Dhyanganga Shikshan Prasarak Mandal's

Shripatrao Chougule Arts and Science College
Malwadi-Kotoli, Maharashtra - 416230

Environment and Energy Audit Report

Prepared by

Department of Environmental Science,

Shivaji University, Kolhapur- 416004

2020-21

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Date: 23 FEB 2021

Certificate

This is to certify that the Department of Environmental Science, Shivaji University, Kolhapur has conducted detailed "**Energy Audit**" of "Shripatrao Chougule Arts and Science College Malwadi-Kotoli, Dist. Kolhapur Maharashtra" during the academic year 2020-2021. The green audit was conducted in accordance with the applicable standards prescribed by Central Pollution Control Board, New Delhi and Ministry of Environment, Forest and Climate Change, New Delhi. The audit involves water, wastewater, energy, air, green inventory, solid waste etc and gives an 'Environmental Management Plan', which the institute can follow to minimize impact on the intitutional working framework. The performance of Institute was found to have good quality with respect to sustainable Green Practices. In an opinion and to the best of our information and according to the information given to us, said green audit gives a true and fair view in conformity with environmental auditing principles accepted in India.

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Est : 15-8-1995, Reg. No. F- 10983
Dnyanganga Shikshan Prasarak Mandal, Malwadi Sanchalit
SHRIPATRAO CHOUGULE ARTS AND SCIENCE COLLEGE
Malwadi- Kotoli, Tal. Panhala, Dist. Kolhapur. (Maharashtra)
(Senior, Junior - Arts & Science) Jr. College Index No. J 23.10.012
• Accredited by NAAC, Bangalore with CGPA of 2.73 on four point scale at B+ grade
• Permanently affiliated to Shivaji University, Kolhapur.
• B.VOC - Aporoved by UGC
• M.A. Regular Mode
• M. Sc (Mathematics) - Distance Mode
(02328) 299899 Web Site : www.sccmk.ac.in E-mail ID : shripatraochougulecmk@yahoo.in
Founder President : Hon'ble Dr. K. S. Chougule. M.A. & D.Litt. (International Honours)
Ex. Member of the Senate, Shivaji University, Kolhapur.
Ex. Sabhapati, Construction & Health Committee Z. P. Kolhapur.

Ref. No.: 0516-1) 2020-2021 Date : 15/01/2021

Principal's Address

Shripatrao Chougule Arts and Science College Malwadi-Kotoli is situated rural, hilly area. Institute is providing Higher Education at degree level with B.A., B.Sc and Post graduation in Marathi, Hindi, English, Economics and Psychology. Institute has also started seven B.Voc Courses.

Our environment is constantly changing. However, as our environment changes, so does the need to become increasingly aware of the problems that surround it. There are many environmental issues in India. Environmental issues are of the primary causes of disease, health issues and long term livelihood impact for India.

A green campus is a place where environmental friendly practices and education combain to promote sustainable and eco-friendly parches in the campus. The green campus concept offers and institution the opportunity to take the lead in redefining its environmental culture through instilling environmental ethics among student and staff. The Institute also promotes clean and Green campus through adopting practicing and promoting environmental friendly practices among students and staff to generate Eco-consciousness among them and in the area around them. Institute protects its own environment with its green campus initiatives and maintains a pollution free green and clean campus. Environment development is its basic work with the educational politics implemented on the campus.

I/C. Principal
Shripatrao Chougule Arts and Science College, Malwadi - Kotoli

Scanned with CamScanner

COORDINATOR'S ADDRESS

Rapid industrialisation and urbanisation has given rise to several environmental issues which may lead to ecological crisis. On this background it becomes essential to adopt the system of the Green Campus for the institutes which will lead for sustainable development and at the same time reduce a sizable amount of atmosphere Co2 from the environment. Green Audit is connected to sustainable development process. It is an effective way to solve the environmental problems. Green Audit is the process of assessing the environment impact of an organisation, process etc. The process of green audit is based on operational activities within an institution happens not necessarily based on laws. It is largely based on awareness and concerns on environmental performances within and outside the institute's premises. Our institute has already conducted green audit in the recent past, it has realised the importance of the same as they could easily manage their operational costs and provide good atmosphere to their stakeholders. The green audit also provides opportunities to identify full range of operations within an organisation, the impacts of maintaining and functioning of its operational goods and services, the actual source of raw materials for different activities within the organisation. There are so many advantageous of green audit. First of all it helps to protect the environment and solve environmental problems. It suggests correct measures for future complications etc. For our bright future, saving time, many and befitting the environment green audit and energy audit is very necessary.

