

**GOVT. HOLKAR (MODEL AUTONOMOUS)
SCIENCE COLLEGE, INDORE**



(An ISO 9001:2015 & ISO 14001:2015 Certified Institution)



SSR DOCUMENT

2017-18 TO 2021-22

CRITERION – 6

Governance, Leadership and Management

Metric No.: 6.5.3

Document Title:
Quality audit

तमसो मा ज्योतिर्गमय



Office of the Principal

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

(ISO 9001:2015 & ISO 14001:2015 Certified)

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(Re-accredited 'A' Grade by NAAC)

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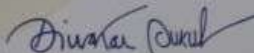
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Has been certified for
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Certificate of Energy Audit



This is to certify that

Government Holkar (Model, Autonomous) Science College, Indore, M.P. Energy Audit was successfully completed on 15th/ 16th of December 2022 in accordance with the standards set by the MoEF & CC and the CPCB for energy and renewable energy. The college was given seven out of seven golden stars for its efforts.



Certificate No. GCCS/02/23/262519

Initial Register Date : 15/12/2022

Issue Date. 15/01/2023

1st Surveillance Date : 16/12/2023

2nd Surveillance Date : 16/12/2024

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Certificate of Environmental Audit



This is to certify that

At Government Holkar (Model, Autonomous) Science College, Indore, M.P. environmental audit was successfully completed on 15th / 16th of December 2022 in accordance with the standards set by the MoEF & CC and the CPCB & MP State Pollution Control Board norms for water, waste water, energy, renewable energy, the air quality index, waste management, and biodiversity. The college was given seven out of seven golden stars for its efforts.



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Certificate of Green Campus Audit

This is to certify that

Government Holkar (Model, Autonomous) Science College, Indore, M.P. Green Campus Audit was successfully completed on 15th/ 16th of December 2022 in accordance with the standards set by the MoEF & CC and the CPCB for Water, Wastewater, Air Quality Inde, Waste Management and Biodiversty. The college was given seven out of seven golden stars for its efforts.



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Certificate of Appreciation

This is to certify that during an audit conducted at Holkar Science College, Indore on 15th/16th December 2022, it was found that College is purchasing all Star-rated Energy appliances. Also, solar panels producing 25kW have also been installed. This was possible under the able leadership & Guidance of the Respected principal of the Govt. Holkar Science College, Indore.

Ashutosh Kumar Srivastava

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Certificate of Appreciation

This is to certify that a field test was conducted at Holkar Science College on 15th/16th December 2022 at 3 locations for the quality of water. Total of 9 parameters were checked and all results. we are found within permissible limits according to ISO:10500-2012. This was possible under the able leadership & Guidance of the Respected principal of the Govt. Holkar Science College, Indore.

Ashutosh Kumar Srivastava

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Certificate of Appreciation

This is to certify that Air Quality at Holkar Science College for 13 parameters at 22 locations was checked on 15th/16th December 2022. All are parameters were found within permissible limits. This was possible under the able leadership & Guidance of the Respected Principal of the Government Holkar Science, College, Indore.

Ashutosh Kumar Srivastava

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Commerce, Lead Auditor ISO 9001,14001,17020, 22001, 45001, 50001)

DETAILED ENERGY **AUDIT REPORT**

Year – 2020-21



GOVT. HOLKAR SCIENCE COLLEGE

A.B. Road, Near Bhawarkua, Indore, Madhya Pradesh, India

CUNDUCTED BY :



SABS INDIA



WE BUILDS A SOLID FOUNDATION FOR SAVING ENERGY

**90/2 Abhinav Nagar, Teen Emali Square, Behind Vishesh Hospital
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Project Title:	Energy Audit
Organization:	SABS INDIA SALES CORPORATION
Client:	GOVT. HOLKAR SCIENCE COLLEGE, Indore
Prepared By	
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Acknowledgement

SABS INDIA SALES CORPORTION expresses sincere thanks to the management of **Govt. Holkar Science College , Indore** for the inviting **SABS INDIA SALES CORPORTION** to conduct comprehensive Energy Audit 2020-21 of their Premises at **Govt. Holkar Science College , Indore**. The field study of this audit was carried out on November 2019.

The officials of **Govt. Holkar Science College , Indore** have coordinated and helped to the audit team during the field study and measurement. **SABS INDIA SALES CORPORTION** express special thanks to the following persons of **Govt. Holkar Science College , Indore**

Dr. Suresh T. Silawat -Principal, Holkar Science College , Indore

Dr. R. C. Dixit -Administrative Officer -Holkar Sc. College, Indore

Dr. Sanjeeda Iqbal -Convener & Coordinator Green campus Committee, Holkar Science College, Indore

And all other officers, technicians and staffs for the keen interest shown in this study and the courtesy extended.

We are thankful to the management for giving us the opportunity to be involved in this very interesting and challenging project.

We would be happy to provide any further clarifications, if required, to facilitate implementation of the recommendations



List of Contents

LIST OF TABLE	5
1 EXECUTIVE SUMMARY	6
2.1 COLLEGE DETAILS :	6
2 INTRODUCTION	10
2.1 ENERGY AUDIT	10
2.2 METHODOLOGY & APPROACH	10
2.3 INSTRUMENT USED IN ENERGY AUDIT:	11
3 CHAPTER	12
SITE VISIT AND INSPECTION	12
3.1 COLLEGE DETAILS :	12
3.2 SITE VISIT AND SITE INSPECTION	13
4 CHAPTER	17
LIGHTING SYSTEM	17
4.1 LIGHTING FIXTURES	17
4.2 DIFFERENT TYPE OF OUT DOOR LIGHTING SYSTEM	33
4.3 OBSERVATIONS & COMMENTS	33
5 CHAPTER	34
CEILING,WALL AND EXHAUST FAN	34
5.1 OBSERVATIONS & COMMENTS	42
6 CHAPTER	43
AIR CONDITIONING SYSTEM	43
6.1 PERFORMANCE EVALUATION OF WINDOW / SPLIT / TOWER AC	43
6.2 THE DETAILS OF DIFFERENT TYPE OF AIRCONDITIONING SYSTEM	44
6.3 OBSERVATION AND COMMENTS	45
7 CHAPTER	46
PUMPING SYSTEM	46
7.1 SUBMERSIBLE PUMPS	46
7.2 DETAILS OF PUMPING SYSTEM INSTALLED AT HOLKAR SCIENCE COLLGE , INDORE	46
7.3 SUBMERSIBLE PUMPS POWER MEASUREMENT	48
7.4 OBERAVTION AND COMMENTS	48
8 CHAPTER	49
DIESEL GENERATORS	49
ANNEXURE - 1	50
1 STANDARD LUX LEVEL	50

List of Table

TABLE 1: DIFFERENT TYPE OF LIGHTING FIXTURE	17
TABLE 2: DIFFERENT TYPE OF CEILING,WALL AND EXHAUST FANSYSTEM	36
TABLE 3 THE DETAILS OF DIFFERENT TYPE OF AIRCONDITIONING SYSTEM	44
TABLE 4 DETAILS OF PUMPING SYSTEM INSTALLED AT HOLKAR SCIENCE COLLGE , INDORE	46
TABLE 5: SUBMERSIBLE PUMPS POWER MEASUREMENT	48
TABLE 6 DIESEL GENERATOR DETAILS	49

List of Figure

FIGURE 1 CONNECTED LOAD (KW)	7
FIGURE 2 : ELECTRICITY CONNECTED LOAD DETAILS OF BUILDING IN DIFFERENT ZONE.....	7
FIGURE 3 ADMINISTRATION BUILDING	13
FIGURE 4 : BOTANY DEPARTMENT	13
FIGURE 5: ZOOLOGY DEPARTMENT	13
FIGURE 6:MICROLOGY AND BIOCHEMISTRY DEPARTMENT	13
FIGURE 7 : PHYSICS DEPARTMENT	13
FIGURE 8 : BIOINFORMATICS DEPARTMENT	13
FIGURE 9 BIOTECHNOLOGY DEPARTMENT	13
FIGURE 10: CONFERENCE HALL AT COLLEGE CAMPUS....	13
FIGURE 11: SEEDS TECHNOLOGY DEPARTMENT	14
FIGURE 12 CONFERENCE HALL IN HOLKAR SCIENCE COLLEGE	14
FIGURE 13 YASWANT HALL FOR SAMINAR AND CONFERENCE HOLKAR	14
FIGURE 14 BOYS HOSTLE IN	14
FIGURE 15 CHEMISTRY LABORATORY	14
FIGURE 16 COMPUTER SCIENCE LAB	15
FIGURE 17 PHYSICS LABORATORY	15
FIGURE 18 EXAMINATION DEPARTMENT	15
FIGURE 19 LIBRARY AT HOLKAR SCIENCE COLLEGE CAMPUS	15
FIGURE 20 CHEMISTRY LABORATORY	15
FIGURE 21 POWER MEASUREMENT IN CHEMISTRY DEPT.	15
FIGURE 22 POWERMEASUREMENT IN BOTANY DEPT.....	16
FIGURE 23 POWER MEASUREMENT IN BOYS HOSTEL	16
FIGURE 24 POWER MEASUREMENT FOR PUMP	16
FIGURE 25 TRANSFORMER AT HOLKAR SCIENCE COLLEGE	16
FIGURE 26 OUTDOOR CONVENTIONAL LIGHTING SYSTEM	16
FIGURE 27 OUTDOOR LED LIGHTING	16
FIGURE 28 CEILING FAN (150 W) AT CHEMISTRY DEPT AND VARIOUS LOCATION OF COLLEGE CAMPUS	34
FIGURE 29 CEILING FAN (120 W) AT VARIOUS LOCATION OF COLLEGE CAMPUS	34
FIGURE 30 CEILING FAN (120 W) AT VARIOUS LOCATION OF COLLEGE CAMPUS	35
FIGURE 31 CEILING FAN (60 W) AT VARIOUS LOCATION OF COLLEGE CAMPUS	35
FIGURE 32 SPLIT TYPE OF 5 STAR,1.5 TR AIRCONDITIONING SYSTEM	43
FIGURE 33 SPLIT TYPE OF CONVENTIONAL OLD ,1.5 TR AIRCONDITIONING SYSTEM.....	43
FIGURE 34 SPLIT TYPE OF CONVENTIONAL OLD ,1.5 TR AIRCONDITIONING SYSTEM.....	44
FIGURE 35 WINDOW AIR CONDITIONING SYSTEM IN DEPARTMENT OF BIO TECHNOLOGY	44
FIGURE 36 3 HP SUBMERSIBLE PUMP	46

1 EXECUTIVE SUMMARY

2.1 COLLEGE DETAILS :

Particulars	Units	Details
Name of the Unit	-	Govt. Holkar Science College, Indore
Address	-	A.B. Road, Near Bhawarkua, Indore (M.P.) 452017, INDIA
Principal	-	Dr. Suresh Silawat
No. of Shifts	Nos.	1
Daily Operating Hours	Hrs./day	9
Annual Working Days	Days/yr.	300
Source of Electricity	-	MPPKVVCL, Indore
Total connected Load	kW	333
Total Sanctioned Load	(kW)	145.57
Average Energy Charge in per unit	Rs./kWh	8.56

a. Existing Major Energy Consuming Technology and Electricity billing analysis :

The major equipments are installed in Govt. Holkar Science College, Indore like Lighting fixtures , Airconditioning system, Ceiling & Exhaust Fan , Pumps Refrigerators and laboratory equipments .

Figure 1 Connected Load (kW)

Sr. No	Connected Load	kW
1	indoor Lighting Load	64.66
2	outdoor Lighting Load	3.1
3	Ceiling Fan , Exhuast fan	74.88
4	Pumping System	11.623
5	Airconditioning Load	31
6	Printer, PC , Water Cooler, Refrigeretor and other lab equipments	148.03
Total Connected Load kW		333

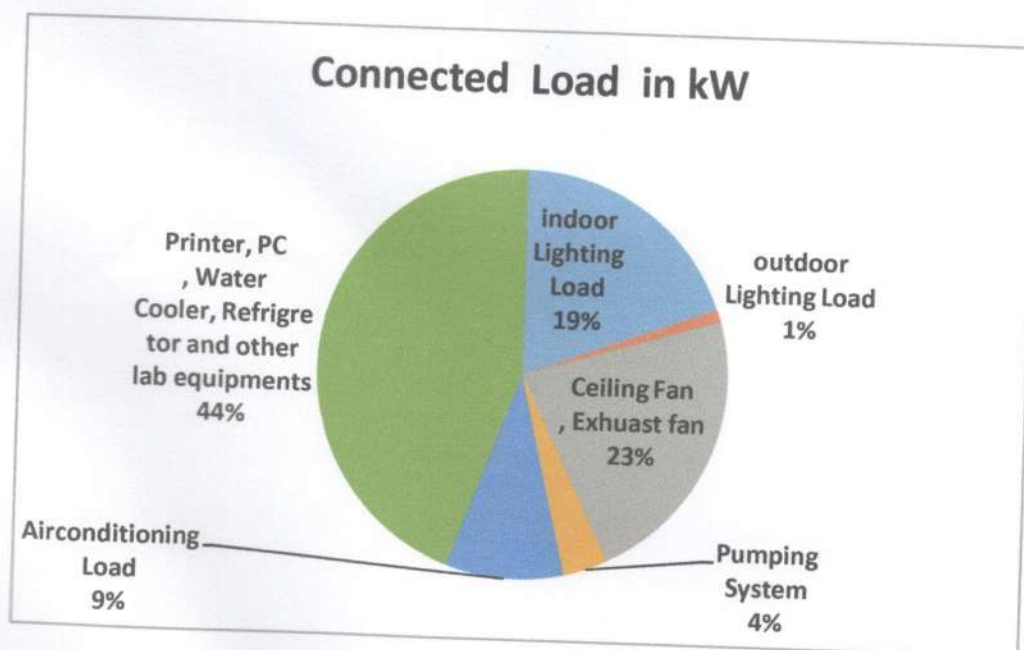


Figure 2 : Electricity Connected Load details of building in different zone

- As per electricity bills observation and analysis, **Total Sanction load is 145 kW** for all 31 no of electricity bill in college premises.



- As per electricity bills observation and analysis, Total average annually electricity unit (kWh) **consumption is 260629 kWh**.
- We are recommending to installed centralize electricity connection, which capacity is **110 kW or kVA and will get saving approximately annually Rs 8 to 9 lacs.**
- **Note –College is maintaining electricity bill logbook properly in record for monitoring and analysis of electricity bill ,**

b. Proposed Energy Saving Technologies with Cost Economics

❖ LIGHTING SYSTEM

- We observed that during energy audit and site visit , Most of lighting luminaries Energy efficient LED lumanaries.
- We are suggesting to purchases all electrical equipment as per star leveling program by Bureau of energy efficiency, and will get huge amount of electricity saving .
- We observed lighting fixtures maintenance procedures are followed regularly as per site visit and discussion..
- We observed Lux level for most departments were good as per above lux level measurement.

Note –The lux level in most of locations are good as compare with the desired standard level. so , it should be increased.The low level lux is mentioned in red colour also .

❖ CIELING , EXHUAUST FAN SYSTEM

- We observed, most of the Fan was installed for proper air delivery to student
- We are recommended with New Super energy efficient 5 star rated BLDC ceiling fan and will get huge amount of electricity saving as per Star leveling program by Bureau of Energy Efficiency.



❖ AIRCONDITIONING SYSTEM

- There are various types 26 No's split and window Air Conditioning system are installed at various location in the Govt. Holkar Science College Indore and they also contribute very high electricity consumption
- We are suggesting to purchases New AC as 5 star rated Air Conditioning system as per Star leveling program by Bureau of Energy Efficiency 2019, and will get huge amount of electricity saving.

