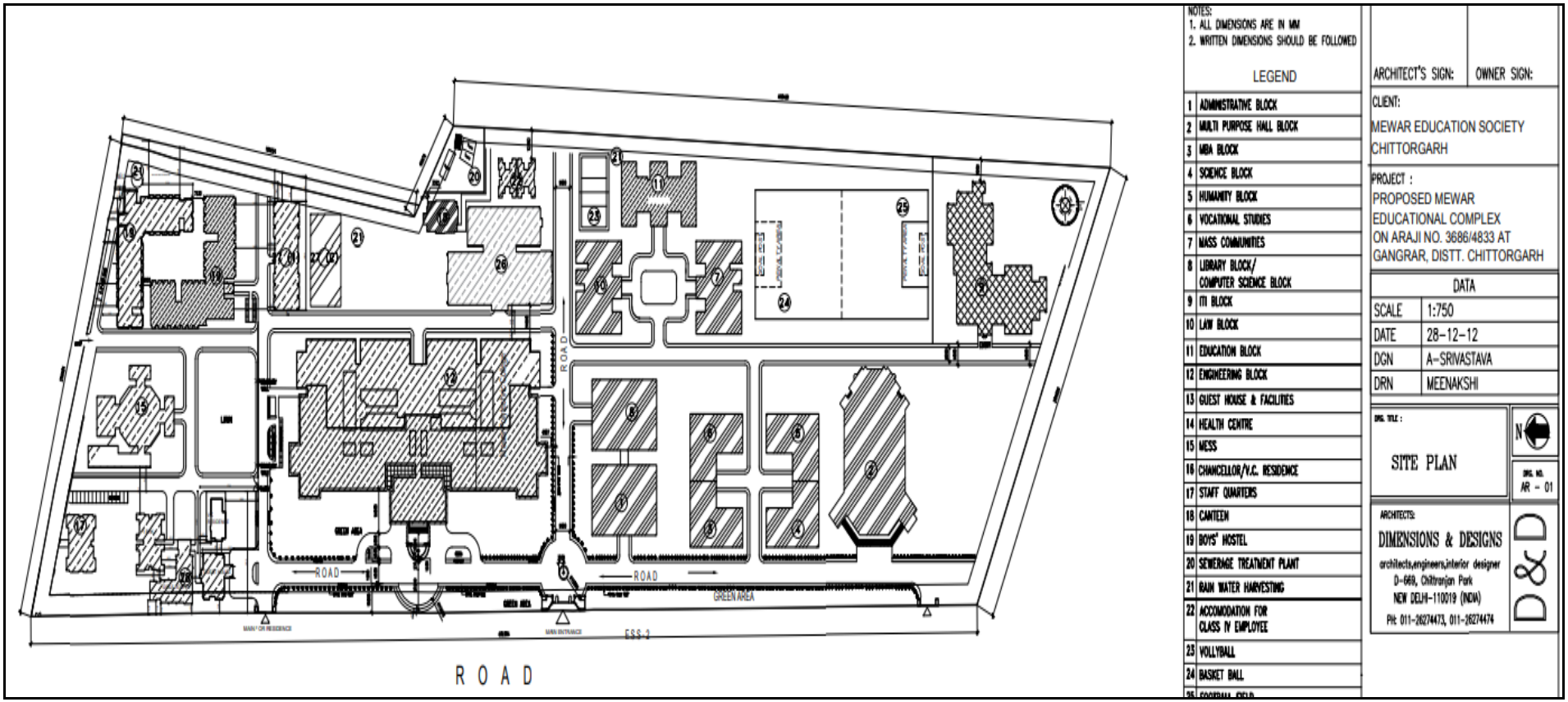


Figure 1.1: - Satellite Image of Mewar university from Google map

1.3 MEWAR UNIVERSITY LAYOUT OF VARIOUS BUILDINGS

Layout map of Mewar University



1.4 About Green Auditing

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

Green audit means to identify opportunities for sustainable development practices, enhance environmental quality, improve health, hygiene, and safety, reduce liabilities achieve values of virtue. A 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 **"Mewar University"** enables assessment of the lifestyle, action, and its impact on the environment. This green audit was mainly focused on greening indicators like utilization of green energy (solar energy) and optimum use of secondary energy sources (petrol and diesel) in the University campus, vegetation, carbon footprint of the campus, etc. Green auditing aims to help the institution to apply sustainable development practices and to set examples before the community and young learners.

1.5 Objectives of Green Auditing

The general objective of a green audit is to prepare a baseline report on "Green campus" and 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 a green audit mechanism.
- Providing a database for corrective actions and plans.
- To identify the gap areas and suggest recommendations to improve the green campus status of the University.

