GREEN AUDIT REPORT

Government Degree College, Shapura

Post - Shahpura, District- Dindori

(M.P.) Pin-481990

PREPARED BY

EMPIRICAL EXERGY PRIVATE LIMITED

Flat No. 201, OM Apartment, 214 Indrapuri Colony,
Bhawarkuan,Indore – 452 001 (M. P.), India
0731-4948831, 7869327256
Email ID:eempirical18@gmail.com
www.eeplgroups.com

(2022-23)

GOVT DEGREE COLLEGE SHAHPURA DISTT DINDORI(MP) IQAC Coordinator

प्राचार्य
शासकीय स्नातक महाविद्यालय
शहपुरा जिला डिण्डौरी(म.प्र.)

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ACKNOWLEDGEMENT

Empirical Exergy Private Limited (EEPL) in Indore, Madhya Pradesh, would like to take this opportunity to express our appreciation and gratitude to the management of **Government College, Shahpura, Post - Shahpura, District- Dindori (M.P.)**. We are grateful for granting us permission to conduct green audit for the college.

We are genuinely touched by the helpful attitudes and co-operation displayed by all the faculty members and technical staff involved in the study. Their valuable assistance and cooperation significantly contributed to the successful execution of the audit.

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]

GOVT DEGREE COLLEGE IQAC Coordinator SHAHPURA DISTT DINDORI(MP)

प्राचार्य
शासकीय स्नातक महाविद्यालय
शहपुरा जिला डिण्डौरी(म.प्र.)

TheAuditTeam

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

- **Mr. Rakesh Pathak**, [Director &Electrical Expert]
- **Mr. Rajesh Kumar Singadiya** [Director &Energy Expert]
- **Ms. Laxmi Raikwar** [Energy Expert and Report Reviewer]
- **Mr. Charchit Pathak** [Asst. Project Engineer]
- **Mr. Mohan Choudhary** [Sr. Electrician]

EXECUTIVE SUMMARY

Green Initiatives Taken by the College

Campaign of Plantation and Green Campus:

The college has approximately 1,129 trees on its campus. This proactive step taken by the management towards creating a green campus through the plantation campaign is commendable.

Areas for Improvement

5 Dustbin Systems:

It has been observed that the college currently employs a single dustbin system for all types of waste generated on the campus. It is recommended to implement a 5-dustbin system for the proper segregation of various types of waste.

QR Code System on Trees:

As the world increasingly embraces digital platforms and people have less time for extensive reading and information processing, the college could consider providing QR codes on trees. This innovative approach would offer quick access to information about the trees and leverage the growing QR code platform for a unique purpose.

Installation of Organic Waste Composting Machine:

The college holds potential for installing an organic waste composting machine. This machine could efficiently treat the organic waste originating from trees and the lawn area of the campus. The resulting output from this machine can serve as valuable manure for the gardens and plants within the campus.

OTHER SUGGESTIONS & RECOMMENDATIONS

Here are some essential suggestions:

- Adopt the Proposed Environmentally Responsible Purchasing Policy: The college should consider embracing the suggested policy to enhance its purchasing decisions and establish strategies for reducing environmental impact.

- Enhance Recycling Education on Campus: Efforts to educate the campus community about recycling should be intensified.

- Promote Awareness of Environmentally Sustainable Development: Increase awareness about environmentally sustainable practices within the college campus.

- Practice Institutional Ecology: The college can lead by example in environmental responsibility by implementing institutional ecology policies that encompass resource conservation, recycling, waste reduction, and environmentally sound operations.

- Engage All Stakeholders: Encourage participation from government bodies, foundations, and industries to support interdisciplinary research, education, policy formulation, and information sharing in environmentally sustainable development.

- Promote Interdisciplinary Collaboration: Develop interdisciplinary approaches across curricula, research initiatives, operations, and outreach endeavors to foster a sustainable future.

- Expand Education on "Reduce, Reuse, and Recycle": Increase educational efforts focused on the principles of reducing, reusing, and recycling on campus.

- Establish a Butterfly Garden: Create a butterfly garden to foster appreciation for the diversity of flora and fauna.

- Label Trees and Plants: Assign common and scientific names (using Plant DNA barcodes) to all trees and plants for identification.

- Conduct Environmental Management and Nature Conservation Training: Organize training programs covering environmental management systems and nature conservation.

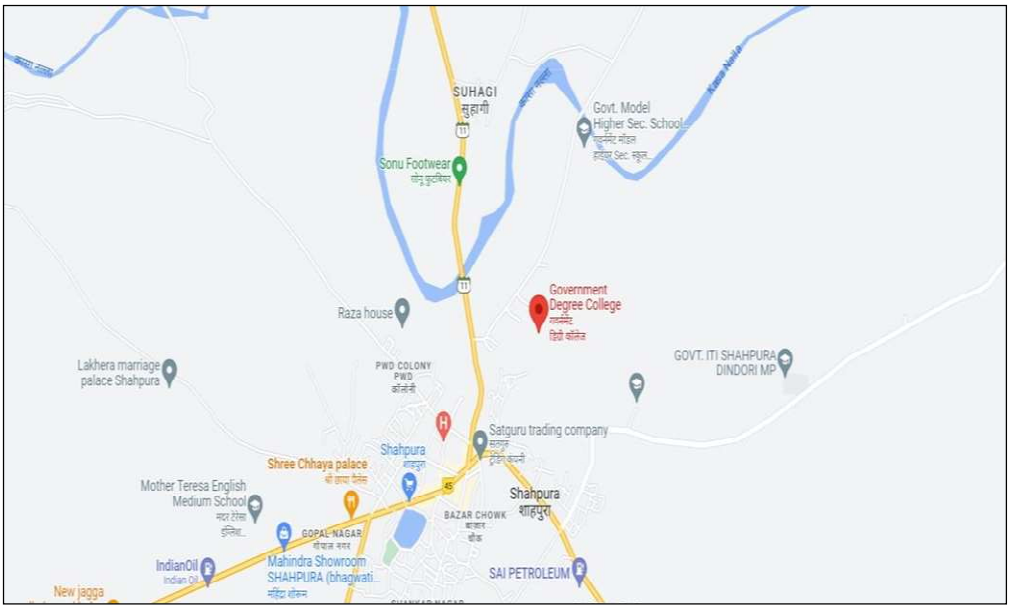
- Encourage Student and Teacher Involvement in Local Environmental Issues: Foster participation from students and teachers in addressing local environmental concerns.

- Minimize Plastic and Thermacol Usage: Refrain from using plastic and thermacol plates and cups during college or department-level functions.

CHAPTER-1
INTRODUCTION

About the College

Government Degree College, Shahpura Is an affiliated College Established In 1983 In Dindori, Madhya Pradesh. Government Degree College, Shahpura Offers Various Programme Approved By University Grants Commission And Is Affiliated With Rani Durgavati Vishwavidyalaya, Jabalpur.



Source: **Image of Government College Shahpura (M.P) from Google map**

Vision

To empower the youth, especially belonging to the underprivileged sections of society, through quality education by inculcating philanthropic values and enabling them to meet the challenges of the contemporary knowledge society.

Mission

To translate the vision into reality the institution is committed to -

- Embrace in its fold students from all sections and categories especially addressing to the needs of the first generation learners.
- Expose the students (especially the under-privileged ones) to variety of activities, academic and extra-academic, aiming at their overall development.
- Inculcate humanistic and social values in the students to motivate them towards community services.

Build-up area of the college

Details are the total build-up area given in the table

Sr.No.	Description	Area(Sqm.)
1	Total area	80937
2	Total build up area	

College Population

Sr. No.	College Staff/ Student	Population (No.)
1	Total teaching staff	6
2	Total Non teaching staff	7
3	Total No. of student	614

About Green Auditing

The concept of the Eco Campus has been implemented in numerous educational institutions worldwide to foster sustainability, primarily due to their significant resource consumption and environmental impact through waste discharge.