❖ Submersible pumping system :

- We observed during Energy Audit and site visit , 1HP , 1.5 , 2 HP and 3 HP capacity 11 no. of submersible pump were installed within college campus for drinking water and gardening purpose .
- We observed , Total connected load is **11.625** kW for 10 no. of submersible pumps .
- Campus has well define water management system by using pump .
- We are suggesting to purchse 5 star rated pumps and will get huge amount of saving as per Star leveling program by Bureau of Energy Efficiency 2019.

2 INTRODUCTION

2.1 Energy Audit

Energy Audit is an effective means of establishment present efficiency levels and identifying Potential areas of improvement in energy consumption.

Energy audit of utility systems largely helps , Which are given below :

- Reducing the energy consumption with resultant reduction in electricity bills.
- Audit involves data collection , data verification and detailed analysis of the data.
- The analysis leads to recommendations, which are short term (with minimum investment), medium term (with moderate investment) and long term (with capital expenditure).
- The cost benefit analysis of various energy conservation proposals enables managements to take decisions regarding implementation schedules.

Energy conservation is a worldwide objective to save the human being from possible disaster. Under the mandate of The Energy Conservation Act 2001, the Bureau of Energy Efficiency and Government of India are implementing various programmers to provide momentum of the energy conservation movement in the country. Energy Auditing is most vital part of the conservation of energy. In order to improve the efficiency of the Energy consuming system, energy auditing is the first necessary action to be taken by the concerned firm. Through the energy auditing actual parameters can be detected at each step, which can be compared with the standard achievable parameters. For proper Energy auditing and energy accounting, parameters need to be monitored on regular.

Govt. Holkar Science College Indore has engaged **SABS INDIA SALES CORPORTION** for conducting detailed energy audit in their premises for the year of 2019.

2.2 Methodology & Approach

The audit involved basic design data collection for various electrical & thermal utilities, kick of meeting with concern departmental engineers & managers, carrying out various field measurements, performance analysis and loss analysis covering all major energy consuming sections of Govt. Holkar Science College Indore to realistically assess losses mainly in energy consuming utility areas and potential for energy savings. The major areas of study include:

- Building energy bills analysis.
- Electrical supply and distribution system analysis
- Lighting system analysis.
- Air conditioning system analysis.
- Water pumping system analysis.
- Buildings envelop analysis.
- Specific Energy Consumption.



During study several interactions was made to the office personnel and technicians to share the actual operational features of equipment, equipment's maintenance schedule and equipment break down, down time of machineries, safety measures etc. At the same time required data was collected from the various departments and review the same with the operational actual data.

The study focused on improving energy use efficiency and identifying energy saving opportunities at various equipments. The analyses included simple payback period and life cycle cost calculations where investments are required to be made to implement recommendations, to establish their economic viability.

2.3 Instrument used in Energy Audit:

We have a wide array of latest, sophisticated, portable, diagnostic and measuring instruments to support our energy audit investigations and analyses. The audit study made use of various portable instruments along with plant online instrumentations, for carrying out various measurements and analyses. The specialized instruments that were used during the energy audit include:

- Power Analyzer.
- Ultra Sonic Flow Meter.
- Digital power clamp meter & multi-meter (2745 KUSAM MECO)
- Digital Hygrometer HD-304 HTC
- Digital Lux Meter (LX-101A HTC TM)
- Digital Anemometer (AVM -07 HTC)
- IR Thermometers for temperature measurement HTC TM (IR -50 to 1550 0C)
- Digital distance meter
- Measuring Tap meter

3 CHAPTER

Site Visit and inspection

3.1 College Details :

Holkar college Indore was founded by the then king of erstwhile Holkar state Hon'ble Maharaja Shivaji Rao Holkar in June 1891. The visionary king laid the foundation of this institution with the pious motive of "widening the horizon for the people of Indore and nearby areas." He wanted to lighten up the minds of the people with the help of education in order that they could exploit their potential to their best advantage and equip themselves to meet the challenges of the new world order dominated by science and technology, the signs of which had begin to manifest themselves. He could foresee that conservatism and dogmatic religious beliefs would soon give way to scientific outlook and rationalism. With the increasing number of students and multiplication of disciplines the college was split into two separate and independent units.

One of these two colleges was designated as Govt. Arts and Commerce College while this college retained its prestigious original name i.e. Holkar college. Since it now catered to the study of science exclusively it came to be known as Govt. Holkar Science College. It continued to be housed in the old college building. Ever since its conception the institution has striven hard to fulfill its promises of providing high quality education to produce thoughtful, intelligent and competent human beings capable of facing the challenges of the life bravely. The alumni of the college have occupied prestigious positions in almost every walk of life.

The graduates of this institution can be seen engaged in creative endeavour not only in the far-flung areas of our country but those of the world too. At present the institution is imparting instruction in science with the emphasis on scientific research. During the course of its journey the college remained affiliated to Calcutta and Allahabad universities. At present it is affiliated to Devi Ahilya Vishwavidyalya (DAVV) which has recently been adjudged as **A grade accredited university by the NAAC.**

In view of the quality of education provided by the college the Govt. of M.P. recognized this college as a model college. In the year 1989 the UGC found it fit to be an autonomous college and ever since then the college has been a full-fledged autonomous institution (in both at UG and PG levels). In the session 2001- 2002 it was also given the status of being a "College of Excellence" by the state govt. The college opted to go for accreditation by the NAAC twice. First accreditation was in the year 2003 when it was awarded a 3 star ranking and then in the year 2009 when it was awarded with 'B' grade (with 2.79 CGPA).

3.2 Site visit and site inspection

Energy audit team visited at college campus premises and also had completed of electrical measurement and appliances data collection.



Figure 3 Administration Building



Figure 4 : Botany Department



Figure 5: Zoology Department



Figure 6:Micrology and Biochemistry Department



Figure 7 : Physics Department



Figure 8 : Bioinformatics Department



Figure 9 Biotechnology Department



Figure 10: Confrence Hall at College campus



Figure 11: Seeds Technology Department College



Figure 12 Conference Hall in Holkar Science



Figure 13 Yaswant Hall for Saminar and conference



Figure 14 Boys Hostle in Holkar



Figure 15 Chemistry Laboratory



Figure 16 Computer Science Lab



Figure 17 Physics Laboratory



Figure 18 Examination Department



Figure 19 Library at Holkar Science College campus



Figure 20 Chemistry Laboratory



Figure 21 Power Measurement in Chemistry Dept.



Figure 22 Power Measurement in Botany Dept.



Figure 23 Power Measurement in boys Hostel Figure 24 Power Measurement for Pump



Figure 25 Transformer at Holkar Science College



Figure 26 Outdoor Conventional Lighting System Figure 27 Outdoor Led Lighting System

4 CHAPTER LIGHTING SYSTEM

4.1 Lighting Fixtures

The Govt. Holkar Science College Indore has high lighting load and various type of indoor and outdoor lighting fixture are installed in college campus .

The lux measurement was also done at the time of audit. All the parameters all given in the below table:

Table 1: Different type of lighting fixture

Sr. No.	Location	Location of Fixtures	No.of Lighting fixture	Power (Watts)	No.of lumanarie	Total Power (Watts)
1	Chemistry Department	Dr.Anamika Jain	2	36	1	72
			1	40	2	80
		Back Cabin	1	36	1	36
		Computer Cabin	2	36	1	72
			1	40	1	40
		Tea Room	3	36	1	108
		Rest Room	1	36	1	36
		Faculty Room 01	1	36	1	36
			5	40	1	200
		Faculty Room 02	3	36	1	108
			3	40	1	120
		Lab Ass. Cabin	1	40	1	40
		Chemistry Lab 01	18	36	1	648
			4	40	1	160
		Chemistry Lab 02	4	36	1	144
			8	40	1	320
		Chemistry Lab 03	10	36	1	360
			16	40	1	640

Sr. No.	Location	Location of Fixtures	No. of Lighting fixture	Power (Watts)	No. of luminarie	Total Power (Watts)
			3	15	1	45
			1	24	1	24
		Chemistry Lab 04	29	40	1	1160
2	Department of Seed & Horticulture	Dr. Kislaya Pancholi	2	36	1	72
		Class Room	6	36	1	216
			2	9	1	18
			2	18	1	36
			1	85	1	85
		Dept. of Horticult.	2	36	1	72
		Staff Cabin 01	2	36	1	72
			1	85	1	85
		Staff Cabin 02	2	36	1	72
3	Department Of Physics	Dr. G.D. Gupta Cabin	3	28	2	168
		Solar Energy Buld.	10	28	1	280
			6	28	2	336
		Bathroom	4	28	1	112
		Account Office	3	36	1	108
			1	40	1	40
		Computer Lab	3	36	1	108
		Staff Room	1	18	1	18
			3	36	1	108
			5	40	1	200
		B.Sc 1st Year				0
		Room No-01	12	36	1	432
		Room No-02	10	36	1	360

Sr. No.	Location	Location of Fixtures	No. of Lighting fixture	Power (Watts)	No. of luminarie	Total Power (Watts)
			1	18	1	18
		B.Sc 2nd Year Lab	9	36	1	324
			5	40	1	200
			4	18	1	72
		M.Sc 1st Year Lab	2	36	1	72
			7	18	1	126
			1	40	1	40
		M.Sc Finel Year	9	36	1	324
		Seminar Hall	4	36	1	144
			2	40	1	80
		Gallery	2	36	1	72
			1	40	1	40
4	Department of Bioinformatics	Hall	4	36	1	144
			2	40	1	80
		Computer Lab	4	36	1	144
			1	40	1	40
5	Department of Statistics	Prof.M.Chaurang	6	36	1	216
		Staff Room	1	36	1	36
			3	40	1	120
			1	9	1	9
		Computer Lab	2	36	1	72
		Lab	5	36	1	180
			7	40	1	280
			3	18	1	54
		Gallery + Store	2	36	1	72

Sr. No.	Location	Location of Fixtures	No. of Lighting fixture	Power (Watts)	No. of luminarie	Total Power (Watts)
			9	40	1	360
6	Clinic	Hall	1	36	1	36
			2	12	1	24
			2	200	1	400
7	PWD Building	Office	4	9	1	36
			2	5	1	10
		Staff Room	2	15	1	30
			4	9	1	36
8	IGNOU	Staff Room	2	36	1	72
			3	40	1	120
			6	9	1	54
			4	12	1	48
9	Hostel	Office + Staff Room+ Canteen	1	18	1	18
			2	15	1	30
			2	12	1	24
		Ground Floor	12	9	1	108
			22	12	1	264
			4	12	1	48
			3	100	1	300
		First Floor	28	9	1	252
			14	12	1	168
			3	14	1	42
		Bath Room	4	18	1	72
10	Canteen	Room	1	9	1	9
			1	36	1	36

Sr. No.	Location	Location of Fixtures	No. of Lighting fixture	Power (Watts)	No. of luminarie	Total Power (Watts)
11	Department Of Botany	HOD Cabin	1	9	1	9
			1	36	1	36
		M.Sc Lab	84	28	1	2352
			9	40	1	360
			2	85	1	170
		B.Sc Lab	12	36	1	432
			2	40	1	80
			9	18	1	162
		Staff Room	6	40	1	240
		Store	4	40	1	160
12	Mathmamatics Wing	Room No. 1	1	36	1	36
			3	40	1	120
		Store Room	1	85	1	85
			4	40	1	160
		Class Room 10	6	40	1	240
			3	9	1	27
			1	48	1	48
		Forensic Class	2	85	1	170
			1	40	1	40
			4	18	1	72
		Lab 1	3	40	1	120
			2	9	1	18
			1	85	1	85
		Lab Staff Room	1	9	1	9
		Lab 2	1	40	1	40

Sr. No.	Location	Location of Fixtures	No. of Lighting fixture	Power (Watts)	No. of luminarie	Total Power (Watts)
			2	18	1	36
			2	9	1	18
		Class Room 6	1	36	1	36
			1	85	1	85
		English Lab	3	40	1	120
			3	9	1	27
		Crime Scame Lab	5	40	1	200
			2	18	1	36
		Ladies Room	2	40	1	80
			1	85	1	85
			2	9	1	18
		Pharmaciticals Che.	4	40	1	160
		Class Room 3	4	36	1	144
			6	40	1	240
		Dept. of Hindi	1	85	1	85
			1	48	1	48
		Class Room 1	2	40	1	80
			2	36	1	72
			2	85	1	170
		Class Room 2	3	40	1	120
			1	85	1	85
			2	9	1	18
		Lab	7	40	1	280
			2	18	1	36
		HOD Cabin	2	9	1	18

Sr. No.	Location	Location of Fixtures	No.of Lighting fixture	Power (Watts)	No.of luminarie	Total Power (Watts)
		Class Room 4	9	40	1	360
			1	85	1	85
			1	48	1	48
			1	36	1	36
		Class Room 5	7	40	1	280
			1	36	1	36
		Corridor	1	40	1	40
			2	36	1	72
			1	18	1	18
		13	A-Block Building	Room No 30	10	36
1	18				1	18
1	9				1	9
Room No 31	5			36	1	180
	2			18	1	36
	1			85	1	85
Gents Toilet	1			36	1	36
Room No 32	3			36	1	108
	4			18	1	72
Room No 33	1			40	1	40
	6			36	1	216
	2			18	1	36
	2			65	1	130
Room No 34	2			40	1	80
	5			36	1	180

Sr. No.	Location	Location of Fixtures	No. of Lighting fixture	Power (Watts)	No. of luminarie	Total Power (Watts)
			3	18	1	54
		Girls Toilet	2	36	1	72
		Room No 35	4	36	1	144
			2	18	1	36
			2	65	1	130
		Room No 36	8	40	1	320
			2	65	1	130
		Room No 37	1	40	1	40
			8	36	1	288
			2	65	1	130
		Room No 38	10	36	1	360
		Room No 39	7	36	1	252
			3	18	1	54
		Waiting Room	10	36	1	360
		Staff Room	4	36	1	144
		Toilet	1	100	1	100
		HOD Cabin (English)	4	40	1	160
			1	70	1	70
		Kitchen	1	36	1	36
		Corridor	11	40	1	440
			7	9	1	63
		NCC	3	36	1	108
		Staff Room	6	18	1	108
		Class Room	4	18	1	72

Sr. No.	Location	Location of Fixtures	No. of Lighting fixture	Power (Watts)	No. of luminarie	Total Power (Watts)
		Room No 40	8	36	1	288
		Room No 41	12	36	1	432
		Room No 42	12	36	1	432
		Ladies Toilet	2	36	1	72
		Room No 43	12	18	1	216
		Room No 44	12	18	1	216
		Room No 45	8	18	1	144
		Room No 46	12	18	1	216
		Room No 47	12	18	1	216
		Room No 48	12	18	1	216
		Room No 49	8	18	1	144
		Room No 50	12	36	1	432
		Room No 51	12	36	1	432
		Toilet	2	36	1	72
		Corridor	19	36	1	684
			10	18	1	180
14	Exam Controller Building	Control Room	1	18	1	18
		A/C Station	1	36	1	36
			1	65	1	65
		Semster Cell	2	65	1	130
		IT Cell	1	65	1	65
			4	36	1	144
			8	48	1	384
		Controler of Examin	1	36	1	36
			4	40	1	160