Dr.B.N.Ravan

(IQAC Coordinator)

Shripatrao Chougule

Arts and Science College,

Malwadi-Kotoli

INDEX

Chapter - I
Introduction

1.1 Green Audit, a Tool for Environmental Protection:

The modernization and industrialization are the two important outputs of twentieth century which have made human life more luxurious and comfortable. On the other hand, they are responsible for voracious use of natural resources, exploitation of forests and wildlife, producing massive solid waste, polluting the scarce and sacred water resources and finally making our mother Earth ugly and inhospitable. Today, people are getting more familiar to the global issues like global warming, greenhouse effect, ozone depletion and climate change and so on. Now, it is considered that this is the final call by mother Earth. The time has come to wake up, unite and combat together for sustainable environment.

Green Audit is the most efficient ecological tool to solve such environmental problems. Such audit was invented in late 1970s with the motive for inspecting the work conducted within the organization. It is systematic identification, quantification, recording, reporting and analysis of components of ecological diversity and expressing the same in financial or social terms. Through green audit one gets a direction as how to improve the condition of environment.

1.2 Benefits of Green Audit:

There are many advantages of green audit if is implemented properly:

- It would help to protect the environment in and around the campus.
- Recognize the cost saving methods through waste minimization and energy conservation.
- Find out the prevailing and forthcoming complications.
- Empower the organization to frame a better environmental performance.
- It portrays good image of institution through its clean and green campus.

  Finally, it will help to build positive impression for the upcoming NAAC visit.

1.3 NAAC Criteria VII Environmental Consciousness:

Green Audit is assigned to Eco-club. The criterion VII of NAAC. National Assessment and Accreditation Council which is a self-governing organization that declares the institutions as Grade A, Grade B or Grade C according to the scores assigned at the time

of accreditation of the institution. The intention of green audit is to upgrade the environmental condition in and around the institution. It is performed by considering some environmental parameters like water and wastewater management, energy conservation, waste management, air monitoring, etc. for making the institution eco-friendlier.

Students are the major strength of any academic institution. Practicing green actions in any educational institution will inculcate the good habit of caring nature in students. Many environmental activities like plantation and nurturing saplings and trees, cleanliness drives, bird watching camp, no vehicle day, rain water harvesting visits to ecologically important places through Eco clubs will make the student a good citizen of country.

Chapter II

Methodology

The college has conducted Green Audit in the year 2020-21, on a yearly basis. The audit was carried out in three phases.