Green auditing involves identifying opportunities for sustainable development practices, enhancing environmental quality, improving health and safety, reducing liabilities, and embodying values of virtue. It also establishes a foundation for calculating economic benefits from conservation projects by determining current resource usage rates and associated costs.

The green audit conducted for "Government Post Graduate College, Bistan Road, Khargone (M.P.)" aims to assess the institution's lifestyle, actions, and their environmental impact. This audit primarily focuses on green indicators such as the utilization of green energy (solar energy), optimal use of secondary energy sources (petrol and diesel), campus vegetation, and the carbon footprint. The objective of green auditing is to assist the institution in adopting sustainable development practices and setting examples for the community and students.

Objectives of Green Auditing

The overarching objective of green auditing is to compile a baseline report on the "Green Campus" and alternative energy sources (solar energy), along with proposing measures to curtail resource wastage and enhance sustainable practices.

The specific objectives encompass:

Instilling values of sustainable development practices through the green audit mechanism.

Establishing a database for corrective actions and future planning.

Identifying areas of improvement and offering recommendations to enhance the green campus status of the college.

CHAPTER- 2
GREEN CAMPUS

2.1 Green Audit

The survey has prioritized assessing the current condition of plants and trees within the college campus, as well as the conservation initiatives undertaken by the college authorities. The campus is surrounded by an estimated total of over 113 trees. Details are provided below:

Green Campus

Sr. no.	Tree Name	Total
1	Shisham	4
2	Gulmohar	3
3	Rajkumari	2
4	Peepal	2
5	Neem	1
6	Devltri	3
7	Gorichori	6
8	Kanji	3
9	Bargad	2
10	Aamla	1
11	Palm	4
12	Rajgiri	1
13	Gulachin	2
14	Brenia	1
15	Amrod	5
16	Jamun	1
17	Sindur	2
18	Jhagruva	2
19	Aam	1
20	Ashok	2
21	Agasti	1
22	Hohosi	1
23	Sami	1
24	Vaibranchi	1
25	Arlutri	2
26	Jason	3
27	Gulab	5
28	Croton	5

Sr. no.	Tree Name	Total
29	Naagped	1
30	Pigenped	3
31	Neem	9
32	Khajur	3
33	Palas	7
34	Ratan jot	15
35	Kanji	5
36	Mongra	1
37	Munga	1
38	Bel	1
Total		113

Glimpse of some appreciable initiative by theCollege

Chapter-03
Carbon Foot print

About Carbon Foot Print

Climate change stands as one of the most significant challenges confronting nations, governments, institutions, businesses, and humanity at large.

A carbon footprint measures the impact of your activities on the amount of carbon dioxide (CO_2) generated by the combustion of fossil fuels. This impact is expressed in terms of the weight of CO_2 emissions produced in tonnes. Our focus is on consumption within five primary categories: housing, travel, food, products, and services. Additionally, we estimate the portion of national emissions that lie beyond our direct control, including government purchases and capital investment.

For simplicity and clarity, all our calculations adhere to a single basic method. We multiply each footprint by an emissions factor derived from use inputs. All use inputs are calculated per individual and encompass variables such as fuel usage, travel distance, calorie intake, and expenditures. Determining these inputs involves estimating them from your home, travel, diet, and spending patterns.

While computing our inputs might require some investigation on your part, the more intricate aspect of carbon calculations is determining the appropriate emissions factor for your calculations. Whenever possible, it's advisable for this emissions factor to encompass as much of the relevant life cycle as feasible.

In reality, each one of us possesses a carbon footprint...

Methodology and Scope

The carbon footprint provides a comprehensive overview of the College's greenhouse gas emissions, converted into CO_2 equivalents. This data is based on reported information from both internal and external systems. The objectives of these carbon indicators are to measure the carbon intensity per unit of product and enhance environmental transparency for external stakeholders.

The carbon footprint reporting approach employed in this study adheres to the guidelines and principles established in the "Greenhouse Gas Protocol Corporate Accounting and Reporting Standard" (hereinafter referred to as the GHG Protocol). This standard is developed by the Greenhouse Gas Protocol Initiative and is an international standard for quantifying and reporting greenhouse gas emissions, as indicated by ISO 14064. This methodology is widely recognized and utilized for corporate carbon footprint assessments.

The study has evaluated carbon emissions from the College Campus. This encompasses the accounting and reporting of GHG emissions linked directly to activities for which the institution bears responsibility. The items quantified in this study align with the classifications outlined in the ISO 14064 standards. Specifically, the report computes greenhouse gas emissions from the College, including electricity consumption and emissions linked to diesel usage in College vehicles.

Emissions related to air travel, waste generation, administration, and marketing activities have been excluded from the present study. Emissions arising from business activities are generally categorized within scope 1, 2, or 3 areas as defined by the ISO 14064 standards.

Carbon emission from electricity

Direct emissions factors are widely available and indicate the emissions produced by power stations to generate an average kilowatt-hour within a specific grid region.

Unlike other energy sources, the carbon intensity of electricity varies significantly based on its production and transmission methods. For the majority of us, the electricity we consume is drawn from the grid and is generated through a diverse range of sources. While determining the carbon intensity of this mix can be complex, much of this work is generally conducted on our behalf.

The electricity utilized on the site is a substantial contributor to GHG emissions from the unit. Onsite electricity consumption represents the most direct and typically the most impactful element contributing to a unit's carbon footprint. As such, considering an average fuel mix for electricity generation, the carbon dioxide intensity of electricity for the national grid is assumed to be 0.9613 Kg CO_2 /KWh.

Sr.No.	Year	Total Unit Consumption	Unit	Emission Factor kg CO2e/kWh	Emission ton CO2e/ year
1	2022-23	7,552	kWh	0.9613	7.55

Carbon emission from DG set

The college has a single DG set installed on its campus, with an annual diesel consumption of 91 litres from July 2022 to June 2023.

For every litre of diesel fuel, there is approximately 720 grams of pure carbon. In an average liquid hydrocarbon-burning engine, it can be presumed that about 99% of the fuel undergoes oxidation (It is assumed that slightly less than 1% will not fully oxidize and will be emitted as particulate unburned hydrocarbons rather than CO2).

Calculation of Total CO_2 =

- CO_2 Emissions from a Litre of diesel: 2689.56 grams CO_2/ litre.
- Diesel consumption Jul-2022 to Jun-2023= 91Litre
- 91 x 2689 =258197 gram. or 0.258Ton/year

Biomass Calculation and CO_2Sequestration 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)

$$BGB = AGB \times 0.15$$

2 Total Biomass (TB)

$$TB = AGB + BGB$$

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

$$C = W \times 0.50$$

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

$$CO_2 = C \times 3.666$$

Where: -

AGB = Above ground biomass.

D = Diameter of tree breast height.

BGB = Below Ground Biomass.

C = Carbon

TB = Total Biomass.

Biomass Calculation of tree

Sr. no.	Tree Name	Botanical and Family Name	Average Diameter CM (10 to 100)	AGB	BGB	Total	Carbon Storage	Amount of Co2 Sequestered	Total	Total Amount of Co2 Sequestered	Annua Co2 Sequest amou (Ton/y
1	Shisham	Dalbergia sissoo	10	21.7	3.3	24.9	12.5	45.7	4	183	0.00
2	Gulmohar	Delonix regia	40	798.0	119.7	917.7	458.9	1682.2	3	5047	0.07
3	Rajkumari	Zanthoxylum armatum	38	708.3	106.2	814.5	407.2	1493.0	2	2986	0.04
4	Peepal	Ficus religiosa	62	2144.0	321.6	2465.6	1232.8	4519.5	2	9039	0.12
5	Neem	Azadirachta indica	42	893.2	134.0	1027.2	513.6	1882.9	1	1883	0.03
6	Devltri	Alstonia scholaris	48	1211.4	181.7	1393.2	696.6	2553.7	3	7661	0.10
7	Gorichori		16	79.2	11.9	91.1	45.5	166.9	6	1002	0.01
8	Kanji	Peltophorum pterocarpum	38	708.3	106.2	814.5	407.2	1493.0	3	4479	0.06
9	Bargad	Banyan	80	3734.1	560.1	4294.2	2147.1	7871.2	2	15742	0.21
10	Aamla	Phyllanthus emblica	16	79.2	11.9	91.1	45.5	166.9	1	167	0.00
11	Palm	Arecaceae	60	1994.5	299.2	2293.7	1146.8	4204.3	4	16817	0.23
12	Rajgiri	Amaranthus cruentus	26	283.7	42.5	326.2	163.1	598.0	1	598	0.01
13	Gulachin	Pyllanthus emblica	38	708.3	106.2	814.5	407.2	1493.0	2	2986	0.04
14	Brenia	Breynia	24	231.9	34.8	266.7	133.3	488.9	1	489	0.01
15	Amrod	Guava	34	545.0	81.8	626.8	313.4	1148.8	5	5744	0.08
16	Jamun	Syzygium cumini	36	623.9	93.6	717.5	358.7	1315.2	1	1315	0.02
17	Sindur	Bixa orellana	32	471.5	70.7	542.2	271.1	993.9	2	1988	0.03
18	Jhagruva		30	403.5	60.5	464.0	232.0	850.5	2	1701	0.02
19	Aam	Mangifera indica	22	185.6	27.8	213.4	106.7	391.2	1	391	0.01