Sr. No.	Location	Location of Fixtures	No. of Lighting fixture	Power (Watts)	No. of lumanarie	Total Power (Watts)
		Computer Room	1	40	1	40
			1	18	1	18
		Recording Room	1	36	1	36
			1	65	1	65
		Toilet	1	100	1	100
			1	40	1	40
		Store Room	1	36	1	36
			1	65	1	65
15	Department of Biotechnology	HOD Cabin	2	40	1	80
			1	36	1	36
		Corridor	10	40	1	400
		Lab 1	13	40	1	520
			3	36	1	108
		PTC Lab	1	40	1	40
		Lab-2	12	40	1	480
		Computre Lab	3	36	1	108
		Store Room	3	40	1	120
		Staff Room	1	85	1	85
			2	40	1	80
16	Department of Zoology	HOD Cabin	3	36	1	108
			1	65	1	65
		Staff Room	4	40	1	160
			2	9	1	18
		Lab-1	27	40	1	1080
			3	9	1	27

Sr. No.	Location	Location of Fixtures	No. of Lighting fixture	Power (Watts)	No. of luminarie	Total Power (Watts)
		Office Staff	1	40	1	40
			1	85	1	85
		Toilet	2	100	1	200
		Corridor	1	85	1	85
17	Department of Biochemistry	HOD Cabin	2	18	1	36
		Research Lab	10	18	1	180
		Kitchen	1	40	1	40
		Office	2	18	1	36
		BSc Lab	7	36	1	252
		MSc Lab	8	20	1	160
		Toilet	1	40	1	40
			1	36	1	36
		Corridor	12	20	1	240
			12	40	1	480
18	Department of Matematics	HOD Cabin	2	40	1	80
			1	36	1	36
		Office	2	40	1	80
		Associat NCC Cabin	3	36	1	108
		Kitchen	1	40	1	40
		Corridor	3	36	1	108
		Staff Room	4	40	1	160
		Class Room 15	2	36	1	72
			1	40	1	40
			2	18	1	36
		Class Room 16	4	40	1	160

Sr. No.	Location	Location of Fixtures	No. of Lighting fixture	Power (Watts)	No. of luminarie	Total Power (Watts)
19	Department of Sport	HOD Cabin	2	36	1	72
			3	18	1	54
		Staff Room	1	40	1	40
		Electric Supply Room	2	40	1	80
		Placement Cell	1	40	1	40
			1	18	1	18
		Corridor	2	40	1	80
20	Yashwant Hall	Hall	40	40	1	1600
			30	36	1	1080
			5	15	1	75
			6	500	1	3000
			1	1000	1	1000
		Store Room	1	40	1	40
		Corridor	3	40	1	120
21	Department of Electronics	HOD Cabin	6	40	1	240
			2	18	1	36
		Class Room	2	40	1	80
		Lab	7	40	1	280
22	Department of Geology	First Floor				
		MSc Class 1	1	18	1	18
		Class Room 2	2	40	1	80
			1	65	1	65
		Staff Room	3	40	1	120
			2	36	1	72
		Store Room	1	40	1	40

Sr. No.	Location	Location of Fixtures	No. of Lighting fixture	Power (Watts)	No. of luminarie	Total Power (Watts)
		Class Room	3	40	1	120
			3	36	1	108
		Faculty Room	1	18	1	18
		Ground Class Room	5	36	1	180
		Staff Room	2	36	1	72
		Museum	2	40	1	80
			3	36	1	108
		Room No-1	3	36	1	108
		Room No-2	3	36	1	108
		Room No-3	3	36	1	108
		Corridor	1	40	1	40
		Class Room 14	4	40	1	160
		Class Room 23	5	40	1	200
		Class Room 25	5	40	1	200
23	Library	Office	6	40	1	240
		Inside Study hall	49	40	1	1960
		Binding /Kitchen	1	40	1	40
		Study Hall	22	40	1	880
			3	50	1	150
			3	1000	1	3000
		E-Library	3	40	1	120
		Corridor	17	40	1	680
		Girls Toilet	2	40	1	80
		Boys Toilet	2	40	1	80
		Librarian	5	36	1	180

Sr. No.	Location	Location of Fixtures	No. of Lighting fixture	Power (Watts)	No. of luminarie	Total Power (Watts)
24	Admin Building	Office	3	18	1	54
			2	30	1	60
			1	85	1	85
		Account Section	1	30	1	30
			1	36	1	36
		Corridor	1	18	1	18
			1	9	1	9
		Data Store Room	2	30	1	60
		Scholarship Cabin	1	9	1	9
			2	85	1	170
			2	18	1	36
		Out Side Principal Cabin	4	40	1	160
			2	30	1	60
			1	9	1	9
		Principal Chamber	2	36	1	72
			6	18	1	108
			1	85	1	85
			1	200	1	200
		Kitchen	1	36	1	36
		Admis. Office	2	30	1	60
25	Department of Computer Science	Office	1	40	1	40
		Lab-1	2	40	1	80
			3	36	1	108
			2	18	1	36
			1	9	1	9

Sr. No.	Location	Location of Fixtures	No. of Lighting fixture	Power (Watts)	No. of luminarie	Total Power (Watts)
		Store Room	8	40	1	320
		Corridor	3	40	1	120
		Lab-2	3	36	1	108
			2	18	1	36
		E-Gallery	3	40	2	240
			11	36	1	396
			11	18	2	396
		Lab-4	2	18	1	36
			3	40	1	120
			9	36	1	324
		Store Room	4	40	1	160
		MSc Room	2	36	1	72
			6	40	1	240
		Staff Cafereria	4	40	1	160
		Staff Room	2	40	1	80
		HOD Cabin	1	36	1	36
			3	40	1	120
			2	9	1	18
		Entrance	1	40	1	40
			1	9	1	9
26	Dr.W.V.Bhagwat Lab	Front Lab	9	28	1	252
			2	18	1	36
			2	40	1	80
		Class Room	4	18	1	72
			3	36	1	108

Sr. No.	Location	Location of Fixtures	No. of Lighting fixture	Power (Watts)	No. of luminarie	Total Power (Watts)
			2	40	1	80
			2	85	1	170
		Store Room	2	40	1	80
		Gallery	2	40	1	80
		Confrence Hall	5	18	1	90
			4	40	1	160
			21	40	2	1680
		Staff Room	1	18	1	18
27	Department of Microbiology	Flamming Lab	3	40	1	120
		Corridor	1	9	1	9
		Lobert Koch Lab	2	36	1	72
		Staff Room	2	36	1	72
		Louis Pasture Lab	2	85	1	170
		Gallery	2	40	1	80
			1	9	1	9
28	Fish Zone	Class Room	10	18	1	180
			3	9	1	27
		Out Side Light	1	30	1	30

4.2 Different type of Out Door Lighting System

Sr · N o.	Location	Location of Fixtures	Product Type	No.of Lighti ng fixture	Power (Watts)	No.o f luma narie	Total Power (Watts)
1	Out Door Lighting System	Garden area and Street lights within College premises	Halogen	1	50	1	50
2			Street LED	1	30	1	30
3			CFL	3	85	1	255
4			CFL	2	85	1	170
5			CFL	1	85	1	85
6			STL LED	6	18	1	108
7			CFL	2	85	2	340
8			CFL	1	24	1	24
9			CFL	2	85	1	170
10			CFL	2	85	1	170
11			STL (40×1)	4	40	1	160
12			CFL	4	85	1	340
13			CFL	1	85	1	85
14			Street LED	1	30	1	30
15			STL (36×1)	1	36	1	36
16			LED Bulb	1	12	1	12
17			CFL	1	85	1	85
18			Halogen	1	500	1	500
19			STL (36×1)	1	36	1	36
20			CFL	1	85	1	85
21			CFL	3	85	1	255
22			Street LED	1	30	1	30
Total outdoor Lighting Load kW				3.1			

4.3 OBSERVATIONS & COMMENTS

- We observed that during energy audit and site visit , Most of lighting luminaries were conventional like T12 , T8 , CFL , in condensate Bulb and Helogens and which were consuming also very high electricity as compare with LED lighting luminaries .
- We appreciate to use LED Lighting luminaries at some location as per site visit.
- We are suggesting to replace conventional incandescent bulb with Energy efficient 10 W LED luminaries.
- We are suggesting to replace conventional T12 40W , T8 36 W and T5 28 W conventional with energy efficient 18 W LED luminaries.
- We observed during visit, most of FTL/ STL Tube light was fused and not working properly.
- We are suggesting to purchase all electrical equipment as per star leveling program by Bureau of energy efficiency, and will get huge amount of electricity saving .
- We observed lighting fixtures maintenance procedures were not followed regularly as per site visit and discussion.

5 CHAPTER CEILING, WALL AND EXHAUST FAN

There are various types of conventional ceiling fan, wall fan and exhaust fan are installed at various location in the Govt. Holkar Science College Indore and they also contribute very high electricity consumption.

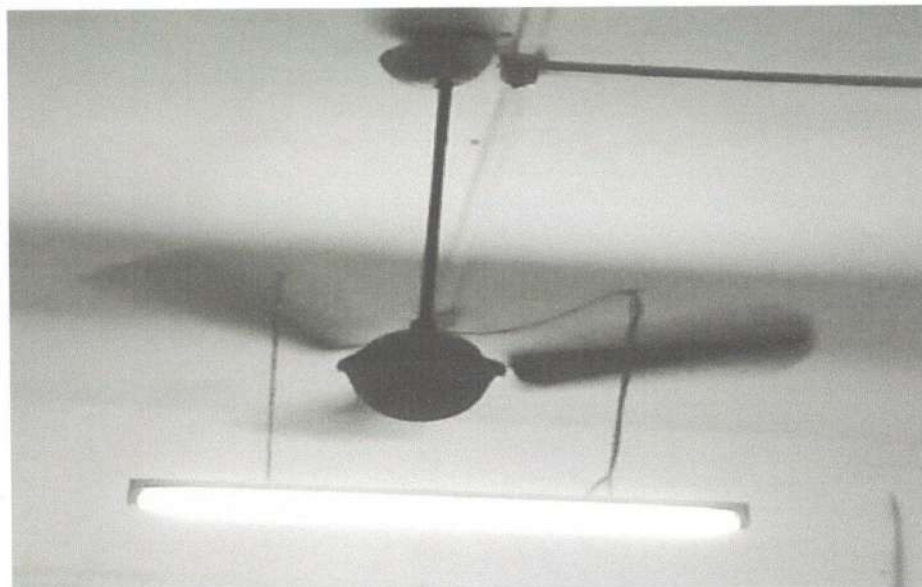


Figure 28 Ceiling fan (150 W) at Chemistry dept and various location of College campus



Figure 29 Ceiling fan (120 W) at various location of College campus



Figure 30 Ceiling fan (120 W) at various location of College campus

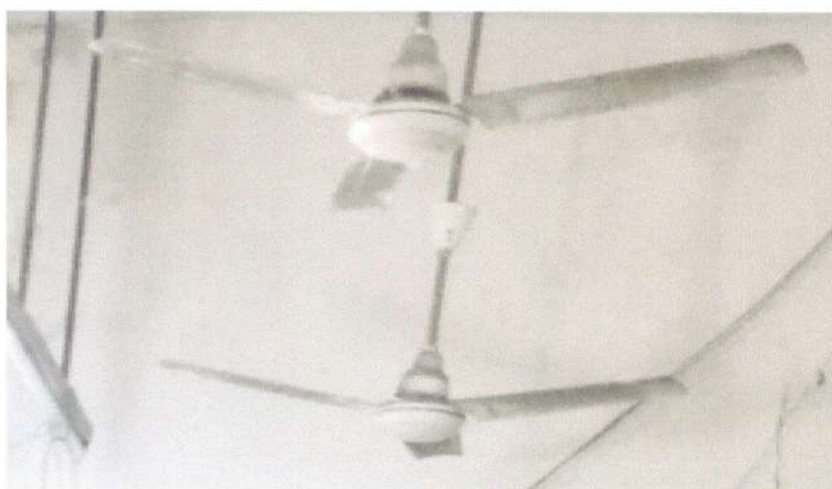
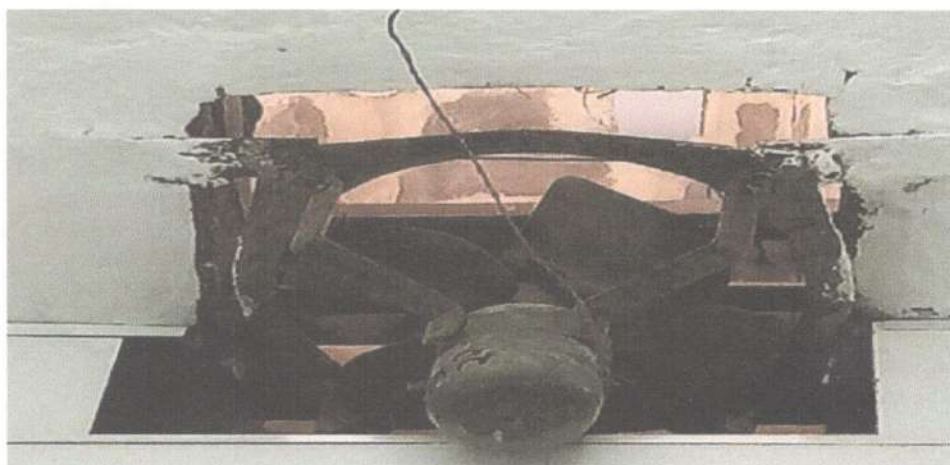


Figure 31 Ceiling fan (60 W) at various location of College campus



The detail of the equipment is given in the below table:

Table 2: Different type of Ceiling,Wall And Exhaust FanSystem

Sr. No.	Location	Location of FAN	Type of FAN	Number of FAN	Power (Watts)	Total Power (Watts)
1	Department of Chemistry	HOD Cabin	Ceil. Fan	1	80	80
		Back Office	Wall Fan	1	50	50
		Front Office	Wall Fan	1	50	50
		Tea Room	Ceil. Fan	2	150	300
		Rest Room	Ceil. Fan	1	150	150
		Faculty Room1	Ceil. Fan	2	80	160
			Ceil. Fan	1	120	120
		Faculty Room2	Ceil. Fan	4	60	240
		Lab 1	Ceil. Fan	1	120	120
			Ceil. Fan	1	80	80
			Exhaust(B)	1	75	75
			Exhaust(S)	6	45	270
		Waiting Place	Ceil. Fan	4	60	240
		Lab 2	Ceil. Fan	3	80	240
			Exhaust(S)	6	45	270
		Lab 3	Ceil. Fan	2	80	160
			Exhaust(S)	7	45	315
		Lab Ass.Cabin	Ceil. Fan	2	60	120
		Lab 4 (Room 1)	Ceil. Fan	4	80	320
			Exhaust(S)	3	45	135
		Room 2	Ceil. Fan	4	60	240
			Exhaust(S)	2	45	90
		Room 3	Ceil. Fan	3	80	240
		Room 4	Ceil. Fan	1	150	150
			Ceil. Fan	1	80	80
			Exhaust(S)	1	45	45
2	Department of Seed Technology	HOD Cabin	Ceil. Fan	1	80	80
			Wall Fan	1	50	50
		Class Room	Ceil. Fan	4	80	320
			Wall Fan	1	50	50
		Staff Cabin 1	Ceil. Fan	2	60	120
			Wall Fan	1	50	50
3	Department of Horticulture	Cabin 1	Ceil. Fan	1	80	80
		Cabin 2	Ceil. Fan	1	60	60
			Wall Fan	1	50	50
4	Department of Physics	HOD Cabin	Ceil. Fan	3	60	180
		Solar Energy	Ceil. Fan	9	60	540
		Bathroom	Ceil. Fan	1	80	80
		Account office	Ceil. Fan	1	150	150