CHAPTER- 2
GREEN CAMPUS & SUSTAINABLE DEVELOPMENT

2.1 Green Audit

In the survey, the focus has been given to the assessment of the present status of plants and trees on the university campus and efforts made by the university authorities for nature conservation. The campus is in the vicinity of approximately more than 1685 trees/medicinal herbs/ornamental plants. The detail is given below:

Figure .2.1 Green Campus

2.1 List of plants on the university campus.

1. **Common Timber Trees**

Sr. No	Common Name	Scientific Name	Family	Number of Trees
1.	Neem	Azadirachta indica	Meliaceae	87
2.	Kadamba	Neolamarckia kadamba	Rubiaceae	08
3.	Drum Stick	Moringa oleifera	Moringaceae	17
4.	Peepal	Ficus religiosa	Moraceae	06
5.	Desi Babul	Acacia nilotica	Fabaceae	29
6.	Siris	Albezia lebbeck	Fabaceae	31
7.	Shisham	Dalbergia sissoo	Fabaceae	20
8.	Arjun	Terminalia arjuna	Combretaceae	19
9.	Ashapala	Polyalthia longifolia	Annonaceae	41
10.	Rudrax	Elaeocarpus ganitrus	Elaeocarpaceae	05
11.	Royal Palms	Roystonea rigia	Arecaceae	10
12.	Vilayati Babul	Prosopis juliflora	Fabaceae	50
13.	Monkey Puzzled Tree	Araucaria heterophylla	Araucariaceae	16
14.	Indian Laburnum	Cassia fistula	Fabaceae	17
15.	Bel	Aegle marmelos	Rutaceae	15
16.	Geiger Tree	Cordia sebestena	Ehretiaceae	16
17.	Siamea Tree	Cassia siamea	Caesalpiniaceae	32
18.	Pagoda Tree	Plumeria rubra	Apocynaceae	35
Total				454

2. Common Ornamental plants

S.No.	Common Name	Scientific Name	Family	Number of Trees
1.	Kachnar	Bauhinia variegate	Fabaceae	132
2.	Devil Tree	Alstonia scholaris	Apocynaceae	62
3.	Gulmohar	Delonix regia	Fabaceae	43
4.	Silver Oak	Grevillea robusta	Proteaceae	04
5.	Ashapala	Polyalthia longifolia	Annonaceae	41
6.	Ashoka	Saraca asoca	Fabaceae	13
7.	Benjamina	Ficus benjamina	Moraceae	36
8.	Date Palms	Phoenix dactylifera	Arecaceae	15
Total				346

Anthocephalus Cadamba (Kadamb)

Bauhinia variegata (Kachnar)

3. Common Fruits Yielding Plants

S.No.	Common Name	Scientific Name	Family	Number of Trees
1.	Amla	Emblica officinalis	Euphorbiaceae	36
2.	Mango	Mangifera indica	Anacardiaceae	15
3.	Guava	Psidium gujava	Myrtaceae	16
4.	Mulberry	Morus alba	Moraceae	05
5.	Jamun	Syzygium cumini	Myrtaceae	07
6.	Jackfruit	Artocarpus heterophyllus	Moraceae	12
7.	Ber	Ziziphus mauritiana	Rhamnaceae	08
8.	Pears	Pyrus spp.	Rosaceae	07
Total				106

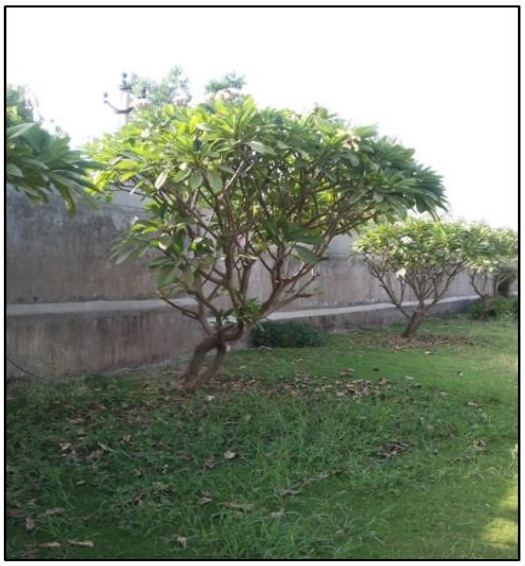
Delonix regia (Gulmohar)

Guazuma ulmifolia (Bhadraksh)

4. Common Shrubs & Plants

S.No.	Common Name	Scientific Name	Family	Number of Trees
1.	Lemon	Citrus lemon	Rutaceae	21
2.	White Champa	Plumeria alba	Apocynaceae	86
3.	Rose	Rosa indica	Rosaceae	95
4.	Duranta	Golden duranta	Verbenaceae	31
5.	Mehndi	Lawsonia inermis	Lythraceae	12
6.	Kaner	Nerium oleander	Apocyanaceae	21
7.	White Cedar	Thuja occisentalis	Cupressaceae	12
8.	China Rose	Hibiscus rosa-sinensis	Malvaceae	40
9.	Golden Durant	Duranta erecta	Verbenaceae	38
Total				356

Nyctanthes arbor-tristis (Harsinghar)



Plumaria rubra (Champa)