Sr. no.	Tree Name	Botanical and Family Name	Average Diameter CM (10 to 100)	AGB	BGB	Total	Carbon Storage	Amount of Co2 Sequestered	Total	Total Amount of Co2 Sequestered	Annua Co2 Sequest amou (Ton/y
20	Ashok	Saraca indica	30	403.5	60.5	464.0	232.0	850.5	2	1701	0.02
21	Agasti	Sesbania grandiflora	24	231.9	34.8	266.7	133.3	488.9	1	489	0.01
22	Hohosi	Lagerstroemia speciosa	28	340.9	51.1	392.0	196.0	718.5	1	718	0.01
23	Sami	Acacia polyacantha Willd	30	403.5	60.5	464.0	232.0	850.5	1	850	0.01
24	Vaibranchi	Solanum virginianum	40	798.0	119.7	917.7	458.9	1682.2	1	1682	0.02
25	Arlutri	Phyllanthus emblica	24	231.9	34.8	266.7	133.3	488.9	2	978	0.01
26	Jason	Syzygium cumini	26	283.7	42.5	326.2	163.1	598.0	3	1794	0.02
27	Gulab	Rosa × centifolia	10	21.7	3.3	24.9	12.5	45.7	5	229	0.00
28	Croton	Euphorbiaceae.	16	79.2	11.9	91.1	45.5	166.9	5	835	0.01
29	Naagped	Mesua ferrea	22	185.6	27.8	213.4	106.7	391.2	1	391	0.01
30	Pigenped	Cajanus cajan	24	231.9	34.8	266.7	133.3	488.9	3	1467	0.02
31	Neem	Azadirachta indica	42	893.2	134.0	1027.2	513.6	1882.9	9	16946	0.23
32	Khajur	Phoenix dactylifera	82	3937.9	590.7	4528.6	2264.3	8300.9	3	24903	0.34
33	Palas	Butea monosperma	12	35.4	5.3	40.7	20.4	74.7	7	523	0.01
34	Ratan jot	Alkanna Tinctoria	14	54.6	8.2	62.8	31.4	115.1	15	1726	0.02
35	Kanji	Millettia pinnata	16	79.2	11.9	91.1	45.5	166.9	5	835	0.01
36	Mongra	Jasminum sambac	14	54.6	8.2	62.8	31.4	115.1	1	115	0.00
37	Munga	Vigna radiata	24	231.9	34.8	266.7	133.3	488.9	1	489	0.01
38	Bel	Aegele marmolas	24	231.9	34.8	266.7	133.3	488.9	1	489	0.01
Total											1.87

The college has 113 trees on its campus. This initiative taken by the management for creating a green campus under the plantation campaign is commendable. It's truly appreciable. The total amount of CO_2 sequestered is 1.87tons per year. This is also highly commendable.

Total CO_2 Emission by the College

Sr. No.	CO_2 Emission by	Total CO_2 Emission ton/year
1	Electricity	7.55
Total CO_2 Emission		7.55
CO_2 Emission Neutralized by		
1	Trees	1.87
Total CO_2 Emission		**5.68**

Other Emissions Excluded

This study did not assess the carbon sequestration potential of existing factors such as staff commuting, food supply, official flights, paper products, water supply, and waste disposal and recycling. This limitation arises due to restricted data availability. The present study, however, highlights the areas where data monitoring, recording, and archiving need to be developed to expand the scope of mapping GHG emissions in the upcoming years.

Consequently, a set of tools and record-keeping procedures will be developed to enhance the quality of data collection for future carbon footprint studies.

CHAPTER- 4
WASTE MANAGEMENT

About Waste

Human activities generate waste, and the manner in which these wastes are handled, stored, collected, and disposed of can pose risks to both the environment and public health. Effective waste management is crucial for establishing an eco-friendly campus. In the college, various types of waste are produced, and their collection and management present significant challenges.

Solid waste can be categorized into three main types: biodegradable, non-biodegradable, and hazardous waste. Biodegradable waste includes items like food waste, canteen waste, and waste from toilets. Non-biodegradable waste consists of materials commonly discarded in households and schools, such as plastic, tins, and glass bottles. Hazardous waste encompasses materials that could pose threats to health or the environment, including cleaning chemicals, acids, and petrol.

Improper handling of these wastes, such as dumping them in pits or burning them, can lead to harmful contamination of soil and water sources. Additionally, burning waste can produce greenhouse gases that contribute to global climate change. Special attention should be directed toward the proper management of hazardous waste generated within the college.

Bio-degradable waste can be effectively utilized for energy generation through anaerobic digestion or converted into fertilizer using composting technology. Non-biodegradable waste can be managed through recycling and reuse practices. Thus, minimizing solid waste is essential for promoting sustainability within the college. The auditor assesses the existing waste disposal policies and proposes effective solutions to address the challenges.

Table 4.1 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.

Waste management Practices adopted by the College

The audit team visited various departments, classrooms, and other areas to identify waste generation points and waste collection areas for potential improvement. Detailed information is provided in the table.

Figure 4.2 Waste collection bin in college campus

Recommendation

It is recommended to adopt a 5-Bin Waste Collection System to efficiently collect different types of waste generated within the college premises.

Recommended 5 Dust Bin waste collection System

Waste Collection Points

The audit team visited various departments, classrooms, staffrooms, and laboratories to identify waste generation areas and waste collection points for potential improvements. Details are provided in the table.

Details of Waste collection Dust bin system

Sr.no.	Location	No. of dustbins
1	Corridor	1
2	Office	1
3	Principal room	1
4	Chemistry lab	1
5	Classroom	1
6	Library	1
7	History dept.	1
8	Physics lab	1
Total		8

Observation:- The audit team had previously recommended a 5-dustbin system, while the college currently has 8 dustbins in place.

Organic Waste Composting Machine

The audit team visited various departments and the garden and engaged in discussions with the management regarding the waste collection process. Following the audit, we recommended the installation of an organic waste composting machine for the daily waste generated by the college.

An organic waste composting machine is a standalone unit designed to enhance the composting process and yield higher-quality compost. It takes waste as input and produces manure as output. Composting without the use of an organic waste composting machine would consume a significant amount of time.

About Composting Process

The highly compact composting machine utilizes special microorganisms to efficiently break down and decompose various types of organic waste into compost within 24 hours, resulting in a volume reduction of 85-90% when organic waste is introduced into the machine, the humidity sensor, heater, mixing blades, and exhaust system work in tandem to manage moisture levels effectively.

Recommendation: The college possesses significant potential for installing an organic waste composting machine.

CHAPTER- 5
RECOMMENDATIONS AND SUGGESTIONS

QR Code System

In a world increasingly embracing digital technologies, individuals often find themselves lacking the time to engage with books and fully absorb the information they offer. Therefore, the college could consider implementing QR codes on trees to offer relevant information. This innovative approach harnesses the rapidly expanding digital platform for a distinct purpose.