Sr. No.	Location	Location of FAN	Type of FAN	Number of FAN	Power (Watts)	Total Power (Watts)
			Ceil. Fan	1	80	80
		Computer Lab	Ceil. Fan	1	80	80
		Staff Room	Ceil. Fan	4	80	320
		B.Sc Lab 1	Ceil. Fan	7	80	560
			Exhaust(S)	3	45	135
		B.Sc Lab 2	Ceil. Fan	3	150	450
			Ceil. Fan	3	80	240
			Exhaust(S)	1	75	75
		B.Sc Lab 3	Ceil. Fan	8	60	480
			Ceil. Fan	2	80	160
			Ceil. Fan	1	150	150
		M.Sc Lab 1	Ceil. Fan	2	80	160
			Ceil. Fan	1	150	150
		M.Sc Lab 2	Wall Fan	3	50	150
		Corridor	Ceil. Fan	2	80	160
5	Department of Bioinformatics	Computer Lab	Ceil. Fan	3	60	180
			Ceil. Fan	2	80	160
		Hall	Ceil. Fan	8	80	640
6	Department of Statistics	HOD Cabin	Ceil. Fan	2	80	160
		Staff Room	Ceil. Fan	2	80	160
		Computer Lab	Ceil. Fan	2	80	160
		Corridor	Ceil. Fan	4	60	240
			Ceil. Fan	2	80	160
		1st Flow. Lab1	Ceil. Fan	6	80	480
		Lab 2	Ceil. Fan	6	80	480
		Store	Ceil. Fan	2	80	160
7	Clinic	Hall	Ceil. Fan	1	150	150
8	PWD Building	Office	Ceil. Fan	2	60	120
		Staff Room 1	Ceil. Fan	1	150	150
		Staff Room 2	Ceil. Fan	2	80	160
		Class Room	Wall Fan	1	50	50
9	Department of Ignou	Office	Ceil. Fan	1	80	80
		Staff Room 1	Ceil. Fan	2	80	160
			Wall Fan	1	50	50
		Staff Room 2	Ceil. Fan	2	80	160
			Wall Fan	3	50	150
10	Hostel	Ground Flower	Ceil. Fan	25	80	2000
			Ceil. Fan	4	120	480
		First Flower	Ceil. Fan	24	80	1920
			Ceil. Fan	6	120	720
		Canteen	Ceil. Fan	4	150	600
			Ceil. Fan	1	80	80
			Exhaust(S)	2	45	90

Sr. No.	Location	Location of FAN	Type of FAN	Number of FAN	Power (Watts)	Total Power (Watts)
11	Campus Canteen	Hall	Ceil. Fan	1	80	80
12	Department of Botany	HOD Cabin	Ceil. Fan	3	80	240
		Staff Room	Ceil. Fan	4	60	240
		M.Sc Lab	Ceil. Fan	6	80	480
		B.Sc Lab	Ceil. Fan	12	80	960
			Exhaust(S)	1	45	45
		M.Sc Last Year	Ceil. Fan	6	150	900
		Store Room	Ceil. Fan	1	80	80
13	Mathematics Wing	Staff Room	Ceil. Fan	2	80	160
		Store Room	Ceil. Fan	1	80	80
		Room 10	Ceil. Fan	7	80	560
		Forensic Class	Ceil. Fan	2	150	300
		Lab	Ceil. Fan	2	80	160
			Exhaust(S)	2	45	90
		Faculty Room	Wall Fan	1	50	50
		Room	Wall Fan	1	50	50
			Ceil. Fan	1	80	80
		Room 6	Ceil. Fan	3	80	240
		English Lab	Ceil. Fan	2	150	300
		Class Room	Ceil. Fan	5	80	400
		Ladies Room	Ceil. Fan	1	150	150
		Pharma. Chemi	Ceil. Fan	1	150	150
		Lab	Exhaust(S)	4	45	180
			Ceil. Fan	2	80	160
			Wall Fan	2	50	100
		HOD Cabin	Wall Fan	2	50	100
		Class M.Sc	Ceil. Fan	1	150	150
		Room 3	Ceil. Fan	7	80	560
		Dept.of Hindi	Ceil. Fan	2	80	160
		Room 1	Ceil. Fan	6	80	480
		Room 2	Ceil. Fan	5	80	400
		Room 4	Ceil. Fan	7	80	560
			Stand Fan	1	55	55
		Room 5	Ceil. Fan	6	80	480
14	A-Block Building	Room 30	Ceil. Fan	6	80	480
		Room 31	Ceil. Fan	6	80	480
		Gents Toilet	Exhaust(S)	2	45	90
		Room 32	Ceil. Fan	6	80	480
		Room 33	Ceil. Fan	6	80	480
		Room 34	Ceil. Fan	6	80	480
		Girls Toilet	Exhaust(S)	2	45	90
		Room 35	Ceil. Fan	6	80	480
		Room 36	Ceil. Fan	6	80	480

Sr. No.	Location	Location of FAN	Type of FAN	Number of FAN	Power (Watts)	Total Power (Watts)
		Room 37	Ceil. Fan	6	80	480
		Room 38	Ceil. Fan	6	80	480
		Room 39	Ceil. Fan	6	80	480
		Waiting Room	Ceil. Fan	6	80	480
		Staff Room	Ceil. Fan	2	80	160
		HOD Cabin	Stand Fan	1	55	55
		English	Ceil. Fan	2	60	120
		Corridor	Ceil. Fan	3	80	240
		Ncc	Ceil. Fan	2	80	160
		First Floor	Ceil. Fan			
		Staff Room	Ceil. Fan	4	60	240
		Class Room	Ceil. Fan	2	60	120
		Corridor Staff	Ceil. Fan	8	60	480
		Room 40	Ceil. Fan	9	60	540
		Room 41	Ceil. Fan	9	60	540
		Room 42	Ceil. Fan	9	60	540
		Ladies Toilet	Exhaust(S)	3	45	135
		Room 43	Ceil. Fan	9	60	540
		Room 44	Ceil. Fan	9	60	540
		Room 45	Ceil. Fan	6	60	360
		Room 46	Ceil. Fan	9	60	540
		Room 47	Ceil. Fan	6	60	360
		Room 48	Ceil. Fan	9	60	540
		Room 49	Ceil. Fan	6	60	360
		Room 50	Ceil. Fan	9	60	540
		Room 51	Ceil. Fan	9	60	540
		Toilet	Exhaust(S)	2	45	90
		Corridor	Ceil. Fan	2	60	120
15	Exam Controller Building	Office	Ceil. Fan	1	80	80
		A/C Station	Ceil. Fan	1	80	80
		Semstor Cell	Wall Fan	2	75	150
		IT Cell	Wall Fan	1	50	50
		Hall	Ceil. Fan	6	60	360
		Cont.of Exam.	Wall Fan	2	75	150
		Store Room	Exhaust(S)	1	45	45
		Toilet	Exhaust(S)	1	45	45
		Room	Ceil. Fan	1	80	80
		Store Room	Ceil. Fan	2	80	160
16	Department of Biotechnology	HOD Cabin	Ceil. Fan	1	80	80
		Corridore	Ceil. Fan	5	80	400
		Lab 1	Ceil. Fan	6	80	480
		PTC Lab	Ceil. Fan	1	80	80
		Lab 2	Ceil. Fan	6	80	480
		Computer Lab	Ceil. Fan	2	80	160

Sr. No.	Location	Location of FAN	Type of FAN	Number of FAN	Power (Watts)	Total Power (Watts)
		Store Room	Ceil. Fan	1	80	80
		Staff Room	Ceil. Fan	2	60	120
			Wall Fan	1	50	50
17	Department of Zoology	Staff Room	Ceil. Fan	2	150	300
		Lab 1	Ceil. Fan	12	80	960
		Office Staff	Ceil. Fan	1	80	80
		Toilet	Ceil. Fan	3	45	135
		Corridor	Ceil. Fan	1	80	80
			Stand Fan	1	50	50
18	Department of Biochemistry	Research Lab	Ceil. Fan	6	80	480
		Kitchen	Ceil. Fan	1	80	80
		Office	Ceil. Fan	2	80	160
		HOD Cabin	Ceil. Fan	1	60	60
		B.Sc Lab	Ceil. Fan	3	150	450
			Ceil. Fan	8	60	480
		M.Sc Lab	Ceil. Fan	5	80	400
		Corridor	Ceil. Fan	4	80	320
		Ground Floor	Ceil. Fan	7	80	560
19	Department of Mathematics	Ground Cabin	Ceil. Fan	1	60	60
		HOD Cabin	Ceil. Fan	1	150	150
		Corridor	Ceil. Fan	2	150	300
			Wall Fan	1	50	50
			Ceil. Fan	1	80	80
		Cabin	Ceil. Fan	2	80	160
		Class Room 15	Ceil. Fan	3	150	450
			Ceil. Fan	2	80	160
		Class Room	Ceil. Fan	4	80	320
20	Department of Sport	HOD Cabin	Ceil. Fan	3	60	180
		Room	Ceil. Fan	1	80	80
		Electric Room	Ceil. Fan	1	150	150
		Placement Cell	Ceil. Fan	1	60	60
		Corridor	Ceil. Fan	2	60	120
21	Yashwant Hall	Hall	Ceil. Fan	14	80	1120
			Ceil. Fan	3	150	450
			Wall Fan	9	50	450
			Stand Fan	2	55	110
			Exhaust(S)	7	45	315
22	Department of Electronics	HOD Canib	Ceil. Fan	7	80	560
		Class Room	Ceil. Fan	2	80	160
			Wall Fan	1	50	50
		Lab	Wall Fan	6	50	300
23	Department of Geology	Class Room 1	Ceil. Fan	1	80	80
		Class room 2	Ceil. Fan	6	60	360
		Staff Room	Ceil. Fan	1	80	80

Sr. No.	Location	Location of FAN	Type of FAN	Number of FAN	Power (Watts)	Total Power (Watts)
		Store Room	Ceil. Fan	1	150	150
		Class Room 3	Ceil. Fan	3	80	240
		Faculty Room	Wall Fan	1	50	50
		Class Room 4	Ceil. Fan	4	60	240
		Staff Room	Ceil. Fan	2	80	160
		Museum	Ceil. Fan	4	80	320
		Corridor	Ceil. Fan	2	80	160
		Room 1	Ceil. Fan	6	80	480
		Room 2	Ceil. Fan	6	80	480
		Room 3	Ceil. Fan	3	80	240
		Room 24	Ceil. Fan	4	80	320
		Room 23	Ceil. Fan	4	80	320
		Room 25	Ceil. Fan	2	60	120
		24	Library Building	Office	Ceil. Fan	4
Hall	Ceil. Fan			36	60	2160
Binding Sect.	Ceil. Fan			1	80	80
Study Hall	Ceil. Fan			14	80	1120
E-Library	Ceil. Fan			2	80	160
Corridor	Ceil. Fan			12	80	960
Toilet	Exhaust(S)			1	45	45
Librarian	Ceil. Fan			1	80	80
	Stand Fan	1	100	100		
25	Admin Building	Office	Ceil. Fan	4	80	320
		Account office	Ceil. Fan	1	60	60
		Corridore	Ceil. Fan	2	80	160
		Data Store	Ceil. Fan	4	120	480
		Store	Ceil. Fan	1	80	80
		Scholarship	Ceil. Fan	4	80	320
		Front Office	Ceil. Fan	2	60	120
		Principal Cabin	Ceil. Fan	2	60	120
			Stand Fan	1	50	50
		Kitchen	Ceil. Fan	1	80	80
		Admis. Office	Ceil. Fan	1	60	60
			Wall Fan	1	45	45
26	Department of Computer Science	Office	Ceil. Fan	1	80	80
		Lab 1	Exhaust(S)	2	45	90
			Ceil. Fan	4	80	320
		Store Room	Ceil. Fan	1	80	80
		Corridor	Ceil. Fan	4	80	320
		Lab 2	Ceil. Fan	6	80	480
		Store	Ceil. Fan	2	80	160
		Corridor	Ceil. Fan	1	80	80
		E-Gallery	Ceil. Fan	15	80	1200
Store Room	Ceil. Fan	2	120	240		

Sr. No.	Location	Location of FAN	Type of FAN	Number of FAN	Power (Watts)	Total Power (Watts)
			Ceil. Fan	1	80	80
		M.Sc Room	Ceil. Fan	2	120	240
			Ceil. Fan	2	80	160
			Wall Fan	2	50	100
		Lab 4	Ceil. Fan	2	120	240
			Ceil. Fan	4	80	320
		Staff Cafereria	Ceil. Fan	2	120	240
		Staff Room	Ceil. Fan	2	150	300
		HOD Cabin	Wall Fan	2	50	100
27	Dr.W.V.Bhagwat	Lab	Ceil. Fan	1	150	150
			Ceil. Fan	1	120	120
			Ceil. Fan	4	80	320
			Stand Fan	1	80	80
		Class Room	Ceil. Fan	2	80	160
		Store	Ceil. Fan	1	80	80
		Gallery	Ceil. Fan	1	80	80
28	Confrence Hall	Staff Room	Ceil. Fan	2	80	160
		Hall	Ceil. Fan	6	80	480
29	Department of Microbiology	Flamming Lab	Ceil. Fan	2	80	160
		Corridor	Ceil. Fan	1	80	80
			Wall Fan	1	50	50
		Lobert Lab	Ceil. Fan	2	80	160
		Staff Room	Ceil. Fan	3	80	240
		Louis Pasture	Ceil. Fan	3	80	240
			Wall Fan	1	50	50
Gallery	Wall Fan	1	50	50		
30	Fish Zone	Staff Room	Ceil. Fan	4	80	320
		Hall	Ceil. Fan	8	60	480
			Stand Fan	1	50	50
Total Power Consumption in kW						74.88

5.1 OBSERVATIONS & COMMENTS

- We observed, most of the Fan was good and delivering best air delivery .
- We are suggesting to purchases New energy efficient BLDC fan as per Star leveling program by Bureau of Energy Efficiency, and will get huge amount of electricity saving.
- Energy Saving calculation and recommendation for the existing Conventional Ceiling fans with BLDC super energy efficient fan has been given in this report .
- We observed Fan maintenance procedures were not followed regularly as per site visit and discussion.
- We are also suggesting to improve their Air delivery of Fan by Replacing New energy efficient BLDC Fan as per 5 star leveling of Bureau of energy efficiency.

6 CHAPTER

AIR CONDITIONING SYSTEM

6.1 Performance Evaluation of Window / Split / Tower AC

There are various types 26 No's split and window Air Conditioning system are installed at various location in the Govt. Holkar Science College Indore and they also contribute very high electricity consumption .