5. Common Medicinal Plants

S.No.	Common Name	Scientific Name	Family	Number of Trees
1.	Harsringar	Nyctanthes arbor-tristis	Oleaceae	21
2.	Patharchatta	Bryophyllum pinnatum	Crassulaceae	40
3.	Tulsi	Ocimum tenuiflorum	Lamiaceae	67
4.	Sarpaganda	Rauvolfia serpentina	Apocynaceae	62
5.	Lemon	Citrus limon (L.)	Rutaceae	34
6.	Ashwaganda	Withania somnifera	Solanaceae	23
7.	Beach Launaea	Launaea sarmentosa	Asteraceae	12
8.	Aloe Vera	Aloe barbadensis Mill.	Asphodelaceae	41
9.	Lemon Grass	Cymbopogon citratus	Poaceae	36
10.	Chaff-Flower	Achyranthes aspera	Amaranthaceae	14
11.	Ajwain	Trachyspermum ammi	Apiaceae	17
12.	Kalmegh	Andrographis paniculata	Acanthaceae	21
13.	Satawar	Asparagus racemosus	Liliaceae	16
14.	Giloey	Tinospora cordifolia	Menispermaceae	11
15.	Harad	Terminalia chebula	Combretaceae	8
Total				423

2.2 Tree plantation and Biodiversity on the campus: -

Fig.2.2 – Tree plantation and Biodiversity on the campus

University has **1685 trees** on the campus. This is a good initiative taken by management for a green campus under the campaign of the plantation. **It's APPRECIABLE.**

CHAPTER- 3
RENEWABLE ENERGY AND SUSTAINABLE DEVELOPMENT

3.0 Grid Connected Solar Photovoltaic System (480 KWp)

There are 480 KWp solar photovoltaic rooftop grid-connected systems installed on most buildings. System details are given below:

Sr. No	Description	Technical Specification
1	Plant Information	
1.1	Plant capacity	480 KWp
1.2	Locations	1. Main University building. 2. Kumbha Hostel building. 3. Pratap Hostel building. 4. Sanga Hostel building. 5. Mess Buildinhg 6. Panna Dhai Girls Hostel . 7. Meera Girls Hostel.
1.3	Latitude & Longitude	23.3103 N & 77.3619 E
2	PV Panel Details	
2.1	Make	M/s. Goldi Green Technologies Pvt. Ltd
2.2	Panel Type	Poly-crystalline
2.3	Panel Wattage	320 Wp
2.4	No of PV Panels	1478
2.5	Total Capacity	480 kWp
3	Inverter Information	
3.1	Make	KSTAR
3.2	Model	1. KSG-50K = 04 2. KSG-20K = 06 3. KSG-15K = 01 4. KSG-20K =05
3.3	Capacity	480 Kw

Sr. No	Building Name	Total No of Inverter	Inverter Modal	No of Penal
1	University Main Building	2	KSG-20 K	730
		4	KSG-50 K	
2	Kumbha Hostel	2	KSG-20 K	110
3	Pratap Hostel	1	KSG-15 K	108
		1	KSG-20 K	
4	Sanga Hostel	2	KSG-30 K	190
5	Mess	2	KSG-30 K	190
6	Panna Dhai Hostel	1	KSG-20 K	60
7	Meera Girls Hostel	1	KSG-30 K	90

Photographs of Solar Plant:-

Figure 3.1:- Solar Plant 480 KWp and Inverter System

Total Solar unit generation :-

Table 3.2:- Total Solar Unit generation Year-2018 to 2022

Sr. No	Year	Unit
1	2018-19	4,15,350
2	2019-20	5,69,087
3	2020-21	6,29,936
4	2021-22	6,20,672
	Total	**22,35,045**