Fig: 6.1 QR Code System for plants

These codes can provide students with comprehensive information about the tree, ranging from its scientific name to its medicinal value. All they need to do is utilize their smart phones. QR codes simplify the process for everyone to access knowledge about plants or trees instantly. Any application capable of generating QR codes, available for free on online stores, can be employed to access tree-related information**.**

Eco-restoration programmes

Develop long-term eco-restoration programs aimed at replacing exotic Acacia plantations with indigenous trees. The need of the hour is to formulate a comprehensive campus development plan.

Other Suggestions

Here are the some suggestions,

- Adopt the proposed Environmentally Responsible Purchasing Policy and work towards creating and implementing a strategy to reduce the environmental impact of purchasing decisions.
- Increase recycling education on campus.
- Raise awareness of environmentally sustainable development on the college campus.
- Practice Institutional Ecology - Set an example of environmental responsibility by establishing institutional ecology policies and practices, including resource conservation, recycling, waste reduction, and environmentally sound operations.
- Involve all stakeholders - Encourage government, foundations, and industry participation in supporting interdisciplinary research, education, policy formation, and information exchange for environmentally sustainable development.
- Collaborate for Interdisciplinary Approaches - Develop interdisciplinary approaches to curricula, research initiatives, operations, and outreach activities that promote an environmentally sustainable future.
- Enhance education on reducing, reusing, and recycling on campus.
- Create a butterfly garden to foster appreciation for flora and fauna diversity.
- Label all trees and plants (Plant DNA barcodes) with their common and scientific names.

- Organize training programs on environmental management systems and nature conservation.
- Renovate the cooking system in the canteen to save gas by installing a solar water heater system with a heat pump.
- Establish a procurement policy that prioritizes energy-saving and eco-friendly practices.

END OF THE REPORT

THANKS

ENERGY AUDIT REPORT

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Flat No. 201, OM Apartment, 214 Indrapuri Colony,
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0731-4948831, 7869327256
Email ID:eempirical18@gmail.com
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CONTENT

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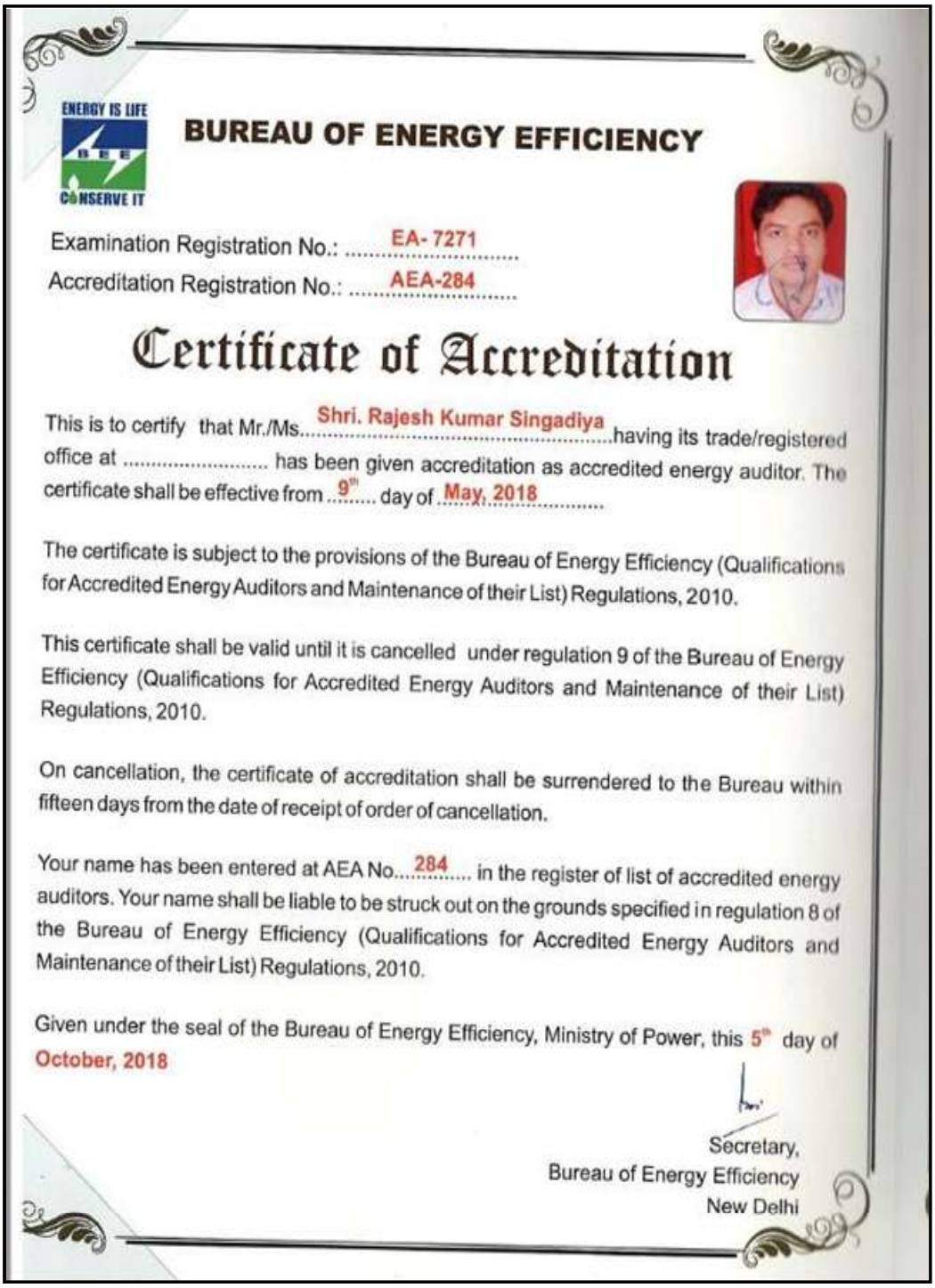
(BEE, Ministry of Power, Govt. of India)
Empanelled Energy Auditor with MPUVN, Bhopal M.P.
Lead Auditor ISO 50001:2011 [EnMS) from FICCI, Delhi
Certified Water Auditor (NPC, Govt of India)
Chartered Engineer [M-1699118], The Institution of Engineers (India)
Member of ISHRAE [58150]

Certificate of Accreditation



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

The Audit Team

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

- **Mr. Rakesh Pathak**, [Director & Electrical Expert]
- **Mr. Rajesh Kumar Singadiya** [Accredited Energy Auditor (AEA-0284)]
- **Ms. Laxmi Raikwar** [Energy Expert & Report Reviewer]
- **Mr. Charchit Pathak** [Sr. Project Engineer]
- **Mr. Mohan Choudhary [**Sr. Electrician**]**

GOVT DEGREE COLLEGE IQAC Coordinator SHAHPURA DISTT DINDORI(MP)

प्राचार्य
शासकीय स्नातक महाविद्यालय
शहपुरा जिला डिण्डौरी(म.प्र.)

Green Monitoring Committee

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EXECUTIVE SUMMARY

The executive summary of the energy audit report provided in this section briefly outlines the identified energy conservation measures and other recommendations made during the project. These measures can be implemented in a phased manner to conserve energy and enhance productivity within the college campus.

ENERGY MANAGEMENT INITIATIVES BY THE COLLEGE

SOLAR SYSTEM

A rooftop grid-connected solar system under installation with a capacity of 25 KWp under RESCO model through state nodel agency MPUVNL, Bhopal. This accomplishment is commendable

ENERGY AUDIT RECOMMENDATIONS

LIGHTING SYSTEM

The college has already taken steps to install energy-efficient lighting within the premises. This includes the replacement of conventional tube lights with energy-efficient LED lights. However, there remains significant potential for further improvement. Specifically, the replacement of 47 conventional tube lights (40W) with energy-efficient 18 Watt LED lighting is recommended. This change is estimated to result in an energy saving potential of 1034 units per year.