Figure 32 Split type of 5 star,1.5 TR Airconditioning System

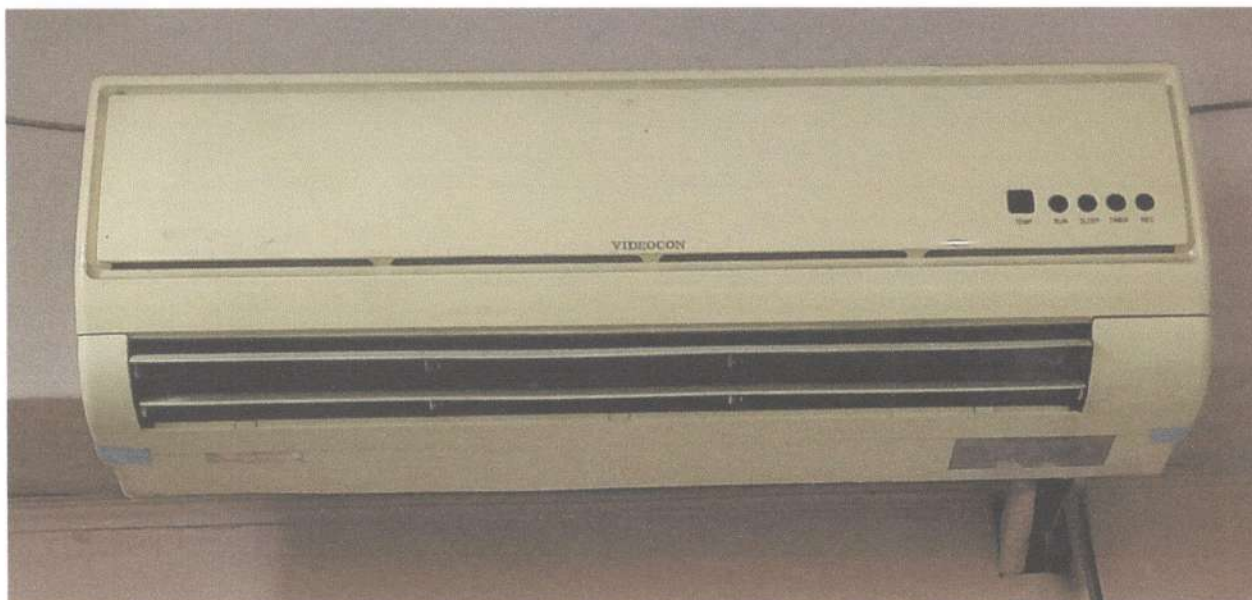


Figure 33 Split type of conventional Old ,1.5 TR Airconditioning System



Figure 34 Split type of conventional Old ,1.5 TR Airconditioning System



Figure 35 Window Air conditioning system in Department of bio technology

6.2 The details of Different type of Airconditioning System

Table 3 The details of Different type of Airconditioning System

Sr. No	Location	No. of AC	Air Conditioning				Power Consumption in		Specific Power Consumption
			Type	Star	Make	Ton	Watt	Total (kW)	kW/TR
1	Chemistry (HOD Cabin)	1	Split	3	VOLTAS	1.5	1450	1.45	0.97
2	Physics (HOD Cabin)	1	Split	3	VOLTAS	1.5	1450	1.45	0.97
3	Placement Cell	1	Split	OL	VIDEOCON	1.5	1950	1.45	0.97
4	Librarian Cabin	1	Split	3	Haier	1.5	1556	1.45	0.97
5	English (HOD Cabin)	1	Split	OL	VIDEOCON	1.5	1950	1.45	0.97
6	Examination Bulding	1	Split	3	Haier	1.5	1556	1.45	0.97
		1	Split	OL	VIDEOCON	1.5	1950	1.45	0.97

Sr. No	Location	No of AC	Air Conditioning				Power Consumption in		Specific Power Consumption
			Type	Star	Make	Tonn	Watt	Total (kW)	kW/TR
				D					
		3	Split	5	VOLTAS	1.5	1425	4.35	2.90
		1	Split	3	Haier	1.5	1556	1.45	0.97
7	Biotechnology (PTC LAB)	1	Split	OL D	VIDEOCON	1.5	1950	1.45	0.97
8	Principal Cabin	2	Split	OL D	CRUISE	1.5	1850	2.9	1.93
9	administrative Cabin	1	Split	3	VIDEOCON	1.5	1650	1.45	0.97
10	Dr.Bhagwat LAB	1	Split	5	Haier	1.5	1452	1.45	0.97
11	Confrence Hall	3	Split	3	LG	1.5	2375	4.35	2.90
12	Yashwant Hall	3	Split	3	LG	1.5	1925	4.35	2.90
Total No of AC		22	TOTAL POWER CONSUMPTION (kW)					32	

6.3 Observation and Comments

- We observed during visit, most of air conditioning were Spilt AC and window type ,3 star rated and Zero star rated also and very high specific power consumption from 0.97 to 2.9 kW/TR as per Star leveling program by Bureau of Energy Efficiency 2019.
- We are suggesting to purchases New AC as 5 star rated Air Conditioning system as per Star leveling program by Bureau of Energy Efficiency 2019, and will get huge amount of electricity saving.
- We observed, most of outdoor unit (condenser) of air conditioning system placed open area, so performance of outdoor system degrade continuously due to environmental impact.

7 CHAPTER PUMPING SYSTEM

7.1 Submersible Pumps

There are 9 no of different capacity submersible pump installed within college campus for drinking water and gardening purpose.



Figure 36 3 HP submersible pump

7.2 Details of Pumping system installed at Holkar Science Collge , indore

Table 4 Details of Pumping system installed at Holkar Science Collge , indore

Details of Pumping system installed at Holkar Science Collge , indore										
Sr. No	Address	Pump of Capacity (HP)	Type of Pump	Depth (Feet)	Power Measue ment				Working Hr	Remarks
					Voltage (V)	Current Amp	PF	Measured Power (kW)		
1	Botany building	1	Submercible	400	241	3.82	0.89	0.82	2 to 3	Rewinded more than 5 Year old
2	Chemistry Building	1.5	Submercible	600	243	5.12	0.93	1.16	2 to 3	Rewinded more than 3 Year old
3	Academic Building	1.5	Submercible	400	242	5.25	0.92	1.17	2 to 3	Rewinded more than 2 Year old

Details of Pumping system installed at Holkar Science Collge , indore

Sr. No	Address	Pump of Capacity (HP)	Type of Pump	Depth (Feet)	Power Measurement				Working Hr	Remarks
					Voltage (V)	Current Amp	PF	Measured Power (kW)		
4	Main office	1	Submercible	400	240	3.92	0.98	0.92	2 to 3	Rewinded more than 2 Year old
5	Library	1.5	Submercible	550	242	5.35	0.99	1.28	2 to 3	Rewinded more than 2 Year old
6	Front of Zoology Department	1.5	Submercible	400	242	5.29	0.98	1.25	2 to 3	Rewinded more than 3 Year old
7	Behind of Zoology Department	1	Submercible	400	242	3.81	0.95	0.88	2 to 3	Rewinded more than 2 Year old
8	Hostel	2	Submercible	600	244	6.24	0.99	1.51	3 to 4	Rewinded more than 3 Year old
9	Infront of 3 no. gate	3	Submercible	500	230	14	0.92	2.96	2 to 3	Rewinded more than 2 Year old
10	Infront of baba garden	1.5	Submercible	350	240	5.3	0.99	1.26	3-Jan	Rewinded more than 3 Year old

7.3 Submersible Pumps power measurement

Table 5: Submersible Pumps power measurement

Govt.Holkar Science College,Indore						
Sr. No.	Location	Phase	Measured Data			
			Volt	Amps	PF	KW
1	3 HP Pump at 3 No Gate	R	230	14.01	0.92	2.73
		Y	233	14.55	0.82	2.75
		B	230	14.52	0.78	2.76

7.4 Observation and Comments

- We observed during Energy Audit and site visit , 1HP , 1.5 , 2 HP and 3 HP submersible pump were installed within college campus for drinking water and gardening purpose .
- Power consumption of 3 HP submersible pump was 2.75 kW as per site visit and measurement.
- We are suggesting to purchase 5 star rated pumps and will get huge amount of saving as per Star leveling program by Bureau of Energy Efficiency 2019.

8 CHAPTER

DIESEL GENERATORS

There 1 no. of Diesel Generators is installed to supply power at the time of power failure. The capacity of Diesel generators are 10 KVA.

Table 6 Diesel Generator Details

DG Rated KVA	10
RPM	1500
Pahse	Single
Rated Outpute Power (KW)	8
Rated Voltage Volt	230
Current Amp	43.4
PF	0.8
Frequency Hz	50



❖ Oberavtion and Comments

- We observed during Energy Audit and site visit , a diesel generator is installed at in college campus for unintrepted power supply.
- The capacity of Diesel generators is 10 KVA .
- It help to save most of equipment during falier

Annexure - 1

1 Standard Lux Level

Activity	Illumination (lux, lumen/m ²)
Public areas with dark surroundings	20 - 50
Simple orientation for short visits	50 - 100
Working areas where visual tasks are only occasionally performed	100 - 150
Warehouses, Homes, Theaters, Archives	150
Easy Office Work, Classes	250
Normal Office Work, PC Work, Study Library, Groceries, Show Rooms, Laboratories	500
Supermarkets, Mechanical Workshops, Office Landscapes	750
Normal Drawing Work, Detailed Mechanical Workshops, Operation Theatres	1,000
Detailed Drawing Work, Very Detailed Mechanical Works	1500 - 2000
Performance of visual tasks of low contrast and very small size for prolonged periods of time	2000 - 5000
Performance of very prolonged and exacting visual tasks	5000 - 10000
Performance of very special visual tasks of extremely low contrast and small size	10000 - 20000



ENVIRONMENT AUDIT REPORT

YEAR-2020-21



Govt Holkar Science College

Indore (Dist.), Madhya Pradesh, India

CONDUCTED BY:



SABS INDIA



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Acknowledgement

SABS INDIA is thankful to the **Govt Holkar Science College** for their positive support in undertaking this intricate task of Environment Audit. The field studies would not have been completed on time without their interaction and timely support. We are grateful for their co-operation during field studies and provision of data for the study. The field study of this audit was carried out on September 2018 to June 2019

The officials of **Govt Holkar Science College** coordinated and helped to the audit team during the field study and measurement. **SABS INDIA** expresses special thanks to the following persons of **Govt Holkar Science College**.

Dr. Suresh T. Silawat -Principal, Holkar Science College , Indore

Dr. R. C. Dixit -Administrative Officer -Holkar Sc. College, Indore

Dr. Sanjeeda Iqbal -Convener & Coordinator Green campus Committee, Holkar

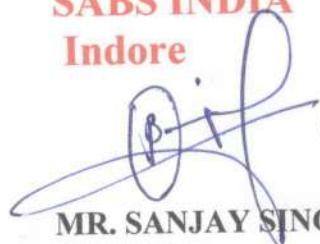
Science College, Indore

And all other officers, technicians and staffs for the keen interest shown in this study and the courtesy extended.

We are thankful to the management for giving us the opportunity to be involved in this very interesting and challenging project.

We would be happy to provide any further clarifications, if required, to facilitate implementation of the recommendations.

SABS INDIA
Indore



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EA-1462

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M. Tech (Energy Management)



List of Contents

Sr. No.	Topic	Page No.
1	Introduction	5-6
2	General Overview of The Concept of Land use	7-8
3	Air Quality	9-10
4	Water Management	11-15
5	Waste Management	16-17

CHAPTER:1

INTRODUCTION

1.1 About the College

Govt.(Model, Autonomous) Holkar Science college, Indore was established by, the then King of erstwhile Holkar state Hon'ble Maharaja Shivaji Rao Holkar in June 1891. The visionary king selected Mr. Cholmondeley from UK as its first principal. The college started with the best talent available in teaching in India and abroad. At the time of opening of the new building of the college, the manager of the state stressed the need of girl education. The king could foresee that conservatism and dogmatic religious beliefs would soon give way to scientific outlook and rationalism. With the increasing number of students and multiplication of disciplines, the college was split into two separate and independent units. One of these two colleges was designated as Govt. Arts and Commerce College while this college retained its prestigious original name i.e. Holkar College. It continued to be housed in the old college building. Ever since its inception the institution has striven hard to fulfil its promises of providing quality education to produce thoughtful, intelligent and competent human beings capable of facing the challenges of the life bravely. The alumni of the college have occupied prestigious positions in almost every walk of life. Perhaps this is the only college which produced Chief Justice of Supreme Court of India Hon'ble Justice R.C.Lahoti and Chief Justice of Pakistan Hon'ble Justice Alvin "Bobby" Robert Cornelius. The father of Justice Cornelius was a faculty member of the college. At present, the institution is imparting education in science with the emphasis on scientific research.

1.2 Audit Framework

The rapid urbanization and economic development at local, regional and global level has led to several environmental and ecological crises. On this background it becomes essential to adopt the system of the Green Campus for the institute which will lead for sustainable development. Green Audit is a planned identification, data analysis and reporting of mechanisms of environmental diversity. The "Green Audit" aims to analyze environmental practices within and outside the college campus, which will have an impact on the eco-friendly environment.

1.3 Objective Of the Green Audit

The institute, with the advice of the External Quality Assessment Cell (EQAC) has set up an environmental quality assessment Team that aimed at performing the green audit of the College. The main objectives of the audit are:

- To fulfil the Institution's responsibility towards reducing carbon footprint and contribute to environmental protection.
- To promote Environmental Consciousness and Responsibility among students.
- To implement green practices consistently and effectively towards creating a sustainable campus.
- To monitor and evaluate the green practices, towards a sustainable campus

- To generate innovative green practices, promoting the spirit of eco-innovation among students.
-

1.4 Methodology

The Green Audit taken up by **Govt Holkar Science College** has been divided into Three stages:

- Data/ /Observation
- Analysis of finding
- Recommendations

1.5 Division Of Audit

For better investigation and pinpoint observation our team has divided this work in 6 parts



CHAPTER: 2

GENERAL OVERVIEW OF THE CONCEPT OF LAND USE

2.1 Introduction

Land use refers to man's activities and the various uses which are carried on and derived from land. Viewing the earth from space, it is now very crucial in man's activities on natural resource. In situations of rapid changes in land use, observations of the Earth from space give the information of human activities and utilization of the landscape.

Remote sensing and GIS techniques are now providing new tools for advanced land use mapping and planning. The collection of remotely sensed data facilitates the synoptic analyses of earth system, functions, patterning, and change in the local, regional as well as at global scales over time. Satellite imagery particularly is a valuable tool for generating land use map.