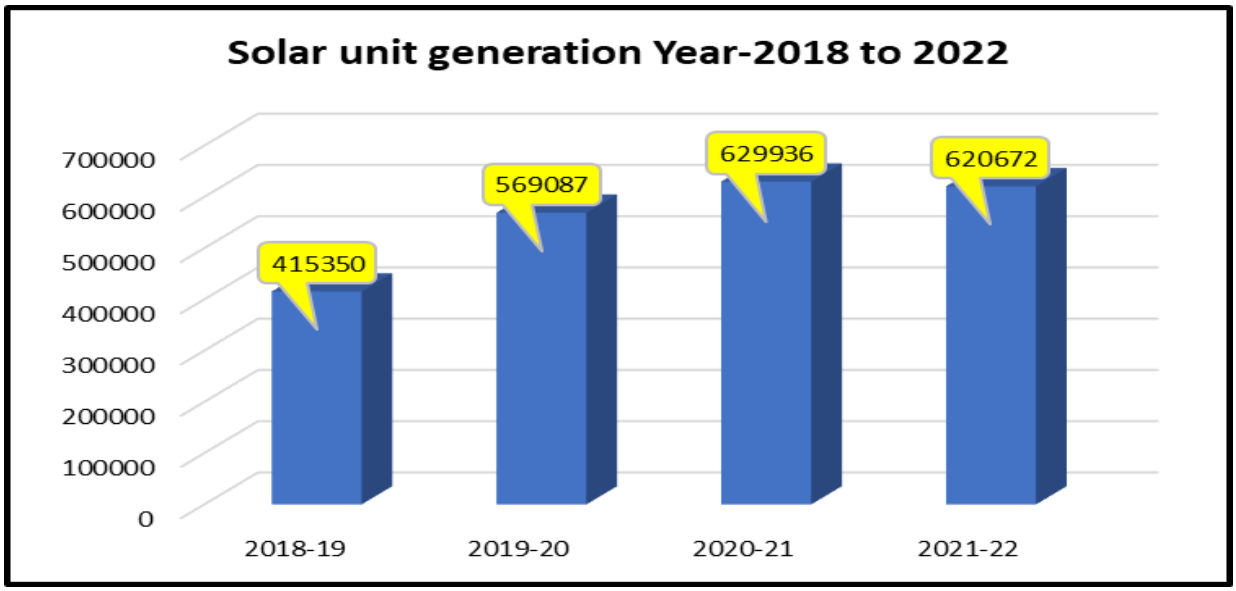


Figure: - 3.2 Graphical presentation of Solar unit generation

Observation: -

Total unit generation from the installation of the solar system up to march-2022 is 22,35,045 units.

Solar unit generation Year-2021-22:-

Table 3.3:- Monthly Solar unit generation Year-2022

Sr. No	Month & Year	Unit (kWh)	Amount (Rs/-)	per unit Charges (Rs/kWh)
1	Apr-21	64,125	2,88,563/-	4.50
2	May-21	56,511	2,54,300/-	4.50
3	Jun-21	52,918	2,38,131/-	4.50
4	Jul-21	46,334	2,08,501/-	4.50
5	Aug-21	44,791	2,01,560/-	4.50
6	Sep-21	41,335	1,86,008/-	4.50
7	Oct-21	60,348	2,71,568/-	4.50
8	Nov-21	47,370	2,13,165/-	4.50
9	Dec-21	42,208	1,89,936/-	4.50
10	Jan-22	50,107	2,25,479/-	4.50
11	Feb-22	52,226	2,35,015/-	4.50
12	Mar-22	62,401	2,80,802/-	4.50
	Total	**6,20,672**	**27,93,028/-**	**4.50**

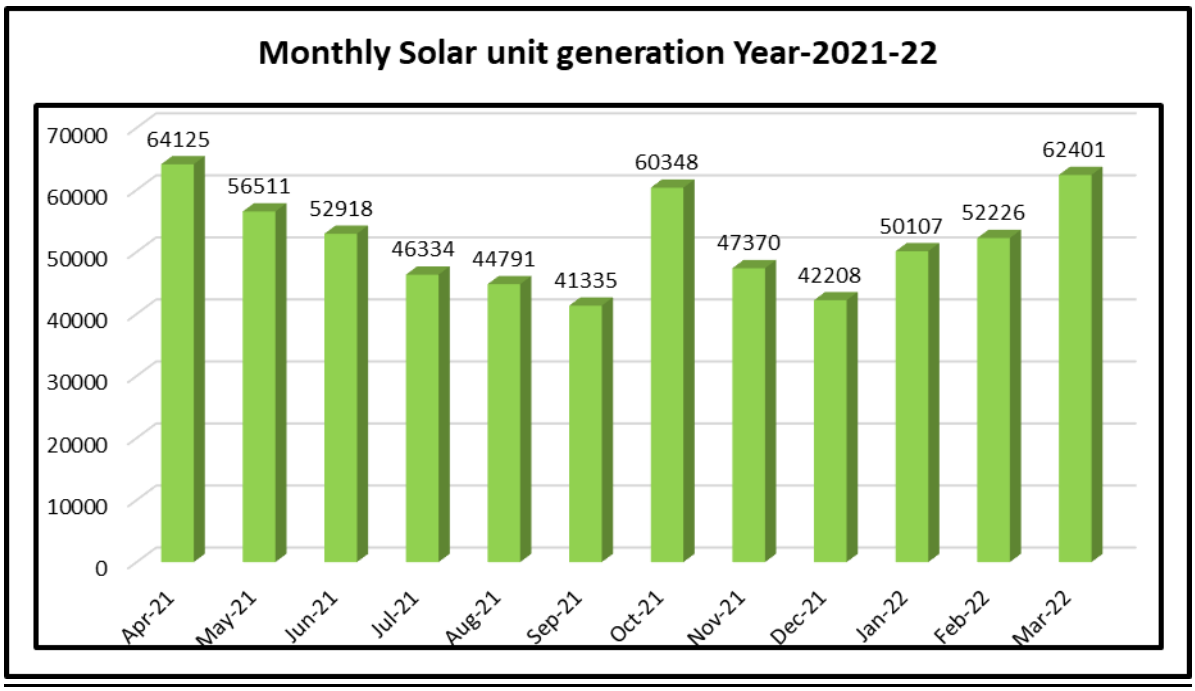


Figure 3.3:- Monthly Solar unit generation Year-2021-22

Observation: -

- **The total CO_2 reduction is 596.652 -tons of CO2e** Sep-2018 to March- 2022. It is a big contribution 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 is purchased from the grid.