CEILING FAN SYSTEM

Replacing "80 conventional ceiling fans (60W) with energy-efficient star-rated fans or BLDC-based energy-efficient fans (28W) in classrooms, laboratories, and faculty cabins" holds significant potential for energy savings.

TIMER-CONTROLLED AND SENSOR BASED LIGHTING

It is recommended to install "timer controls and sensor based lighting system" across the college campus.

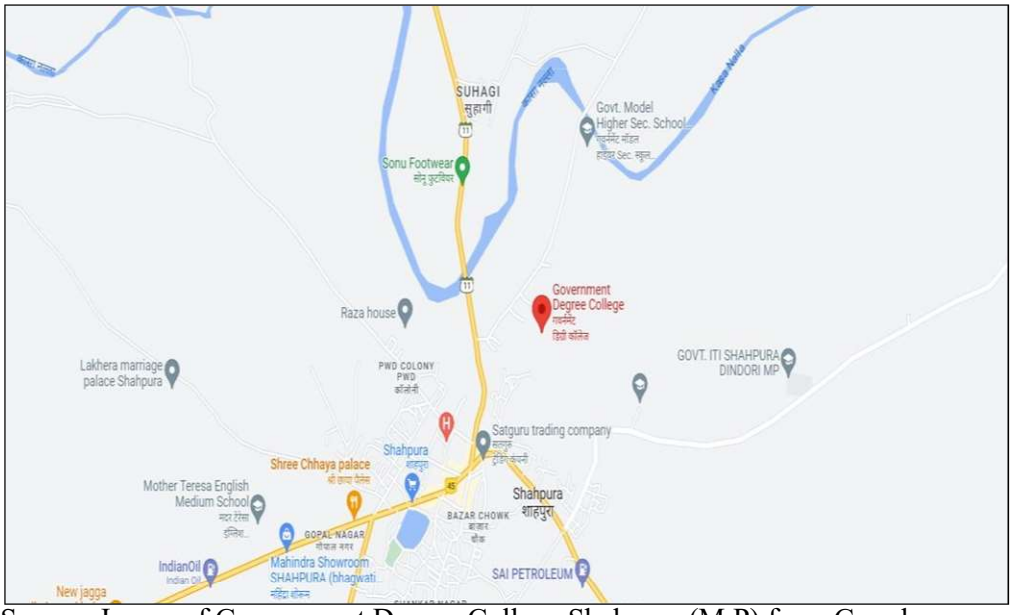
ENERGY CONSERVATION MEASURES

Case Study	Section	Identification	Observation	Recommendation	Annual energy saving (kWh)	Annual cost saving (Rs.)	Investment (Rs.)	Simple payback Period
1	Lighting System	47No. FTL with 40W	Power consumption by FTL with 40W	Replacement of conventional (T-12) with 18W LED tube	1,034	8,789	9,870	13 month
2	Ceiling Fan	80 No. ceiling fan working with 60W in college	Power consumption by existing ceiling fan 60W	Replacement of 60W ceiling fan by 28W BLDC energy efficient fan	2,867	24,371	1,68,000	6.9 year
3	Contract demand 41KW	Demand is not utlizied	Average md 5.4kW	Surender borewell connection. Borewell should be operate main connection	-	9,360	-	-
Total					3,901	42,520	1,77,870	4.1 year

CHAPTER-1
INTRODUCTION

About the College

Government Degree College, Shahpura is an affiliated college established in 1983 in Dindori, Madhya Pradesh. Government Degree College, Shahpura offers various programme approved by university grants commission and is affiliated with Rani Durgavati Vishwavidyalaya, Jabalpur.



Source: Image of Government Degree College Shahpura (M.P) from Google map

Vision

To empower the youth, especially belonging to the underprivileged sections of society, through quality education by inculcating philanthropic values and enabling them to meet the challenges of the contemporary knowledge society.

Mission

To translate the vision into reality the institution is committed to -

- Embrace in its fold students from all sections and categories especially addressing to the needs of the first generation learners.
- Expose the students (especially the under-privileged ones) to variety of activities, academic and extra-academic, aiming at their overall development.
- Inculcate humanistic and social values in the students to motivate them towards community services.

Build-up area of the college

Details are the total build-up area given in the table

Sr.No.	Description	Area(Sqm.)
1	Total area	80937

College Population

Sr. No.	College Staff/ Student	Population (No.)
1	Total teaching staff	6
2	Total Non teaching staff	7
3	Total No. of student	614

About Energy Audit

An energy audit serves to enhance understanding about how energy is utilized within a college, aiding in the identification of areas susceptible to waste and potential areas for improvement. The overall energy efficiency, from generation to the end consumer, stands at 50%. Therefore, conserving one unit by the end user is tantamount to saving two units produced at the power plant.

An energy audit represents the most effective approach to discerning the strengths and weaknesses of energy management practices, while also offering solutions to existing issues. It embodies a professional means of responsible utilization of economic, financial, social, and natural resources. Energy audits contribute value to management control and serve as an evaluative method for systems.

Empirical Exergy Private Limited (EEPL), based in Indore, Madhya Pradesh, conducted an "Energy Audit" on-site to identify gaps in the energy consumption pattern Government College, Government Degree College, Shahpura, Post - Shahpura, District- Dindori (M.P.). A technical report has been prepared in accordance with the project's requirements and specifications.

Objectives of Energy Auditing

Energy auditing provides a critical information foundation for an all-encompassing energy conservation initiative, encompassing energy utilization analysis and the evaluation of energy-saving measures. Its objectives include:

Identifying the cost and quality of different energy inputs.

Evaluating the current energy consumption patterns across various operational cost centers.

Establishing connections between energy inputs and production outputs.

Identifying potential areas for thermal and electrical energy conservation.

Pinpointing areas of major wastage.

Setting energy-saving targets for individual cost centers.

Implementing measures for energy conservation and realizing savings.

Methodology

The methodology employed to achieve the designated objectives, encompassing the assessment of current operational status and potential energy savings, encompasses the following steps:

- Engaging in discussions with relevant officials to identify key areas of focus and related systems.
- Sending a team of engineers to the site for discussions with concerned officials and supervisors, aiming to gather data and information regarding plant operations and load distribution across the premises. The collected data were analyzed to establish a baseline energy consumption pattern.
- Utilizing suitable instruments for measurements and monitoring, including continuous and/or time-lapse recording as appropriate, coupled with visual observations to discern energy usage patterns and system losses.
- Conducting trend analysis for costs and consumption patterns.
- Carrying out capacity and efficiency tests on major utility equipment, wherever applicable.
- Estimating various forms of losses.
- Performing computations and in-depth analysis of the gathered data, utilizing computerized analysis and relevant techniques where appropriate, to derive conclusions and formulate an effective energy conservation plan to enhance and reduce specific energy consumption.

Present Energy Scenario

The college acquires energy in the form of electricity procured from the MPPKVVCL grid. The total billing amount for Govt. Degree College connections is Rs.2,08,991/- reflecting an annual energy consumption of 7,555 units, with an overall per-unit charge of Rs. 27.67per unit during the period from June 2022 to July 2023.

CHAPTER- 2
POWER SUPPLY SYSTEM

Power Supply System

The college's power supply primarily derives from the grid. In the event of grid power failure, an emergency power supply is provided by a DG set.

Grid Power

The college acquires energy in the form of electricity procured from the MPPKVVCL grid. The total billing amount for Govt. Degree College connections are Rs.2,08,991, reflecting an annual energy consumption of 7,552 units, with an overall per-unit charge of Rs. 27.67/- per unit during the period from June 2022 to July 2023. Monthly energy consumption details are outlined in Chapter 3.

DG Set

A DG set is utilized in instances of grid power failure.

DG Set

A single DG set is present on the college campus. The technical specifications for the DG set are provided in the following table (Table 2.1)

Table 2.1 Technical Specifications for DG Set

Sr.No.	Parameter	Technical Specification
1	Make	Kirloskar
2	Capacity (KVA)	7.5
3	Rated Voltage(V)	240
4	Speed(RPM)	1500
5	Phase	1
6	Power factor	0.8

Figure 2.1:- DG set on the college campus

Observation

- DG set is used only in case of power failure.