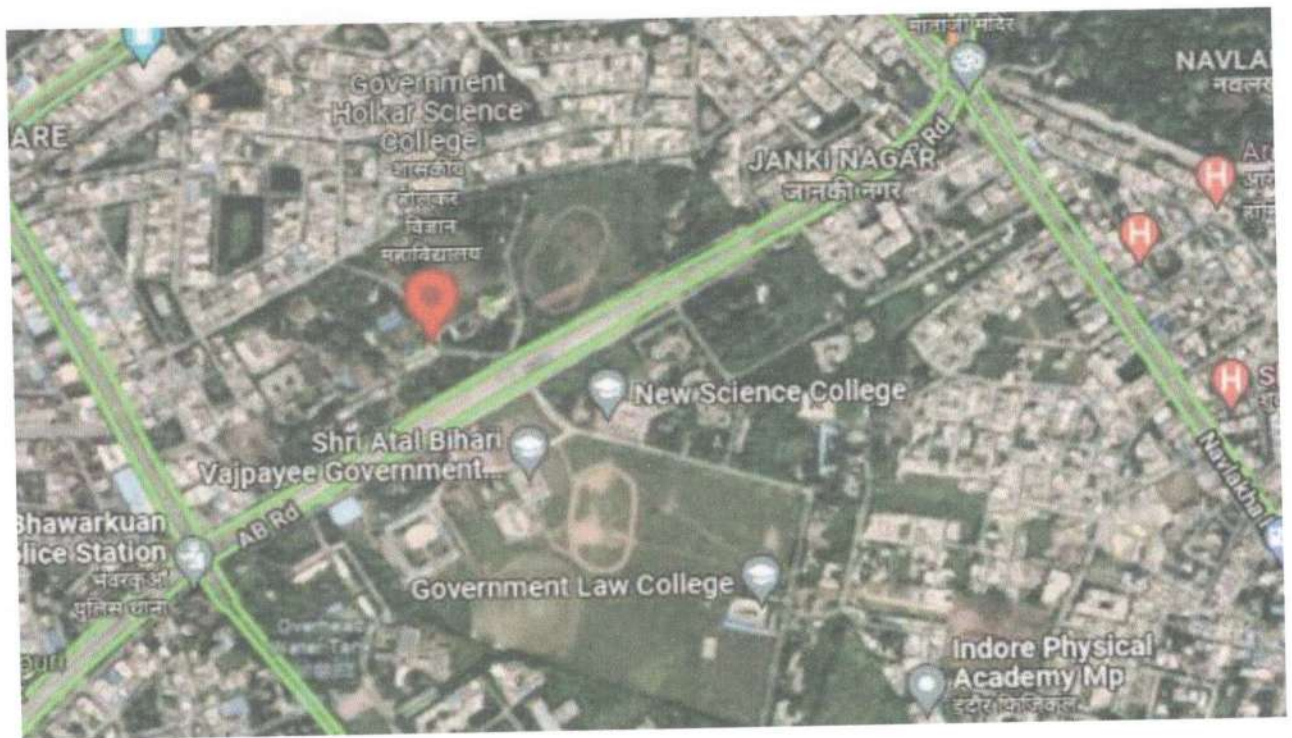


FIGURE 1 : SATELLITE VIEW OF GOVT HOLKAR SCIENCE COLLEGE

2.2 Methodology Adopted for Land Use Mapping

Three types of data that are GPS points, field survey data and Google earth data for Geo referencing have been used in this study. Land use map of the study area have been prepared using the above three types of data with the help of ArcGIS Pro software.

2.3 Data Processing and Analysis

Land use map preparation is executed through the following steps:

Acquisition of data, Geo-coding and Geo referencing of satellite imageries by extracting the ground control points. Supervised classification was carried out with the aid of ground truth data collected during field survey. Scanning and digitization of maps and editing of all the Geo referenced maps were done using GIS. Data manipulation and analysis and linking the spatial data with the attribute data for creation of topology was carried out using GIS software. Creation of GIS output in the form of land use map showing various land use have been prepared. Therefore, attempt has been made in this study to map land use for Geography Department of with a view to detect the land consumption in the built-up land area using both remote sensing and GIS techniques.

2.4 Geographical Location with Campus Map in Scale

The college has 35 acres **pollution-free campus** in Indore. It has an ideal geographical location with the approximately to the important cities of the region. It is On AB road which makes it easy to access. The college is located at 3.5 Km from Indore Junction and 12 Km from the Indore Airport and is easy to reach. Scaled image of college campus is shown. Green colour in Map is representing green area. The Google aerial view of College Campus has been shown in figure.



CHAPTER :3

ENVIRONMENTAL AIR QUALITY AUDIT

3.1 Data/Observations

Air quality in the academic college is very significant for creating good educational atmosphere as well as for the health of the students, faculty, staff and other stake holder of the institute. Being situated in the heart of the city, our college is exposed to various atmospheric pollutants from vehicles as well as by other external means of urban areas, but mainly turn proves that vehicles may contribute to high carbon dioxide emission.

FIGURE 2: AIR QUALITY DATA OF INDORE OF 2 MONTHS

Ambient Air Quality at Govt. Holkar College, Indore Premises							
(During last 5 years)							
S. No.	Parameters	2016	2017	2018	2019	2020	2021
1	PM10	98.6	82.4	79.2	76.8	63.5	6
2	PM2.5	30.4	28.6	25.8	22.4	18.8	20.4
3	SO2	14.6	12.9	10.5	8.8	5.7	7.2
4	NO2	23.8	21.6	19.4	17.6	10.9	12.7
	(In microgram/M3)						

3.2 Finding

From the above study on air quality during these times air quality is good and moderate at which indicates less pollution most of the times.

Study shows the changes in air quality due to regulatory parameters which includes Sulphur di oxide, nitrogen per oxide and particulate matter. All the parameters were within permissible range air quality index inside and around the college campus was better than other parts of the city, mainly because of the greenery & also students prefer public transport to commute. Most students use public transport for commuting since the college is well connected by public transport services as local bus service. Use of Bicycles and public transport is encouraged by the institute amongst the students, faculty members, office staff residing nearby are encouraged to come by bicycles, or public transport which help in reduction of the release of carbon-dioxide in the campus.

The college is Situated on the AB road which makes it easy to reach for students of Pithampur, Mhow and all the parts of the Indore city from public transport. It is in the route of BRTS and

one of the I-Bus stop is for the college in front of it, that is why most students and staff prefer public transport for the transportation.

3.3 Observations & Recommendation

College has campus Covered with trees, number of garden and greenery in campus beautify the campus and automatically neutralize carbon footprint. College has already taken some steps like Plantation of local and common plant species, arranges special programs by inviting the eminent personalities for environmental consciousness of teaching and nonteaching staff in college as well as student, cleaning and beautification of our campus by various activities through various units. The college should plant different types of large number of trees in the campus, this greenery in campus helps to neutralize the carbon products generated. There should be very less use on the entry of vehicles in college premises.

3.4 Observation and Recommendation

- Use of personal vehicles should be decreased further.
- Air quality monitoring display should be in the campus (or near the campus) to aware students about the quality of the air.



National ambient air quality standards



Pollutant	Satisfactory level*	Time weighted average
Sulphur dioxide (SO ₂)	80 µg/m ³	24 hrs
Nitrogen dioxide (NO ₂)	80 µg/m ³	24 hrs
Ozone (O ₃)	100 µg/m ³	8 hrs
Carbon Monoxide (CO)	2 mg/m ³	8 hrs
Ammonia (NH ₃)	400 µg/m ³	24 hrs
Lead (Pb)	1 µg/m ³	24 hrs
PM2.5	60 µg/m ³	24 hrs
PM10	100 µg/m ³	24 hrs
Benzene (C ₆ H ₆)	5 µg/m ³	Annual
Benzo Pyrene	1 ng/m ³	Annual
Arsenic (As)	6 ng/m ³	Annual
Nickel (Ni)	20 ng/m ³	Annual

*Must comply at least 98% of the time

CHAPTER :4

WATER AUDIT

4.1 Introduction

Water is a natural resource, all living matters depend on water. While freely available in many natural environments, in human settlements potable (drinkable) water is less readily available. We need to use water wisely to ensure that drinkable water is available for all, now and in the future. A small drip from a leaky tap can waste more than 180 litre of water in a day. It is therefore essential that any environmentally responsible institution should examine its water use practices. Water audit improves the knowledge and documentations of distribution system:

- It leads to reduce water losses.
- It improves financial performance.
- Efficient use of existing water.

The concerned auditor investigates the relevant method that can be adopted and improved to balance the demand and supply of water.

4.2 Data Related to Water Consumption

TABLE 1 : DATA OF WATER CONSUMPTION IN THE CAMPUS

Location	Tank Capacity	Borewells	No. of Taps	Toilets	No. of people
Exam Section	6000	1	3	2	19
Statistics department	1000	0	1	1	5
Library	4000	1	6	3	13
Zoology	600	0	15	2	17
Biotechnology department	1000	0	6	3	16
Physics department	1000	0	8	2	30
Microbiology department	1000	0	10	2	10
Biochemistry department	1000	0	14	3	8
Botany department	1200	1	5	4	10
chemistry department	4000	1	250	1	49
CSE department	2000	0	4	1	37
Electronics department	0	0	0	0	6
Mathematics department	0	0	1	0	20
Forensic department	2000	0	5	0	9
Language department		0	10	0	11
Pharma department		0		0	12
Hindi department		0		0	2

4.3 Observations

Questioner for data collection

1) What are the uses of water in college?

Answer- Drinking, Washing, Toilet, Lab, Garden, Canteen, Hostel, Staff quarter.

2) What are the sources of water in college?

Answer-The main source of water is Borewell and Municipality water.

3) How many water coolers are there?

Answer- There are 26 no. of water coolers in the campus.



FIGURE 3 : WATER COOLER AT THE ENTRANCE OF COLLEGE

4) No. of motors used for pumping water?

Answer- There are 3 no. of 1 HP Submersible Pump, 5 no. of 1.5 HP Submersible Pump, 1 no. of 2 HP Submersible Pump and 1 no. of 3 HP Submersible Pump installed within college campus for drinking water and gardening purpose.

5) Is there any water collection and recharge system?

Answer- Yes, there are two water collection and recharge system for waste water coming from water cooler and taps and rain water.

6) Is there any Wastage of water?

Answer- No, there is no major wastage of water, 1. No leakage from Taps, 2. No wastage from over flowed tanks 3. Some wastage from water cooler.

7) Is there any treatment plant for the lab water?

Answer- Yes there is an Effluent treatment plant for the lab water in chemistry department. As water drains out in a pit and treated as shown in figure below.



FIGURE 4 : ETP INSTALLED IN CHEMISTRY DEPARTMENT

8) What is the Capacity of tank?

Answer- There are various types of tank present in the departments according to the requirement. But the main tank, which supplies water to the all the departments has tank capacity of 30,000 litres.

9) Any water used in agriculture purpose.

Answer- Yes in garden.

10) Does college harvest rain water?

Answer- Yes, there is rain water harvesting system in Campus.

11) Is drip irrigation used to water plants outside?

Answer- No

12) How many toilets are there in the campus?

Answer- There are 40 toilets in the campus.

13) Is there any Leakages in the Taps?

Answer – No there is no leakage in any of the Tap.

14) Some idea for how your college could save more water.

Answer -a) Stop leakage of water from taps.

b) Use minimum water needed for daily needs.

c) Immediate turns off the, taps after washing hands.

d) Renew water ball for water tanks to 100% prevent the waste of water.

Saving water helps to preserve our environment. It reduces the energy required to process and deliver water, which helps in conserving resources.

4.4 Key findings: -

1. Main water uses in the campus.
 - a) Garden
 - b) Lab
 - c) Cleaning
 - d) Drinking
 - e) Toilet
 - g) Washing
- 2) No water treatment system in Place = 1
- 3) No. of Water Coolers= 26
- 4) No. of water pump = 10
- 5) Municipal water connection - Yes
- 6) Using water from own well – Yes
- 7) No. of water tank for water storage = 24
- 8) Amount of water stored =30000 litres

4.5 Water Recharging System-

Generally, a lot of rain water would go in drain flowing from the roofs and the street. Rain water harvesting is requiring conserving the water and recharging the underground water which helps when there is a water scarcity. When there is too much rain we can collect all the water at roof and via piping system it can be transferred to underground water after filtering so that it can be reused for different purposes.

We can send the rain water flowing on the streets to underground water after proper filter system so that it could be used in the dry seasons. In few places the underground water level goes down so much extent that wells, tube wells are dry in these places. There should be a provision of sending rain to go underground to increase underground water level so that it brings water level of wells and tube wells back to normal. There are many ways to send rain water to underground to increases the underground water level.

Most simple way to recharge is to dig a pit in the ground and make a filtering system so that clean rain water can reach underground and can be reused. Location of the pit should be on a clean ground surface so that polluted water doesn't go underground through the pit. The pit should be deep enough so that rain water would be reach the porous layer of soil as it allows the water to pass though it and get added to the underground water. But water flowing thru the street will still be polluted so we need a filter layers in the pit. First we need a clean big stone or boulders layer of specific thickness. Then above that layer we put layer of clean gravel which is almost as thick as the first layer of boulder. Then finally on the top we put the clean sand make sand layer almost as thick other layers. This completes the filter system and the pit is called

recharge pit. While the rain water from streets overflow passes through the primary sand layer it separates dirty soil from the rain water and makes its clean. Then rain water pass through the secondary layer which ensures that rain which has carried some amount of sand gets filtered out from gravel layer. Finally, the water passes through the boulder layer. The boulder layer actually gives support to upper layer and allows rain water to pass easily to the porous soil and get added to the underground water treasure. This underground water is clean and would supply drinking water as well as other domestic purposes or for household gardens whole year through tube wells and wells.



FIGURE 5: WATER RECHARGING SYSTEM

There are 2 no. of water recharging system in the campus.

Depth -200 feet each

4.6 Reason for water wastage-

- 1) There is no water consumption monitoring system in the college campus.
- 2) Automatic switching system is not installed for pump sets used for overhead tank filling.

4.7 Recommendations-

- 1) Remove old taps and install sensitive taps if possible.
- 2) Drip irrigation for gardens and vegetable cultivation can be initiated.
- 3) Establish rain water harvesting system for each building.
- 4) Water treatment system should be installed for all labs.
- 5) Awareness program on water conservation to be conducted.
- 6) Install display boards to control over exploitation of water.

CHAPTER :5

WASTE AUDIT

5.1Solid Waste

Waste is produced by all types of routine activities carried out in the college that includes waste papers, parts of trees, leaf, poly bags plastics, glass, food products, etc. Reduce-Reuse-Recycle is the root of sustainable development and qualitative human life with green environment, college strongly believes in this philosophy.

Reuse: Reuse of waste materials and recycling of those Recycle: Organic waste material like parts of trees, leaf litters collected & dump in vermi-composting pit. This converts the compost & reuse as a manure in garden for campus.

The waste papers from college centrally collected. Answer sheets and question papers from Autonomous Dept. Practical records collected from science laboratory. Newspapers and magazines from library, etc. The Institute has outsourced a Vendor to dispose of all the Answer Sheets, News Papers and other Paper Material. The Vendor recycle the paper as per the agreed the vendor. All paper waste given to vendors for recycling at regular intervals.

The waste is separated at each level and source. Throwing the waste anywhere is strictly prohibited. Usage of plastic bags is discouraged within the premises of the College. Dustbins are provided throughout the campus. The administrator in each building confirms that the waste in each floor is collected at selected time to time. The staff in each floor collects, clean, segregates and compiles the waste in the Green & Blue dustbins provided at each floor. The floor dustbins are covered and easily portable. Dry garbage from college campus collected by hour keeping staff from different collection point.

The primary goal of solid waste management is reducing and eliminating adverse impacts of waste materials on human health and environment to support economic development and superior quality of life. The entire campus is duly cleaned regularly by sweepers and cleansing works.

5.2Liquid Waste

Well-constructed drainage system leading to the IMC constructed chambers is there in place within the campus. Liquid waste is duly discharged by means of underground well laid pipe lines. But the college does not have waste water treatment plant for waste water, generated from laboratories, canteen, hostel, Toilets.

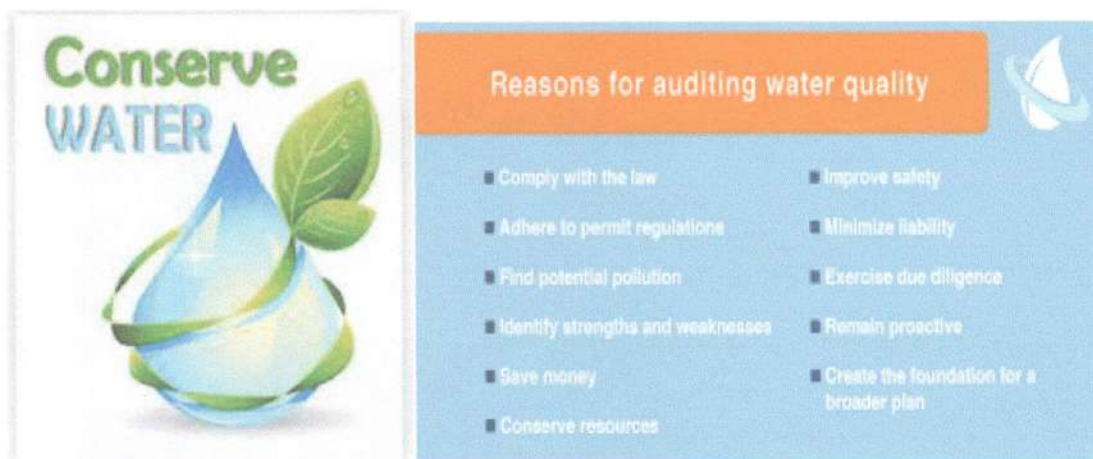
5.3E- Waste

E-waste can be described as consumer and business electronic equipment that is near or at the end of its useful life. This makes up about 5% of all municipal solid waste worldwide but is much more hazardous than other waste because electronic components contain cadmium, lead,

mercury, and Poly chlorinated biphenyls (PCBs) that can damage human health and the environment.