Chapter-04
Carbon Footprint

4.1 About Carbon footprint.

Climate change is one of the biggest challenges faced by the world, nations, governments, institutions, businesses, and mankind today.

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 user 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 behavior.

Although working out your 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…

4.2 Methodology and Scope

The carbon footprint gives a general overview of the Mewar University 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 Mewar University 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 Mewar University. This includes electricity, as well as emissions 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 to produce an average kilowatt-hour within that grid region

Unlike 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 a significant contributor to GHGs emissions 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 for generating electricity, the carbon dioxide intensity of electricity for the national grid is assumed to be 0.9613 KgCO2/Kwh

(Reference: Central Electricity Authority (CEA) Baseline Carbon Dioxide Emission database http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/database_11.zip). Electricity is purchased from the grid

Table:- 4.1 Electricity Purchased from the grid and Emissions from the electricity Import

Sr. no	Year	Total unit Consumption by AVVNL	Unit	Emission Factor kg CO^2e/kWh	Emission ton CO^2e/year
1	2017-18	9,24,726	kWh	0.9613	889
2	2018-19	6,37,311	kWh	0.9613	613
3	2019-20	6,84,660	kWh	0.9613	658
4	2020-21	5,67,163	kWh	0.9613	545
5	2021-22	6,32,638	kWh	0.9613	608
	Total	**34,46,498**		**Total**	**3313**

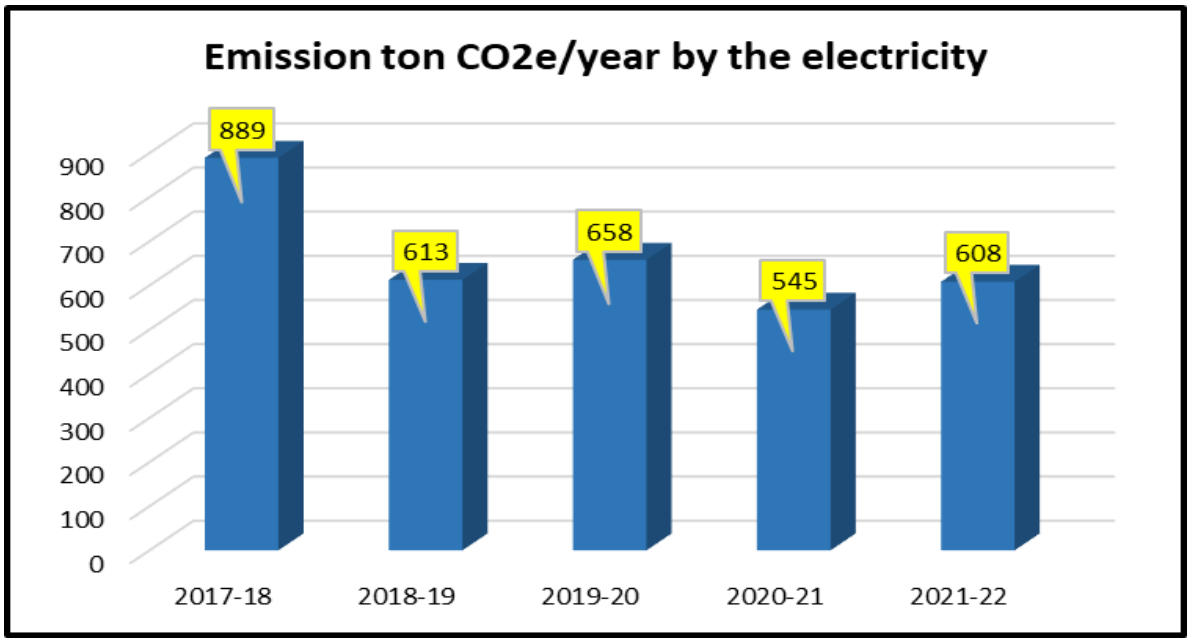


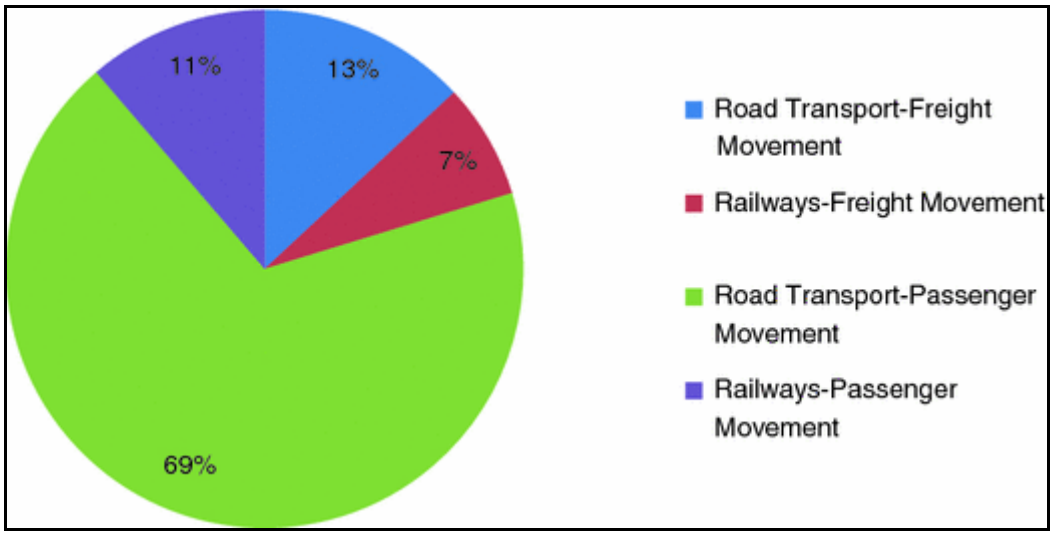
Figure 4.1:- Graphical Presentation of CO2 emission from electricity per year