CHAPTER- 3

ELECTRICITY BILL ANALYSIS

Electricity Bill Analysis 2022-23

An analysis of the electricity bills from the previous year was conducted. Detailed information regarding unit consumption and overall unit charges is provided in Table 3.1.

Table 3.1 Monthly energy consumption 2022-23 of Main connection

Sr. No.	Month & Year	Unit Consumption (kWh)	Total Amount (Rs/-)	Overall per unit charges (Rs./kWh)
1	Jul-22	509	10,315/-	20.27
2	Aug-22	456	12,440/-	27.28
3	Sep-22	630	12,161/-	19.30
4	Oct-22	433	15,404/-	35.58
5	Nov-22	383	30,873/-	80.61
6	Dec-22	499	15,610/-	31.28
7	Jan-23	554	16,002/-	28.88
8	Feb-23	459	15,262/-	33.25
9	Mar-23	505	15,986/-	31.66
10	Apr-23	617	15,418/-	24.99
11	May-23	669	15,758/-	23.55
12	Jun-23	697	15,799/-	22.67
Total		6411	1,91,028/-	31.61

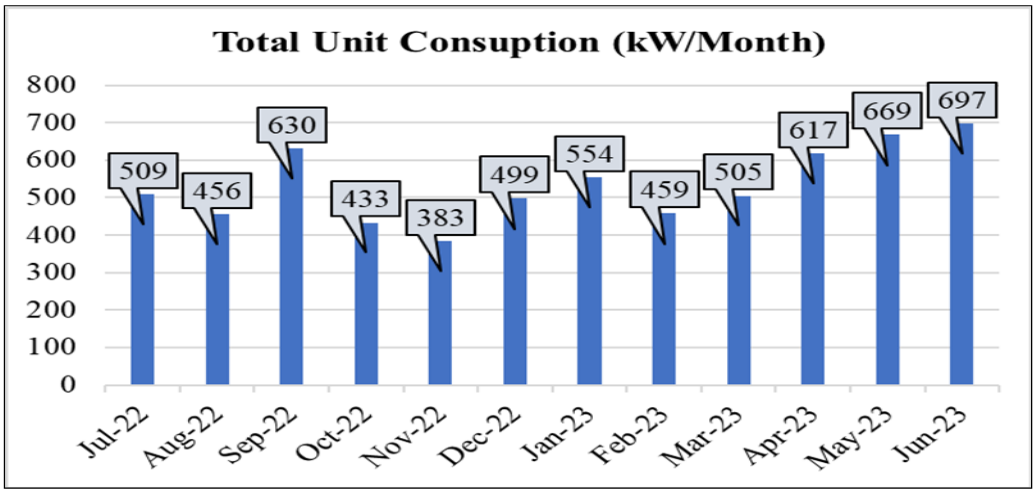


Figure 3.1 Monthly Grid Unit Consumption year-2022-23

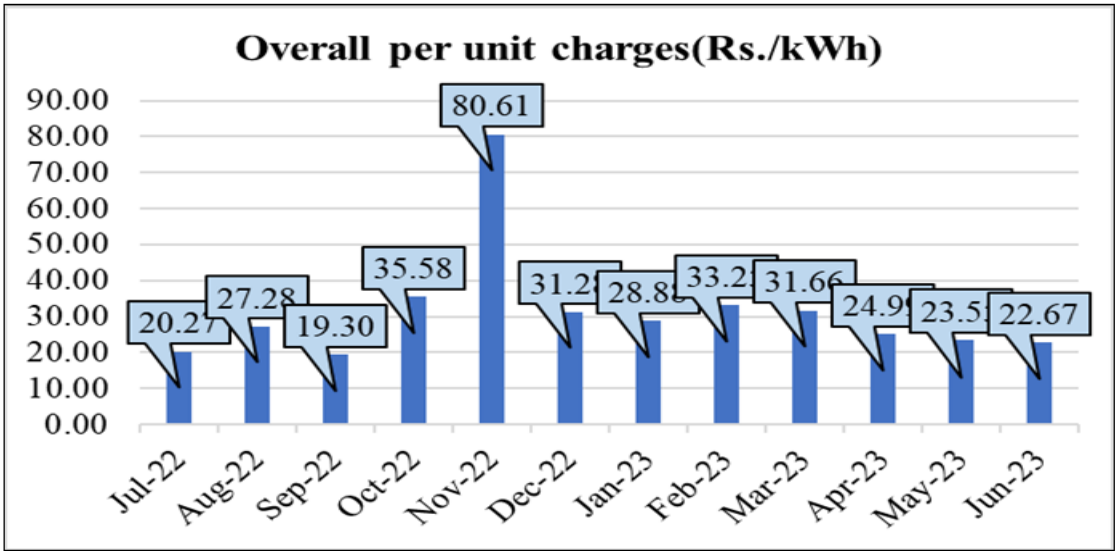


Figure 3.2 Annual average overall per unit charges year -2022-23

Observation - The annual energy consumption of the main connection is 6,411 units, and the overall charge is Rs. 31.61 per unit.

Table-3.2 Monthly Power Factor(2022-23) of Main connection

Sr. No	Month & year	Power factore
1	Jul-22	0.98
2	Aug-22	0.98
3	Sep-22	0.98
4	Oct-22	0.97
5	Nov-22	0.97
6	Dec-22	0.99
7	Jan-23	0.95
8	Feb-23	0.96
9	Mar-23	0.97
10	Apr-23	0.97
11	May-23	0.97
12	Jun-23	0.98
Annual Average Power factor		0.97

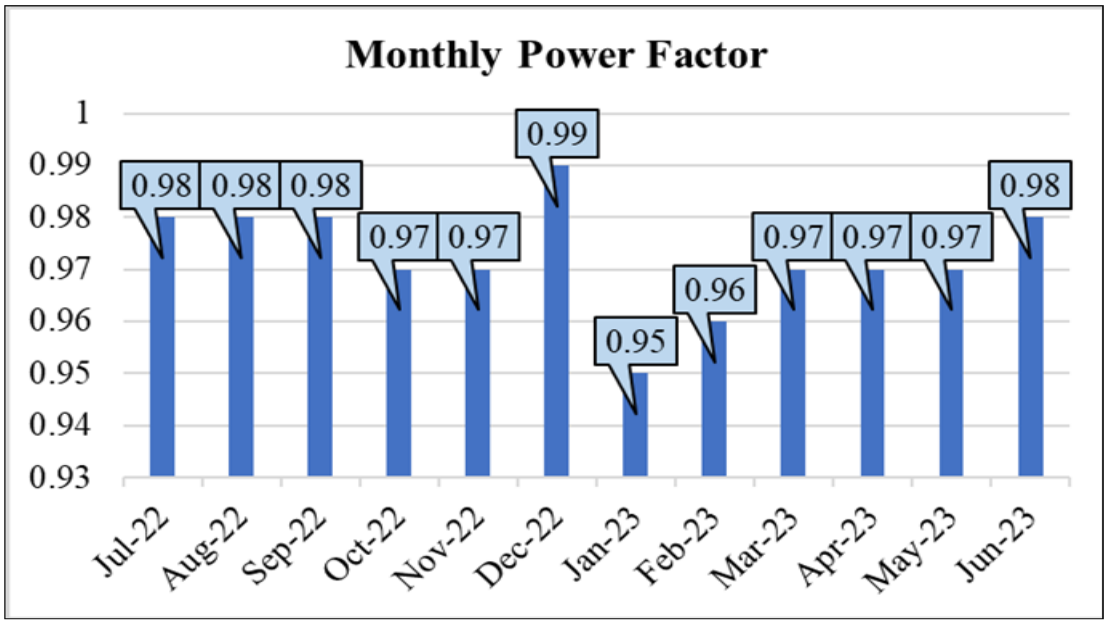


Figure 3.3 Monthly Average Power factor year-2022-23

Observation - The annual average Power factor of the main connection is 0.97

Table 3.3:- Monthly demand analysis (KVA) consumption of main connection year 2022-23