College separates E- waste differently than the other type of waste. It is collected, stored and disposed differently than other solid waste.

E waste in the campus is collected and stored, and then transported to pollution control board Indore. Which takes it for the proper treatment.



GREEN AUDIT REPORT

YEAR-2020-21



Govt Holkar Science College

Indore (Dist.), Madhya Pradesh, India

CONDUCTED BY:



SABS INDIA



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Acknowledgement

SABS INDIA is thankful to the **Govt Holkar Science College** for their positive support in undertaking this intricate task of Green Audit. The field studies would not have been completed on time without their interaction and timely support. We are grateful for their co-operation during field studies and provision of data for the study. The field study of this audit was carried out on September 2018 to June 2019

The officials of **Govt Holkar Science College** coordinated and helped to the audit team during the field study and measurement. **SABS INDIA** expresses special thanks to the following persons of **Govt Holkar Science College**.

Dr. Suresh T. Silawat -Principal, Holkar Science College , Indore

Dr. R. C. Dixit -Administrative Officer -Holkar Sc. College, Indore

Dr. Sanjeeda Iqbal -Convener & Coordinator Green campus Committee, Holkar Science College, Indore

And all other officers, technicians and staffs for the keen interest shown in this study and the courtesy extended.

We are thankful to the management for giving us the opportunity to be involved in this very interesting and challenging project.

We would be happy to provide any further clarifications, if required, to facilitate implementation of the recommendations.

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List of Contents

Sr. No.	Topic	Page No.
1	CH-1 Introduction	5-6
2	Ch-2 General Overview of The Concept of Land use	7-8
3	Ch-3 Tree Diversity of College	9-24
4	Ch-4 Fauna Diversity	25-30
5	Ch-5 Green energy utilization	31-32

Sr. No.	Table	Page No.
1	Table 1: List of Trees	10-23
2	Table 2 : Tables of some of snaks	26
3	Table 3: List of all the Birds in the campus	19-20
4	Table 4 : List of all the Butterfiles in the campus	22
5	Table 4 : Energy data of the campus	24

CHAPTER :1

INTRODUCTION

1.1 About the College

Govt.(Model, Autonomous) Holkar Science college, Indore was established by, the then King of erstwhile Holkar state Hon'ble Maharaja Shivaji Rao Holkar in June 1891. The visionary king selected Mr. Cholmondeley from UK as its first principal. The college started with the best talent available in teaching in India and abroad. At the time of opening of the new building of the college, the manager of the state stressed the need of girl education. The king could foresee that conservatism and dogmatic religious beliefs would soon give way to scientific outlook and rationalism. With the increasing number of students and multiplication of disciplines, the college was split into two separate and independent units. One of these two colleges was designated as Govt. Arts and Commerce College while this college retained its prestigious original name i.e. Holkar College. It continued to be housed in the old college building. Ever since its inception the institution has striven hard to fulfil its promises of providing quality education to produce thoughtful, intelligent and competent human beings capable of facing the challenges of the life bravely. The alumni of the college have occupied prestigious positions in almost every walk of life. Perhaps this is the only college which produced Chief Justice of Supreme Court of India Hon'ble Justice R.C.Lahoti and Chief Justice of Pakistan Hon'ble Justice Alvin "Bobby" Robert Cornelius. The father of Justice Cornelius was a faculty member of the college. At present, the institution is imparting education in science with the emphasis on scientific research.

1.2 Audit Framework

The rapid urbanization and economic development at local, regional and global level has led to several environmental and ecological crises. On this background it becomes essential to adopt the system of the Green Campus for the institute which will lead for sustainable development. Green Audit is a planned identification, data analysis and reporting of mechanisms of environmental diversity. The "Green Audit" aims to analyze environmental practices within and outside the college campus, which will have an impact on the eco-friendly environment.

1.3 Objective Of the Green Audit

The institute, with the advice of the External Quality Assessment Cell (EQAC) has set up an environmental quality assessment Team that aimed at performing the green audit of the College. The main objectives of the audit are:

- To fulfil the Institution's responsibility towards reducing carbon footprint and contribute to environmental protection.
- To promote Environmental Consciousness and Responsibility among students.
- To implement green practices consistently and effectively towards creating a sustainable campus.
- To monitor and evaluate the green practices, towards a sustainable campus
- To generate innovative green practices, promoting the spirit of eco-innovation among students.

1.4 Methodology

The Green Audit taken up by **Govt Holkar Science College** has been divided into Three stages:

- Data/ /Observation
- Analysis of finding
- Recommendations

1.5 Division Of Audit

For better investigation and pinpoint observation our team has divided this work in 6 parts



CHAPTER:2

GENERAL OVERVIEW OF THE CONCEPT OF LAND USE

2.1 Introduction

Land use refers to man's activities and the various uses which are carried on and derived from land. Viewing the earth from space, it is now very crucial in man's activities on natural resource. In situations of rapid changes in land use, observations of the Earth from space give the information of human activities and utilization of the landscape.

Remote sensing and GIS techniques are now providing new tools for advanced land use mapping and planning. The collection of remotely sensed data facilitates the synoptic analyses of earth system, functions, patterning, and change in the local, regional as well as at global scales over time. Satellite imagery particularly is a valuable tool for generating land use map.

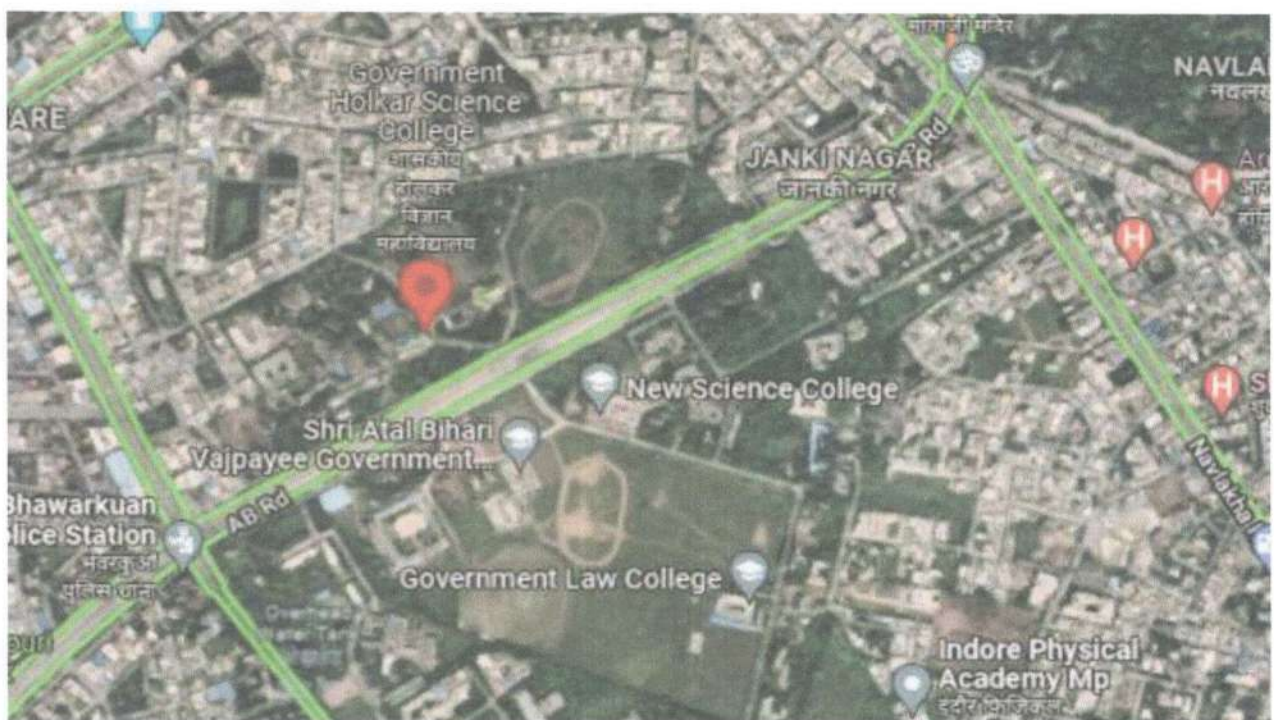


FIGURE 1 : SATELLITE VIEW OF GOVT HOLKAR SCIENCE COLLEGE

2.2 Methodology Adopted for Land Use Mapping

Three types of data that are GPS points, field survey data and Google earth data for Geo referencing have been used in this study. Land use map of the study area have been prepared using the above three types of data with the help of Arc GIS Pro software.

2.3 Data Processing and Analysis

Land use map preparation is executed through the following steps:

Acquisition of data, Geo-coding and Geo referencing of satellite imageries by extracting the ground control points. Supervised classification was carried out with the aid of ground truth data

collected during field survey. Scanning and digitization of maps and editing of all the Geo referenced maps were done using GIS. Data manipulation and analysis and linking the spatial data with the attribute data for creation of topology was carried out using GIS software. Creation of GIS output in the form of land use map showing various land use have been prepared. Therefore, attempt has been made in this study to map land use for Geography Department of with a view to detect the land consumption in the built-up land area using both remote sensing and GIS techniques.

2.4 Geographical Location with Campus Map in Scale

The college has 35 acres **pollution-free campus** in Indore. It has an ideal geographical location with the approximately to the important cities of the region. It is On AB road which makes it easy to access. The college is located at 3.5 Km from Indore Junction and 12 Km from the Indore Airport and is easy to reach. Scaled image of college campus is shown. Green colour in Map is representing green area. The Google aerial view of College Campus has been shown in figure.

CHAPTER:3

TREE DIVERSITY OF COLLEGE CAMPUS

3.1 Objective

The main objective of green audit is to enlist and enumerate the plant diversity of college campus. This is a continuous process and helps in maintenance and conservation of flora of campus.

This study was undertaken with following objectives –

- (a) To identify the plant species growing in the area.
- (b) To make a habit wise list along with their frequency.
- (c) To generate basic data for further reference.
- (d) To create awareness among students.

3.2 Methodology

Phyto diversity of campus was studied by the investigative team. It was divided into parts. Different team visited these areas and noted name and number of plant species. This data was then cumulated and tabled.

3.3 Presentation of the data

The data was categorized on the basis of habits. Grasses and sedges were innumerable so their names were mentioned. In addition to angiospermic plants, other groups were also represented for eg. algae (Diatoms, Oscillatoria, Spirogyra, Vaucheria), fungi, bryophytes (Riccia, Polytrichum, Cyathodium), Pteridophyta (Pteris), gymnosperms (Cycas, Juniperus, Araucaria, Thuja).

3.4 Results

This campus harbours a rich diversity of plants. It is an old institution and hence some members of natural vegetation are still present here. Some plants are introduced for avenue purpose and are combined to the road facing area. The campus has more than 1000 trees and plants which are shown in the table below. Geo-tagging of all the plants and trees is done by the campus. There is also a beautiful “Butterfly Garden” which adds the greenery in the campus.




All the trees and plants are listed below with the numbers which they are present in the campus. A pie chart of distribution of the trees in campus is also shown in the picture to provide the details of distribution

3.5 List of Trees




All the trees present in the campus is mentioned:


TABLE 1 : LIST OF TREES




S.No	Plant Species	Specification
1	Pongamia pinnata A.Cunn.	
		Family- Papilionaceae Hindi name-Karanja English name- Indian Beach No. of trees - 24
2	Polyalthia longifolia Thw	
		Family- Annonaceae Hindi name- Ashok English name- False ashok No. of trees - 4
3	Azadirachta indica A. Juss.	



		<p>Family-Meliaceae Hindi name -Neem English name- The Margosa Tree No of trees - 29</p>
4	Cassia fistula L.	 <p>Family- Caesalpiniaceae Hindi name-Amaltas English name- Indian Laburnum No. of trees - 233</p>
5	Emblica officinalis Gaertn.	 <p>Family-Euphorbiaceae Hindi name-Aola, Amla English name-Emblic myrobolan No. of trees - 7</p>
6	Moringa oleifera Lam	

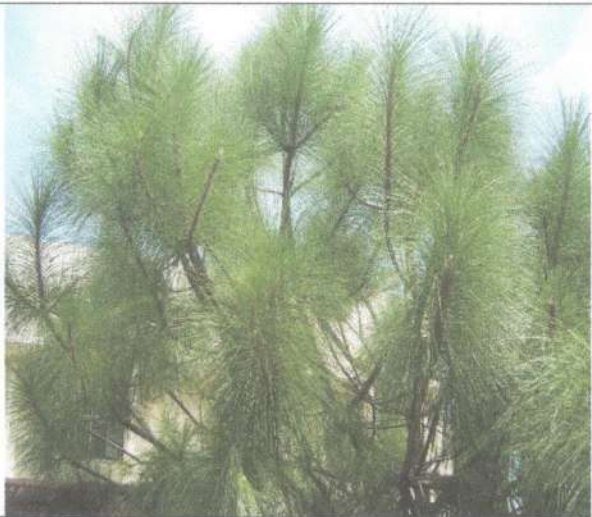

		<p>Family-Moringaceae Hindi name-Surjana English name- Drumstick tree No. of trees- 29</p>
7	<p><i>Alstonia scholaris</i> (L.) R. Br.</p> 	<p>Family-Apocynaceae Hindi name-Satparni English name- Scholars Tree No. of trees - 37</p>
8	<p><i>Zizyphus jujuba</i> Lamk.</p>	



		Family-Rhamnaceae Hindi name-ber English name-Indian Jujube No. of trees - 6
9	Delonix regia (Boj.) Rafin.	
		Family-Caesalpinaceae Hindi name-Gul mohar English name-Flamboyant tree No. of trees - 151
10	Mangifera indica L.	
		Family-Anacardiaceae Hindi name-Aam English name-Mango No. of trees - 18
11	Terminalia catappa Linn.	



		Family-Combretaceae Hindi name- Badam English name- Indian Almond No. of trees -
12	<i>Ficus benghalensis</i> L.	1.7 Family-Moraceae Hindi name-Bargad, Barh English name- The Banyan Number of trees - 13
13	<i>Ficus religiosa</i> Linn.	


		Family-Moraceae Hindi name-Pipal English name- Sacred Fig No. of trees - 13
14	Tamarindus indica L.	
		Family-Caesalpinaceae Hindi name - Imli English name- Tamarind No. of trees- 3
15	Murraya koenigii L.	
		Family-Rutaceae Hindi name-Meetha neem, Kadai patta English Name-Curry leave No. of trees -
16	Psidium guajava L.	