Observation:-

Total CO_2 Emission by indirectly from electricity is 608 Ton CO_2 e/year in 2021-22.

4.4 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 fuels for our cars, trucks, ships, trains, and planes.

We have also considered the total GHGs emission done by transportation facilities available on the campus like Cars, ambulances, Buses, etc. We consider the different types of vehicles which are operated on petrol and diesel fuels

The energy team has analyzed the following vehicle movement for Campus.

Calculation of Carbon footprint analysis: -

As per discussion by the concerned department in the university and data provided by Management.

The following details are given in the table: -

Sr. No	Vehicle Type	Fuel type	Distance Traveling per day (KM)	Average Mileage (Per Liter)	Total Distance traveling per month (25 days)
1	University Bus -01	Diesel	65	15	1,625
2	University Bus -02	Diesel	65	15	1,625
3	University Bus -03	Diesel	80	15	2,000
4	Van-01	Petrol	75	18	1,875
5	Van-02	Petrol	75	18	1,875
6	Ambulance	Diesel	20	12	500
7	Swift Car	Diesel	40	17	1,000
8	Inova Car	Diesel	80	14	2,000
9	Loading Tempo	Diesel	100	15	2,500
Total Distance traveling in a month					**15,000**

- 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 liters)

- CO_2 Emissions from a Littre of gasoline: 2347.95 grams CO_2/ Liter.
- CO_2 Emissions from a Littre of diesel: 2689.56 grams CO_2/ liter.

$$\text{Total } CO_2 \text{ Emissions} = \frac{CO_2 \text{ Per liter}}{\text{Average Mileage (Km/Liter)}} \times \text{Distance (in km)}$$

$$\text{Total } CO_2 \text{ Emissions} = \frac{2689.59}{15.44} \times 600 = \mathbf{104517.71 \text{ gram or } 104.51 \text{ Kg/day}}$$

When Vehicle traveling in 320 Days in Year =

104.51 x 320 = 33445.6 Kg/year or **33.445 ton/year**

4.5 Carbon emission from DG sets: -

University has 02 no DG sets installed on the campus one is a university feeder and the second is for a residency feeder.

Table 4.5 :- Total diesel consumption in a year in the table: -

Sr.No	Month	Diesel (DG)
1	Apr-21	700
2	May-21	800
3	Jun-21	550
4	Jul-21	1,550
5	Aug-21	1,100
6	Sep-21	1,450
7	Oct-21	1,500
8	Nov-21	1,500
9	Dec-21	1,400
10	Jan-22	1,650
11	Feb-22	2,200
12	Mar-22	3,350
	Total	**17,750**

Every liter of diesel fuel contains 720 grams of pure carbon. In an average liquid hydrocarbon burning engine. It can be assumed that about 99 % of the fuel is Oxidized (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 CO_2.

Calculation of Total CO_2 =

- CO_2 Emissions from a Littre of diesel: 2689.56 grams CO_2/ liter.
- Diesel consumption April-2021 to March-2022 = 17,750 Liter
- 17750 x 2689 = 47729750 gram. or **47.72 Ton/year**

4.6 Biomass Calculation and CO^2 Sequestration of the Trees: -

1. Estimation of above-ground biomass (AGB)

$$K= 34.4703 – 8.0671D + 0.6589 D^2$$

Where = K is above-ground biomass.
D is Breast height diameter in (cm)

1 Estimation of below ground biomass (BGD)

BGB = AGB x 0.15

2 Total Biomass (TB)

TB = AGB + BGB

3 Calculation of carbon dioxide Weight sequestered in the tree in Kg.

C = W x 0.50

4 Calculate the weight of CO_2 sequestered in the tree per year in Kg.

CO_2 = C x 3.666

Where: -

AGB = Above ground biomass.

D = Diameter of tree breast height.

BGB = Below Ground Biomass.

C = Carbon

TB = Total Biomass.