Sr. No.	Month & year	Contract Demand (KVA)	Maximum Demand (KVA)
1	Jul-22	41	4.53
2	Aug-22	41	3.58
3	Sep-22	41	5.16
4	Oct-22	41	4.21
5	Nov-22	41	4.25
6	Dec-22	41	3.53
7	Jan-23	41	3.8
8	Feb-23	41	3.5
9	Mar-23	41	3.8
10	Apr-23	41	4.62
11	May-23	41	5.53
12	Jun-23	41	5.39
Contract Demand		41	
Maximum Demand		5.53	
Average maximumDemand		4.32	

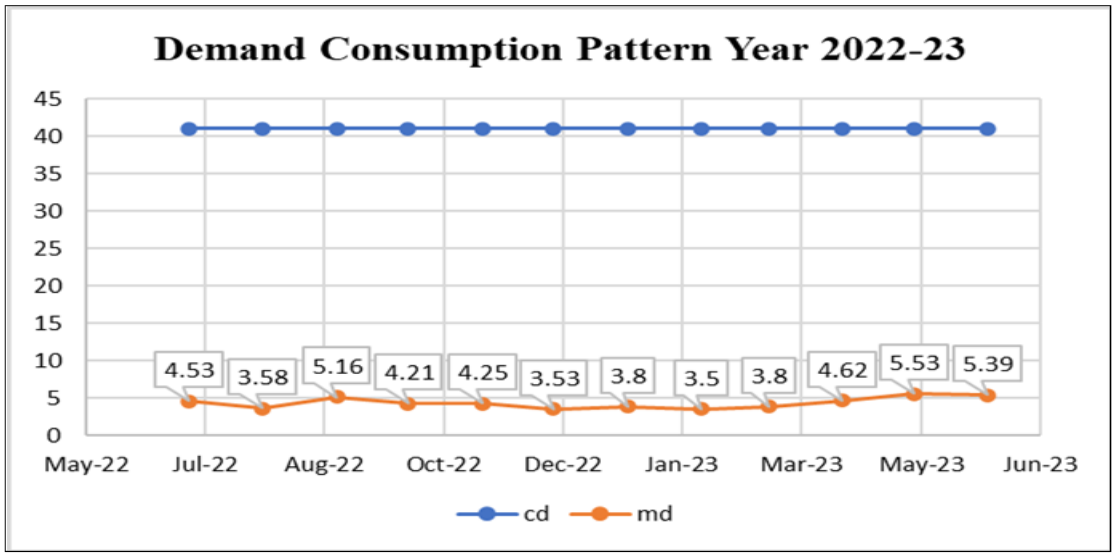


Figure 3.4:- Graphical presentation of demand consumption in the college year 2022-23

Observation: It was observed that the contract demand of the college is 41 KVA. There isa variation in maximum demand. It is a maximum of 5.53 kVA in the Month of May-2023.

Table 3.4 Monthly energy consumption 2022-23 of Motor(borewell)

Sr. No.	Month & year	Unit Consumption (kWh)	Total Amount (Rs/-)	Overall Unit Charges (Rs/kWh)
1	Jul-22	87	1,198/-	13.8
2	Aug-22	108	1,336/-	12.4
3	Sep-22	73	1,106/-	15.2
4	Oct-22	74	1,124/-	15.2
5	Nov-22	108	2,477/-	22.9
6	Dec-22	125	1,486/-	11.9
7	Jan-23	72	1,313/-	18.2
8	Feb-23	70	1,310/-	18.7
9	Mar-23	55	1,649/-	30.0
10	Apr-23	91	1,461/-	16.1
11	May-23	117	1,548/-	13.2
12	Jun-23	164	1,955/-	11.9
Total		1,144	17,963/-	16.6

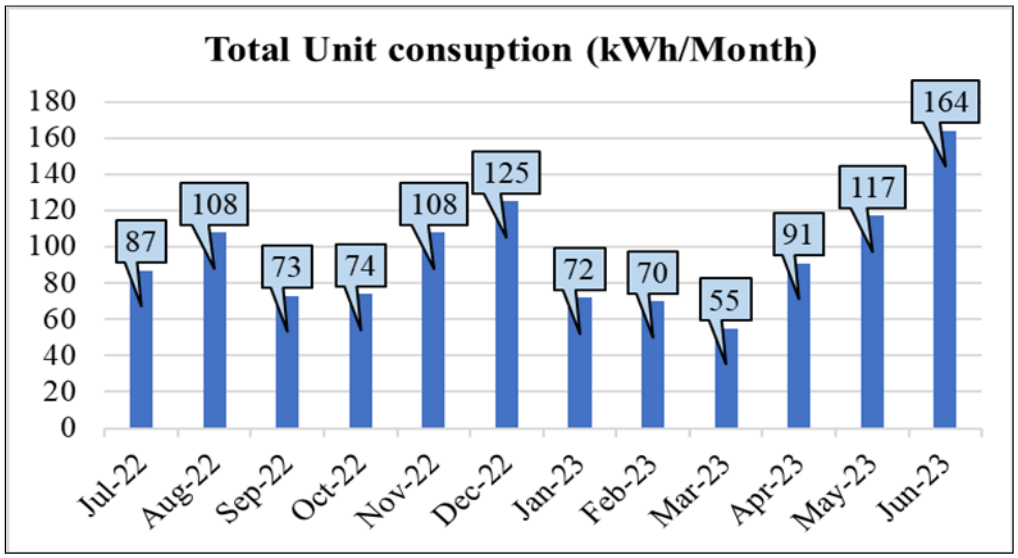


Figure 3.5 Monthly Motor(Borewell) Unit Consumption year-2022-23

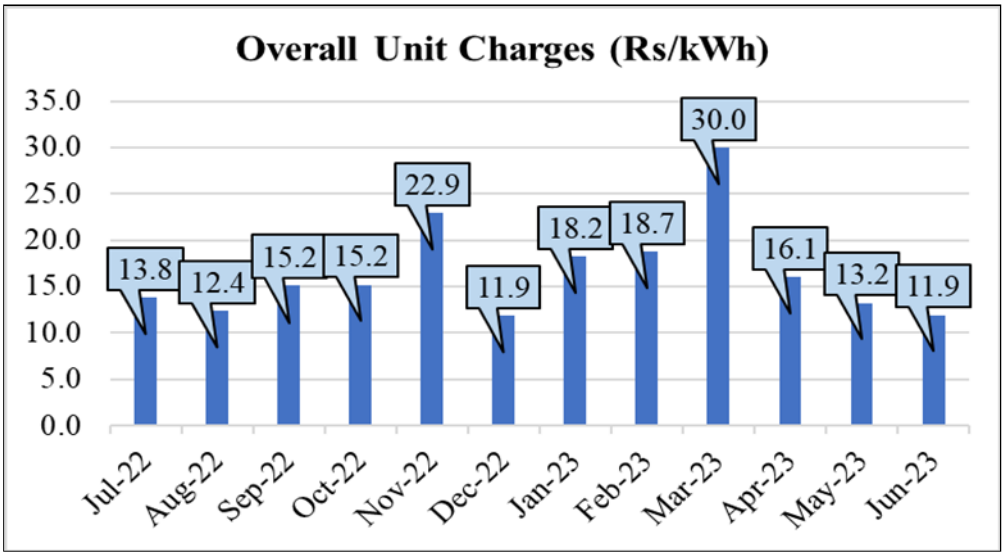


Figure 3.6 Annual average overall per unit charges of (Motor) borewell year -2022-23

Observation - The annual energy consumption of the main connection is 1,144 units, and the overall charge is Rs. 16.6 per unit.