2.1 Questionnaire survey:

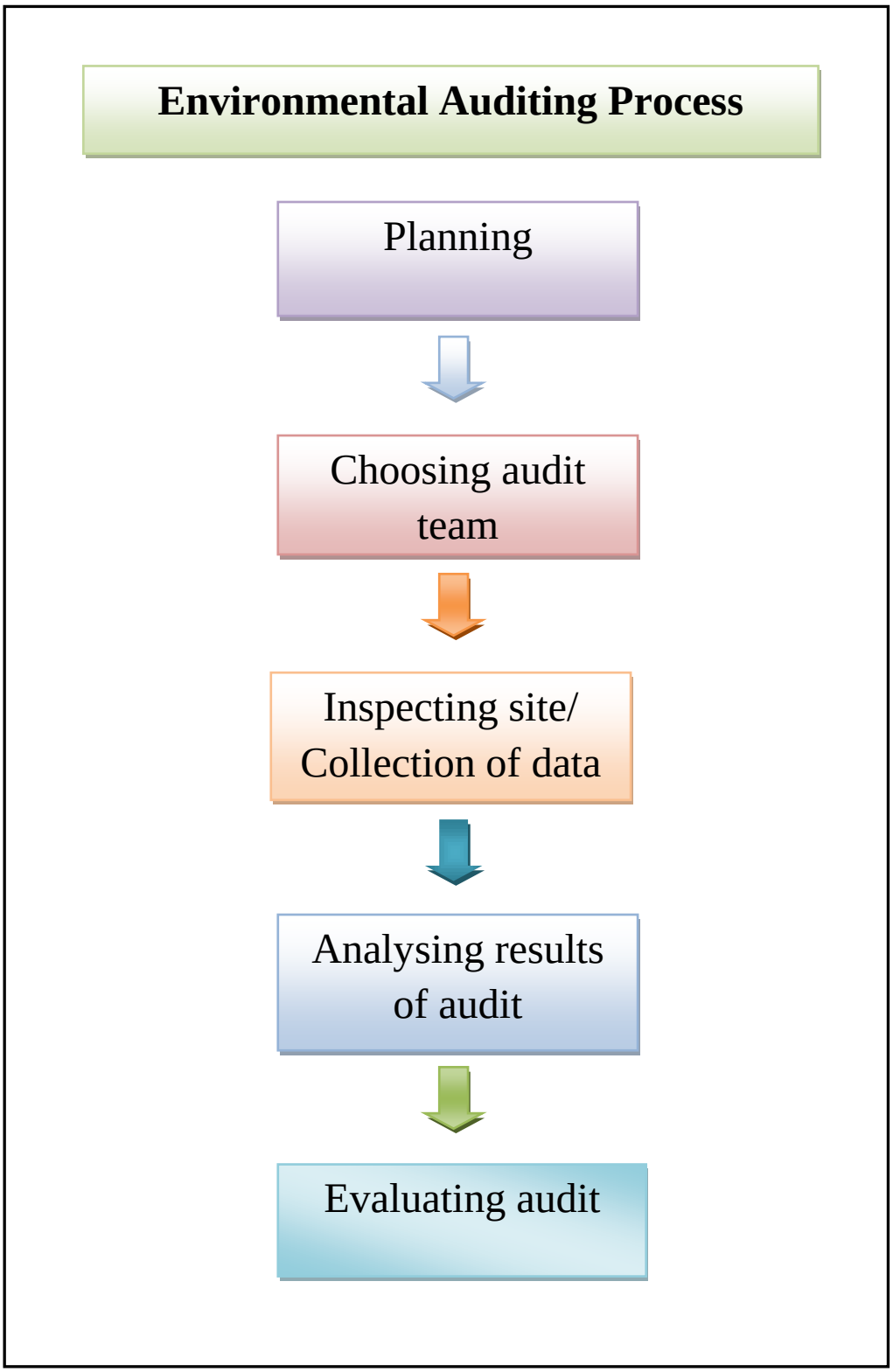
It includes administrative issues associated with the planning of audit, selecting the personnel for the audit team, preparing the audit protocol used by organization, obtaining background information, etc. The scope of the audit was defined at this step. It was decided that the information related to Water and Wastewater management, Energy conservation, Green belt, Carbon inventory, Solid waste management, Hazardous waste management, Air and noise quality status, activities of nature club, etc. should be gathered for the audit purpose. For collecting data related to these different areas, specific questionnaires were prepared.

2. 2 Onsite visit and observations:

The data related to above mentioned areas was collected by visiting each and every facility of college campus. The questionnaires were filled up according to the present situation. Photographic documentation was also done with the help of sophisticated camera.

2.3 Data analysis:

After collection of secondary data, the reviews related to each environmental factor were taken by the green audit team. The data was tabulated, analyzed and graphs were prepared using computer. Depending upon the observations and data collected, interpretations were made. The lacunas and good practices were documented. The Environmental Management Plan (EMP) was prepared for the next academic year in order to have better environmental sensitization. Finally, all the information was compiled in the form of Green Audit Report. The whole data reflects the effect of COVID pandemic situation on the college premises. Students were present through online mode for academic purpose. So the administrative staff, teaching and Non-teaching faculty was using the available resources on the campus which is observed during the audit visit.