Biomass calculation of the tree

Common Name	Average Diameter CM (25 to 100)	AGB	BGB	Total	Carbon Storage	Amount of CO^2 Sequestered	No of Tree	Total Amount of CO^2 Sequestered (Kg)	Annually CO^2 Sequestered amount (Kg)
Neem	75	3248.258	487.24	3735.50	1867.748	6847.164	87	595703.30	8124.70
Kadamba	60	1994.490	299.17	2293.66	1146.832	4204.285	8	33634.28	458.73
Drum Stick	50	1328.370	199.26	1527.63	763.813	2800.138	17	47602.34	649.24
Peepal	50	1328.370	199.26	1527.63	763.813	2800.138	6	16800.83	229.14
Desi Babul	40	798.030	119.70	917.73	458.867	1682.207	29	48784.01	665.36
Siris	55	1644.458	246.67	1891.13	945.563	3466.434	31	107459.46	1465.62
Shisham	40	798.030	119.70	917.73	458.867	1682.207	20	33644.15	458.87
Arjun	65	2378.468	356.77	2735.24	1367.619	5013.691	19	95260.12	1299.24
Ashapala	30	403.470	60.52	463.99	231.995	850.495	41	34870.28	475.59
Rudrax	30	403.470	60.52	463.99	231.995	850.495	5	4252.47	58.00
Royal Palms	30	403.470	60.52	463.99	231.995	850.495	10	8504.95	116.00
Vilayati Babul	35	583.778	87.57	671.34	335.672	1230.574	50	61528.69	839.18
Monkey Puzzled Tree	45	1046.228	156.93	1203.16	601.581	2205.395	16	35286.32	481.26
Indian Laburnum	50	1328.370	199.26	1527.63	763.813	2800.138	17	47602.34	649.24
Bel	36	623.912	93.59	717.50	358.750	1315.176	15	19727.64	269.06
Geiger Tree	35	583.778	87.57	671.34	335.672	1230.574	16	19689.18	268.54
Siamea Tree	45	1046.228	156.93	1203.16	601.581	2205.395	32	70572.65	962.53
Pagoda Tree	60	1994.490	299.17	2293.66	1146.832	4204.285	35	147149.98	2006.96
Kachnar	45	1046.228	156.93	1203.16	601.581	2205.395	132	291112.17	3970.43
Devil Tree	40	798.030	119.70	917.73	458.867	1682.207	62	104296.85	1422.49

Gulmohar	30	403.470	60.52	463.99	231.995	850.495	43	36571.27	498.79
Silver Oak	65	2378.468	356.77	2735.24	1367.619	5013.691	4	20054.76	273.52
Ashapala	65	2378.468	356.77	2735.24	1367.619	5013.691	41	205561.31	2803.62
Ashoka	25	257.108	38.57	295.67	147.837	541.970	13	7045.61	96.09
Benjamina	35	583.778	87.57	671.34	335.672	1230.574	36	44300.66	604.21
Date Palms	36	623.912	93.59	717.50	358.750	1315.176	15	19727.64	269.06
Amla	30	403.470	60.52	463.99	231.995	850.495	36	30617.81	417.59
Mango	27	311.579	46.74	358.32	179.158	656.793	15	9851.90	134.37
Guava	28	340.852	51.13	391.98	195.990	718.498	16	11495.97	156.79
Mulberry	30	403.470	60.52	463.99	231.995	850.495	5	4252.47	58.00
Jamun	54	1578.524	236.78	1815.30	907.652	3327.451	7	23292.15	317.68
Jackfruit	35	583.778	87.57	671.34	335.672	1230.574	12	14766.89	201.40
Ber	37	665.405	99.81	765.22	382.608	1402.641	8	11221.13	153.04
Pears	45	1046.228	156.93	1203.16	601.581	2205.395	7	15437.77	210.55
Lemon	15	66.218	9.93	76.15	38.075	139.583	21	2931.25	39.98
White Champa	26	283.664	42.55	326.21	163.107	597.950	86	51423.73	701.36
Rose	75	3248.258	487.24	3735.50	1867.748	6847.164	95	650480.62	8871.80
Duranta	45	1046.228	156.93	1203.16	601.581	2205.395	31	68367.25	932.45
Mehndi	30	403.470	60.52	463.99	231.995	850.495	12	10205.94	139.20
Kaner	30	403.470	60.52	463.99	231.995	850.495	21	17860.39	243.60
White Cedar	25	257.108	38.57	295.67	147.837	541.970	12	6503.64	88.70
China Rose	46	1099.940	164.99	1264.93	632.466	2318.619	40	92744.77	1264.93
Golden Durant	54	1578.524	236.78	1815.30	907.652	3327.451	38	126443.12	1724.54
Harsringar	28	340.852	51.13	391.98	195.990	718.498	21	15088.46	205.79