ON-site power measurement in college

Sr. No.	Location	Voltage (V)	Current (A)	Power Factor	Power Consumption (kW)
1	Main connection	416	5.7	0.97	4.0
2	Motor(Borewell)	412	5	0.8	2.9

CHAPTER-4
CONNECTED LOAD

4.1 Connected load details of the college

Sr. no.	Location	LED (18w)	FTL (40W)	CFL (9W)	Fan (60W)	Photocopy machine	Printer	Computer	Exhaust fan	LED Light (30W)
1	Head Clerkroom	5	0	0	2	1	0	0	0	0
2	Principal room	3	0	0	1	0	0	0	0	0
3	Office	3	0	0	2	0	2	3	0	0
4	Economics Dept.	1	0	2	1	0	0	0	0	0
5	History Dept.	0	1	0	1	0	0	0	0	0
6	Sports room	2	1	0	0	0	0	0	0	0
7	Hindi Dept.	0	2	0	2	0	0	0	0	0
8	Hall	9	2	0	8	0	0	0	0	0
9	Library	5	1	0	6	0	0	0	2	0
10	Classroom-1	3	2	0	5	0	0	0	0	0
11	Classroom-2	1	4	0	5	0	0	0	0	0
12	Classroom-3	4	1	0	5	0	0	0	0	0
13	Classroom-4	4	2	0	5	0	0	0	0	0
14	Classroom-5	2	4	0	5	0	0	0	0	0
15	Zoology lab	1	7	0	6	0	0	0	0	0
16	Chemistry lab	1	4	0	0	0	0	0	0	0
17	Physics lab	4	2	0	2	0	0	0	0	0
18	Classroom-9	0	6	0	5	0	0	0	0	0
19	Exam control room	4	1	0	4	0	0	0	0	0
20	Geography Dept.	5	1	0	4	0	1	2	0	0

Sr. no.	Location	LED (18w)	FTL (40W)	CFl (9W)	Fan (60W)	Photocopy machine	Printer	Computer	Exhaust fan	LED Light (30W)
21	Bhoj kaksh	1	2	0	4	0	0	0	0	1
22	Street light	2	2	4	0	0	0	0	0	0
23	Corridor	9	2	0	7	0	0	0	0	0
Total		69	47	6	80	1	3	5	2	1

4.2 Connected Load sharing electrical equipment

Sr. No.	Equipment's	Unit Power (Watt)	Quantity	Total Power (Watt)	Load share%
1	LED tubelight	18	69	1242	7
2	FTL(40W)	40	47	1880	10
3	CFL(9W)	9	6	54	0
4	Photocopymachine	800	1	800	4
5	Printer	40	3	120	1
6	Fan	60	80	4800	26
7	Computer	240	41	9840	52
8	Exhaust fan	30	2	60	0
Total				18796	100

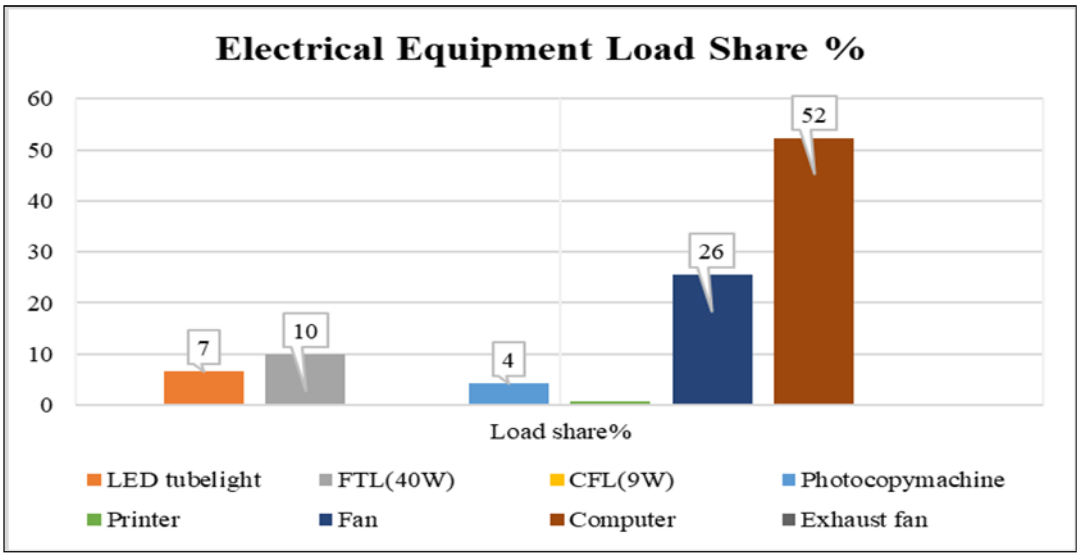


Figure 4.1:- Electrical Equipment load Share % year-2022-23

Some Photographs of Electrical Equipment

Computer

Printer

LED tube light(18W)

Ceiling Fan(60W)

Lux measurement

Sr. no.	Location	Lux Level
1	Head Clerk room	232, 225, 229
2	Principal room	221, 214, 209
3	Office	222, 216, 210
4	History dept.	146, 138, 127
5	Sports dept.	156, 142, 138
6	Chemistry lab	136, 128, 117
7	Physics lab	144, 132, 124
8	Room1	221, 197, 181
9	Room2	218, 194, 179
10	Library	177, 162, 154
11	Bhoj kaksh	134, 128, 116
12	Room3	227, 211, 198
13	Zoology lab	147, 139, 120

Observation

The range of lux reading range is 150/200/250. History dept., Chemistry lab, Physics lab, Bhoj kakash, Zoology lab lux readings are low.

CHAPTER- 5
ENERGY CONSERVATION MEASURES

5.1 Case Study

Replacement of conventional tube light 40 Watt to an energy-efficient LED tube light 18 Watt in college

Sr. No	Items	Parameters	Units
1	Total Power Consumption by T-12 conventional tube light	40	Watt
2	No of T-12	47	Nos.
3	Working Hrs./Day	8	Hrs./Day
4	Working Days/Year	250	Days/Year
5	Rated Power of Energy Efficient T-5 (LED)	18	W
6	Energy Saving Potential	2068	kWh/Year
7	Load Factor	0.5	
8	Expected Annual Energy Saving	1034	kWh/Year
9	Overall, Per Unit Charges	8.5	Rs./kWh
10	Expected Money Saving	8789	Rs./Year
11	Cost of T-5	200	Rs./ Pices
12	Investment on New Light Purchasing	9400	Rs.
13	Maintenance Investment@5%	470	Rs.
14	Total Investment	9,870	Rs
15	Simple Pay Back Period	13	Month

Note:- Energy savings depend on the operation hours per day and the load factor of the systems.

5.2 Case Study

Replacement of 60W conventional ceiling fan by 28W BLDC Energy efficient ceiling fan in college

Sr. No	Item	Parameter	Unit
1	Rated Power of Conventional Ceiling Fan	60	W
2	No. of Fan	80	Nos
3	Working Hrs./Day	8	Hrs./Day
4	Working Days/Year	200	Days/Year
5	Energy Efficient BLDC Fan Rated power	28	W
6	Energy Saving Potential	4096	kWh/Year
7	Load Factor	0.7	
8	Expected Annual Energy Saving	2867.2	kWh/Year
9	Per Unit Charges	8.5	Rs/kWh
10	Expected Money Saving	24371	Rs./Year
11	Cost of New Celling Fan	2,000	Rs./Pices
12	Investment on New Fan Purchasing	160000	Rs.
13	Maintenance Investment@5%	8,000	Rs.
14	Total Investment	1,68,000	Rs.
15	Simple Pay Back Period	6.9	Year

Note:- Energy savings depend on the operation hours per day and the load factor of the systems.

5.2 Case Study

Surrender Borewell connection to main connection

Sr. No	Item	Parameter	Unit
1	Surrender borewell connection	5	KW
2	Contract demand of main connection	40	KW
3	Maximum demand of main connection	5.4	KW
4	Contract demand of borewell connection	5	KW
5	Fixed demand charges of borewell connection per month	780	Rs.
6	Expected connected monetry saving fixed demand	9360	Rs.

END OF THE REPORT

IQAC Coordinator

प्राचार्य
शासकीय स्नातक महाविद्यालय
शहपुरा जिला डिण्डौरी(म.प्र.)

THANKS