		Family-Myrtaceae Hindi name- Amrood English name - Guava No. of trees - 33
17	<i>Pithecellobium dulce</i> (Roxb.) Benth.	
		Family-Mimosaceae Hindi name-Jungle Jalebi English name- Wild Tamarind No. of trees - 8
18	<i>Pinus roxburghii</i>	




		<p>Family- Pinaceae Hindi name- Chir English Name- Pine tree No. of trees - 30</p>
20	Eucalyptus citrodora Hook.	
		<p>Family- Myrtaceae Hindi name—Nilgiri English name - Eucalyptus No. of trees - 2</p>
21	Dalbergia sissoo	
		<p>Family- Fabaceae Hindi name- Shisham English name- Sissoo No. of trees - 13</p>
22	Magnolia champka	



		<p>Family- MAGNOLIACEAE</p> <p>Hindi name- Son Champa</p> <p>English name- Yellow Champa</p> <p>No. of trees - 10</p>
23	<p><i>Syzygium cumini</i></p> 	<p>Family- Myrtaceae</p> <p>Hindi name- Jaamun</p> <p>English name-</p> <p>No. of trees - 2</p>
24	<i>Bombax Ceiba</i>	

		Family- Malvaceae Hindi name- Kapas English name- Cotton No. of trees - 1
25	Swietenia mahogoni	
		Family- Meliaceae Hindi name- Mahogni English name- No. of trees - 55
26	Conocarpus erectus	

		Family- Combretaceae Hindi name- Conocarpus English name- Conocarpus No. of trees - 20
27	Carica papaya	
		Family- Caricaceae Hindi name- Papaya English name- No. of trees - 3
28	Platycladus orientalis (L.)	

		<p>Family- Cupressaceae Hindi name- Vidhya English name- Thuja No. of trees - 38</p>
29	<p>Musa paradisiaca</p> 	<p>Family- Musaceae Hindi name- Kela English name- Banana No. of trees - 27</p>
30	<p>Ficus ornoteana</p> 	<p>Family- Moraceae Hindi name- Paras Peepal English name- No. of trees - 4</p>

31	Bixa orellana		<p>Family- Hindi name- Achiote English name- No. of trees - 33</p>
32	Artocarpus heterophyllus		<p>Family- Moraceae Hindi name- Kathal English name- Jackfruit No. of trees - 1</p>
33	Bambusa vulgaris		<p>Family- Poaceae Hindi name- Baans English name- Bamboo No. of trees - 1</p>

34	Bougainvillea	 <p> Family- Nyctaginaceae Hindi name- Bougainville English name-Bougainville No. of trees - 1 </p>
35	Ananas comosus	 <p> Family- Bromeliaceae Hindi name- Ananas English name-Pineapple No. of trees - 1 </p>

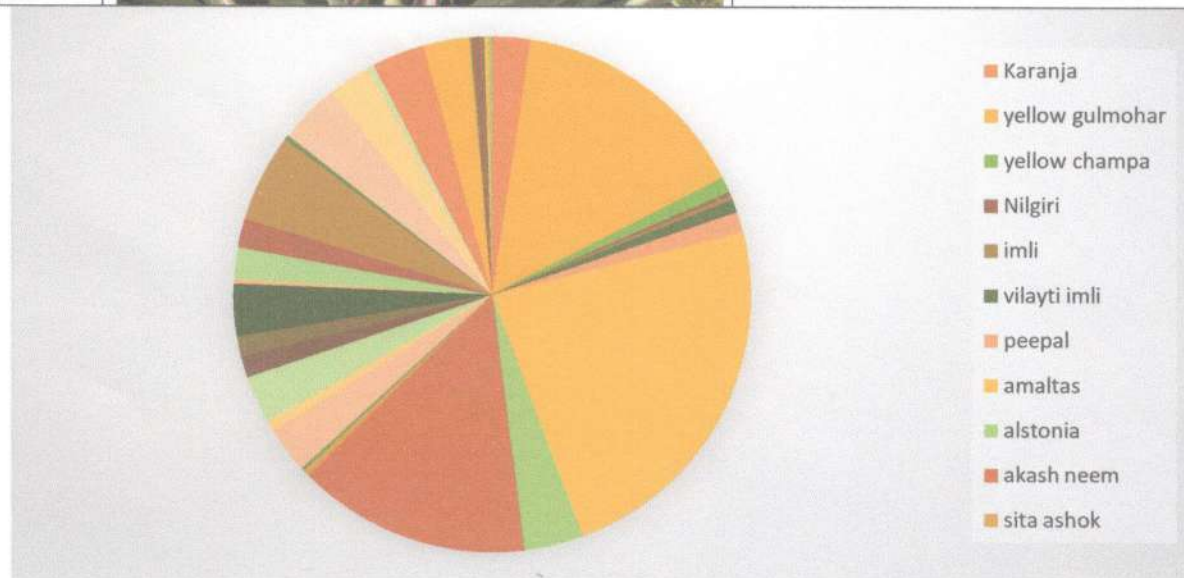


FIGURE 2 : TREES DISTRIBUTION IN CAMPUS



FIGURE 3 : GEO TAGGING OF THE MANGO TREE

3.6 Recommendations-

- Every student of the college should be assigned a tree to take care.
- Plantation program should be organised for awareness among others.

CHAPTER :4

FAUNA DIVERSITY

Biodiversity is the part of the campus. A rich biodiversity not only provides the shelter to many species around the college but also take us closer to the nature and for a student it is very important to connect to nature at every level. Campus is home to many different species around the campus. It has a very rich biodiversity. It consists of the following different animals in the campus-

4.1 Class Amphibia

Amphibians are cold blooded animals, their activity seen in rainy seasons and post monsoon. Frogs are seen in rainy season. Common toad can be seen in winter also.

4.1.2 Family Bufonidae

- i. Common Toad (*Duttaphrynus Melanostictus*)

4.1.2 Family Dicroglossidae

- i. Common Bull Frog (*Hoplobatrachus Tigrinus*)
- ii. Common Skittering Frog (*Euphlyctis Cyanophlyctis*)
- iii. Burrowing Frog (*Sphaerotheca Braviceps*)

4.1.3 Family Rhacophoridae

- i. Common tree frog (*Polypedates maculatus*)

4.2 Class Reptilia

A **reptile** is an air-breathing animal that has scales instead of hair or feathers. The name "**reptile**" comes from Latin and means "one who creeps". All living **reptile** species are cold blooded, have scaly skin, and lay cleidoic eggs.

4.2.1 Lizard Family

- i. House wall lizard (*Hemiductylus flaviviridis*)
- ii. Common Bark Gecko (*Hemiductylus leschenaultii*)
- iii. Brahmini (*Lygosoma punctata*)
- iv. Many keeled grass skink (*Eutrophis carinata*)
- v. Goh or Goyra or Monitor lizard (*Varanus bengalensis*)
- vi. Girgit or Garden lizard (*Calotes versicolor*)





4.2.2 Snake Family

- i. Brahminy worm snake (*Ramphotyphlops braminus*)
- ii. Slender worm snake (*Typhlops porrectus*)
- iii. Common sand boa (*Eryx conicus*)
- iv. Common trinket (*Coelognathus helena*)
- v. Indian rat snake (*Ptyas mucosa*)
- vi. Banded racer (*Argyrogena fasciolata*)
- vii. Common kukri (*Oligodon arnensis*)
- viii. Common wolf snake (*Lycodon aulicus*)
- ix. Striped keelback (*Ampiesma stolata*)

- x. Checkered Keelback (*Fowlea piscator*)
- xi. Indian Cobra (*Naja naja*)
- xii. Common krait (*Bungarus cearuleus*)
- xiii. Russell's Viper (*Daboia russellii*)

Occurance: - Different snakes show their activity in different seasons. Brahminy worm, slender worm snake, common sand boa, striped keel back are seen in rainy season. Common trinket, banded racer, common kukri, common wolf snake, common krait, Russell's viper are seen in winter season. Indian rat snake, checkered keel back and Indian cobra are seen throughout the year.

TABLE 2 : PICTURES OF SOME OF THE SNAKES

Brahminy worm snake	
Slender worm snake	
Common trinket	
Indian Cobra	

4.3 Birds

A warm-blooded egg-laying vertebrate animal distinguished by the possession of feathers, wings, a beak, and typically by being able to fly.

TABLE 3 : BIRDS IN THE CAMPUS

Sr. No.	Common name	Scientific name	Status
1	Small Egret	<i>Eagrata garzetta</i>	R
2	Common Egret	<i>Arcka alba</i>	R
3	Pond Heron	<i>Ardeola grayii</i>	R
4	Water Hen	<i>Amaurornis phenicurus</i>	R
5	Pariha Kite	<i>Milvus migrans</i>	R
6	Brahminy Kite	<i>Haliastar Indus</i>	R
7	Shikra	<i>Accpiter badius</i>	R
8	Red wattled lapwing	<i>Vanellus indicus</i>	R
9	Blue Rock Pigeon	<i>Columba livia</i>	R
10	Spotted Dove	<i>Spilopelia chinensis</i>	R
11	Rose ringed Parakeet	<i>Psittacula kramiri</i>	R
12	Koyal	<i>Eudynamis scolopaceus</i>	R
13	Crow Pheasant	<i>Centropus sinensis</i>	R
14	Red Rumped Swallow	<i>Cecropis daurica</i>	RM
15	Common Crow	<i>Corvus corvus</i>	R
16	House Swift	<i>Apus nipalensis</i>	R
17	Alpine Swift	<i>Tachimarptis melba</i>	RM
18	Spotted Owlet	<i>Athene brama</i>	R
19	Green Bee Eater	<i>Meropus orientalis</i>	RM
20	Blue Jay	<i>Cyanocitta cristata</i>	R
21	Common Hoopoe	<i>Upupa epops</i>	RM
22	Crimson Bristled Barbet	<i>Megalaima haemacephala</i>	R
23	Black Drongo	<i>Dicrurus macrocercus</i>	R
24	Common Myna	<i>Acridotheres tristis</i>	R
25	Tree ple	<i>Dendrocitta vagabunda</i>	R
26	Red Vented Bulbul	<i>Pycnonotus cafer</i>	R
27	Common Babler	<i>Turdoides caudate</i>	R
28	Tailor Bird	<i>Orthotomus sutorius</i>	R
29	Ashy Wren Warbler	<i>Prinia socialis</i>	R
30	Magpie Robin	<i>Copsychus saularis</i>	R
31	Indian Robin	<i>Saxicoloides pulicatus</i>	R
32	Grey Wagtail	<i>Motacilla cinerea</i>	M
33	Yellow Wagtail	<i>Motacilla pava</i>	M
34	Purple Sunbird	<i>Cinnyris asiaticus</i>	R
35	House Sparrow	<i>Passer domesticus</i>	R
36	Indian Grey Hornbill	<i>Ocyeros birostris</i>	R
37	White Throated Munia	<i>Euodice malaborica</i>	R
38	Golden Oriole	<i>Oriolus oriolus</i>	RM
39	Peafowl	<i>Pavo cristatus</i>	R



FIGURE 4 : BIRDS IN THE CAMPUS

4.4 Butterflies

Butterflies are nectar-feeding insect with two pairs of large, typically brightly coloured wings that are covered with microscopic scales. Butterflies are distinguished from moths by having clubbed or dilated antennae, holding their wings erect when at rest, and being active by day.

TABLE 4 : BUTTERFLIES IN THE CAMPUS

S.no.	Common name	Vernacular name	Family
1	Plain Tiger	<i>Danaus chrysippus</i>	Nymphalidae
2	Common Crow	<i>Euploea core</i>	Nymphalidae
3	Lemon Pansy	<i>Junonia lemonias</i>	Nymphalidae
4	Glassy Tiger	<i>Parantica aglea</i>	Nymphalidae
5	Common Emigrant	<i>Catopsilia pomona</i>	Pieridae
6	Blue Jay	<i>Graphium doson</i>	Papilionidae
7	Common Rose	<i>Pachliopta aristolochiae</i>	papilionidae
8	Common Fevering	<i>Melanitis leda</i>	Nymphalidae
9	Lime Butterfly	<i>Papilio demoleus</i>	Papilionidae
10	Black Rajah	<i>Charaxes soron</i>	Nymphalidae



FIGURE 5 : BUTTERFLIES IN THE CAMPUS

There is a butterfly garden for the butterflies in the campus



FIGURE 6 : BUTTERFLY GARDEN

The butterfly is undoubtedly the most beautiful insect on earth. We all automatically relate these colourful creatures with flowers & gardens. The concept of the butterfly garden is simple; a particular garden is developed in such a way that it naturally attracts lots of butterflies. All the plants & overall micro-environment of the garden is made butterfly friendly. The idea is not just to attract butterflies, but also the local butterfly species should feel homely & they should be encouraged to make this garden their own habitat. So when you enter a butterfly garden, you immediately notice their presence.

4.5 Recommendations

- The number of butterflies found to have reduced in the city. over the past few years due to increasing urbanization and pollution levels. So, there is a need to inculcate awareness amongst the college students.
- Students can play an important role in assessing the diversity of the campus by taking them as a part of their project study.

Observation: The college campus is one of the best campus in the malwa region for their Biodiversity, during the visit we have found most of birds and butterflies in the campus

CHAPTER :5

GREEN ENERGY UTILISATION

5.1 Introduction

Energy Audit is an effective means of establishment present efficiency levels and identifying Potential areas of improvement in energy consumption.

Energy audit of utility systems largely helps, which are given below:

- Reducing the energy consumption with resultant reduction in electricity bills.
- Audit involves data collection, data verification and detailed analysis of the data.
- The analysis leads to recommendations, which are short term (with minimum investment), medium term (with moderate investment) and long term (with capital expenditure).

The cost benefit analysis of various energy conservation proposals enables managements to take decisions regarding implementation schedules.

Here we are concerned about alternate energy as well as present use of energy.

5.2 Data/Fact -

Percentage of Energy Needs Met by Renewable Energy

TABLE 5 :ENERGY AUDIT DATA OF THE CAMPUS

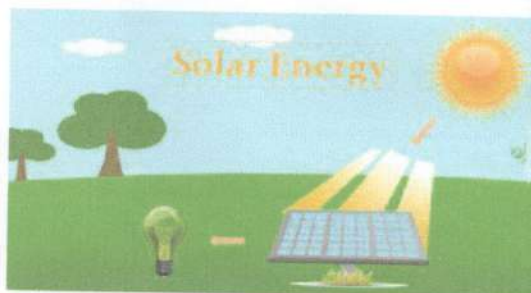
Power requirement met by renewable energy sources	Total power requirement in KW	Renewable energy generated and used	Energy supplied to the grid
6.6 KW		Yes	Yes
Total lighting load	Percentage lighting through LED bulbs	Percentage lighting through Others sources	
67.6 KW	12.3%	87.7%	
Total Fan Load	Percentage Fan load by BLDC Fans	Percentage Fan through Others type of Fans	
74.88 KW	0%	100%	

4.3Recommendation

- Power by renewable energy sources must be added in campus.

- LED lights should be used at all places.
- BLDC Fans should be used instead of conventional ones.

Note – We appreciate use of LED lights at most of the places in the campus.
Solar power generation in the campus on building is done to meet some energy requirement



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BHAWARKUAN, A.B. ROAD, INDORE, MADHYA PRADESH 452001, INDIA

is in accordance with the requirements of the following standard

ISO 14001:2015

(Environmental Management System)

SCOPE

Providing education of Biochemistry, Bioinformatics, Biotechnology Botany, Chemistry, Computer Science, Economics, Electronics, Fisheries, , Forensic Science, Geography, Geology Horticulture, Language, Mathematics, Microbiology, Pharmaceutical Chemistry, Physics, Seed Technology, Statistics & Zoology.

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