Patharchatta	50	1328.370	199.26	1527.63	763.813	2800.138	40	112005.50	1527.63
Tulsi	36	623.912	93.59	717.50	358.750	1315.176	67	88116.80	1201.81
Sarpaganda	39	752.464	112.87	865.33	432.667	1586.156	62	98341.69	1341.27
Lemon	36	623.912	93.59	717.50	358.750	1315.176	34	44715.99	609.87
Ashwaganda	45	1046.228	156.93	1203.16	601.581	2205.395	23	50724.09	691.82
Beach Launaea	46	1099.940	164.99	1264.93	632.466	2318.619	12	27823.43	379.48
Aloe Vera	35	583.778	87.57	671.34	335.672	1230.574	41	50453.53	688.13
Lemon Grass	26	283.664	42.55	326.21	163.107	597.950	36	21526.21	293.59
Chaff-Flower	80	3734.070	560.11	4294.18	2147.090	7871.233	14	110197.26	1502.96
Ajwain	75	3248.258	487.24	3735.50	1867.748	6847.164	17	116401.79	1587.59
Kalmegh	36	623.912	93.59	717.50	358.750	1315.176	21	27618.70	376.69
Satawar	37	665.405	99.81	765.22	382.608	1402.641	16	22442.25	306.09
Giloey	57	1780.397	267.06	2047.46	1023.728	3752.988	11	41282.87	563.05
Harad	50	1328.370	199.26	1527.63	763.813	2800.138	8	22401.10	305.53
		62188.841	**9328.33**	**71517.17**	**35758.584**	**131090.968**	**1685**	**4153779.72**	**56652.75**

University has **1685 trees** on campus. This is a good initiative taken by management for a green campus under the campaign of the plantation.

It's APPRECIABLE.

There are total CO_2 sequestered of **56652 Kg /year or 56.652 Tons /Year.**

Calculation of CO_2 Emission of Mewar University: -

CO_2 Emission Neutralize by the Solar 2021-22: -

April -2021 to March -2022 = 6,20,672 Kwh

6,20,672 X 0.9613 = 5,96,652 Kg/year

5,96,652 / 1000 = 596.652 Ton/year

Total Carbon Footprint generated by the campus	=	Carbon footprint by electricity + Carbon footprint by vehicle + Carbon footprint by DG Sets. - Carbon Neutralize by the tree, - Carbon Neutralize by Solar

Total Carbon Foot print by campus: **608 + 47.71 + 33.44 -56.65 - 596.6 = 35.9 tons/year**

Recommendation: -

Required more plantation and installation of more solar panels to further reduce carbon emission share by the university.

4.7 Other Emissions Excluded

This study did not evaluate the carbon sequestration potential of existing plantation activities and emissions 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 emissions in the future years. Accordingly, a set of tools and record-keeping procedures will be developed for improving the quality of data collection for the next year's carbon footprint studies.

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 public health waste management is important for an eco-friendly campus. In universities, different types of waste are generated, and its collection and management are very challenging.

Solid waste can be divided into three categories: biodegradable, non-biodegradable and hazardous waste. A bio-degradable waste includes food waste, 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 at the University. 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 University. 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 on the University Campus.

Sr. No.	Types of Waste	Particulars
1	Solid wastes	Damaged furniture, paper waste, paper plates, food waste, 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 University

University has implemented a **"Three dust bin"** waste collection system and has banned the use of plastic bags, **It's Appreciable**.

Figure: - 5.1 Three Dustbin Collection system on the university campus

Vermicompost pit

University Vegetable waste and other leaf liters were used to feed in the **"Vermicompost pit"** and the resulting vermin cast is used as manure in the garden. All kinds of waste generated from the various activities are collected.

Figure: - 5.1 Varmi Compost pit.

5.3 Waste Collection Points:

The audit team also visited various departments, Admin building, MBA building, Workshop building, and Mess, to find out waste generation areas and waste collection points for further improvement. Details are given in the table.

Table: 5.2 Detailed Waste collection Dust bin system

Administrative and Academic Block		
Sr.No.	**Location**	**Dustbin**
1	Basement	10
2	First floor	8
3	Second floor	8
4	Third floor	4
	Total	**30**
Education Block		
Sr.No.	**Location**	**Dustbin**
1	Ground floor	6
2	First floor	6
3	Second floor	8
4	Third floor	6
	Total	**26**
Engineering Block		
Sr.No.	**Location**	**Dustbin**
1	Ground floor	6
2	First floor	6
3	Second floor	8
	Total	**20**

Sr.No.	**Location**	**Dustbin**
1	Bhamashah International Hostel	16
2	Sanga Boys Hostel	12
3	Kumbha Boys Hostel	13
4	Pratap Boys Hostel	4
5	Panna Dhai Girls Hostel	8
6	SC Meera Girls Hostel	4
	Total	**57**

Observation:- Total dustbins is more than 200 in the university. **It's Appreciable.**

5.4 Organic Waste Generation in university

- The audit Team also visited in mess and guest house and discussion with the concerned officer the waste collection process. University has approx. 50 Kg per day waste generated. Department wise Generated organic waste is as follows: -

Recommended:- Install an Organic waste composting Machine in the university: -

An organic waste composting machine is an independent unit that facilitates the composting process and provides better compost. It takes waste as its input and provides manure as its output. Composting without an organic waste composting machine will take a considerable amount of time.

About Composting Process: -

Highly compact composting machine, which uses special microorganisms to break down and decompose all kinds of organic waste into compost within 24 hrs with a volume reduction of 85-90%. When organic waste is added to it, moisture is sensed by the humidity sensor, heater, mixing blades, and an exhaust system.

Recommendation: -

University has a good potential to install an organic converter. (Quotations are attached)