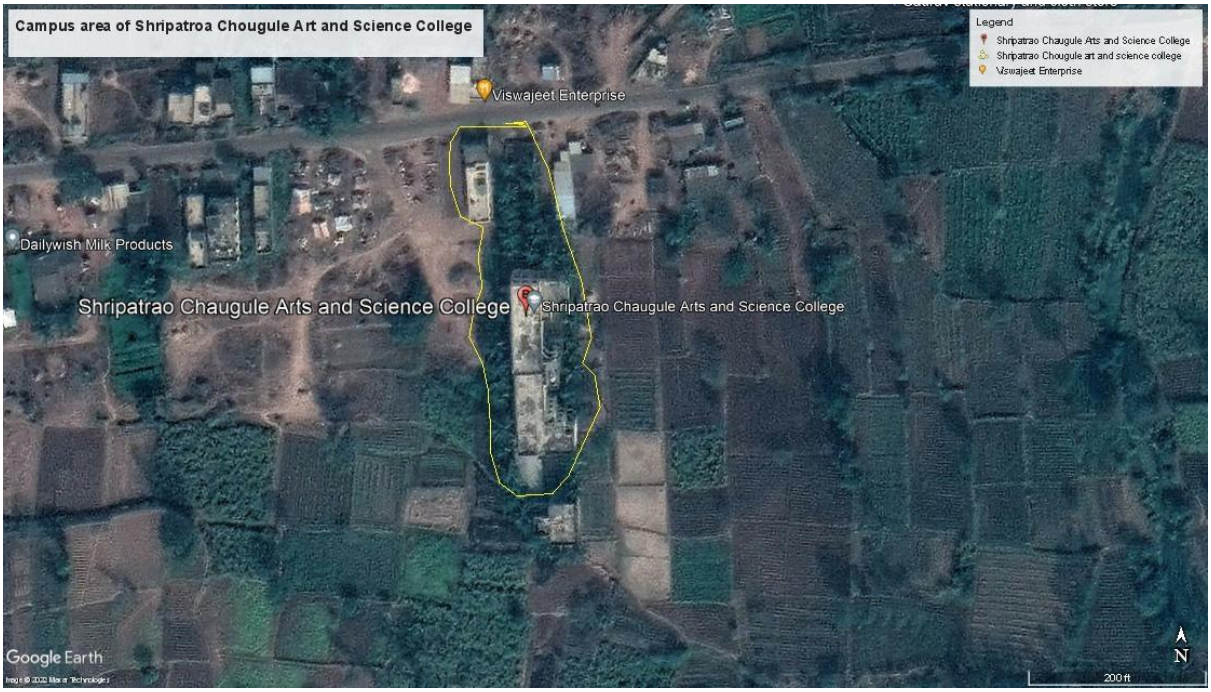

Environmental Auditing Process
Planning
Choosing audit team
Inspecting site/ Collection of data
Analysing results of audit
Evaluating audit

Chapter III

Overview of Green Audit

3.1 Shripatrao Chougule Arts and Science College Malwadi-Kotoli,at a glance

Shripatrao Chougule Arts and Science College Malwadi-Kotoli, Dist. Kolhapur Maharashtra is situated at The college is located at longitude 74^0 02'.76" E and latitude 16°46'.20" N. The Institute's campus is approximately 2054 m^2 in size.



Source: Google Earth

Satellite image of Shripatrao Chougule Arts and Science College Malwadi-Kotoli

COLLEGE PROFILE IN BRIEF

NAME OF THE COLLEGE:	Shripatrao Chougule Arts and Science College Malwadi-Kotoli
ESTABLISHMENT:	1998
PIONEERS:	Dr.Kerba Shripati Chougule
No. OF STUDENTS:	913
FACULTY:	61
STENGTH OF CAMPUS	College received first Prize in the Merit Scholarship among Rural area colleges of Shivaji University, Kolhapur. Presently there is a provision of nine degree level subjects in Humanities and seven subjects in Science Faculty
FACILITIES:	Library,Gymkhana,Ground,Canteen,Frist-Aid-Center, Parking, Xerox, Ladies Room, Vending Machine, Extinguisher, Water Purifier, Exhaust fan, Wi-Fi, Biometric, CCTV.
RESEARCH AND EXTENSION ACTIVITY:	Mangrove conservation, Social and Economical surveys, Yoga and Mediation centre
AREA OF COLLEGE:	2502.36 sq.m

3.2 Water and Wastewater Audit:

Water which is precious natural national resource available with fixed quantum. The availability of water is decreasing due to increasing population of nation, as per capita availability of utilizable water is going down. Due to ever rising standard of living of people, industrialization, urbanization, demand of fresh water is increasing day by day. The unabated discharge of industrial effluent in the available water bodies is reducing the quality of these ample sources of water continuously. Hence, the National Mission on Water Conservation was declared by the then Prime Minister Hon. Dr. Manmohan Singh in 2003 and appealed to all citizens to collectively address the problem of water shortage, by conserving every drop of water and suggested for conducting water audit for all sectors of water use.

Water audit can be defined as a qualitative and quantitative analysis of water consumption to identify means of reducing, reusing and recycling of water. Water Audit is nothing but an effective measure for minimizing losses, optimizing various uses and thus enabling considerable conservation of water in irrigation sector, domestic, power and industrial as well. A water audit is a technique or method which makes possible to identify ways of conserving water by determining any inefficiencies in the system of water distribution. The measurement of water losses due to different uses in the system or any utility is essential to implement water conservation measures in such an establishment.

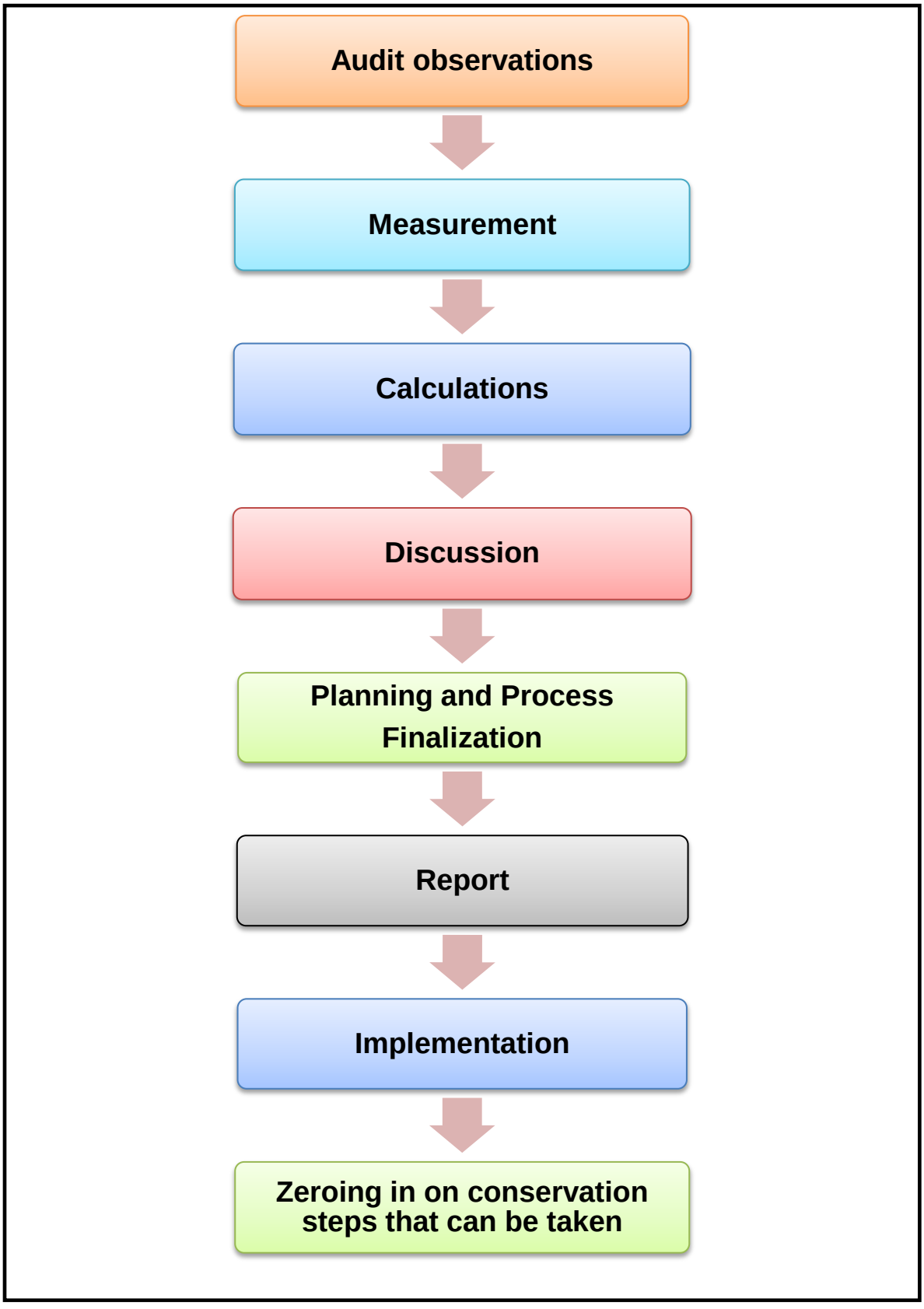
Importance of Water Audit:

It is observed that a number of factors like climate, culture, food habits, work and working conditions, level and type of development, and physiology determine the requirement of water. The community which has a population between 20,000 to 100,000 requires 100 to 150 liters per person (capita) per day. As per the standards provided by WHO Regional office for South East Asia Schools require 2 liters per student for drinking; 10-15 liters per student if water-flushed toilets, Administration requires (Staff accommodation not included) 50 liters per person per day, Staff accommodation requires 30 liters per person per day and for sanitation purposes it depends on technology.

3.2.1 Water Audit:

Water usage can be defined as water used for all activities which are carried out on campus from different water sources. This includes usage in all residential halls, academic buildings, on campus and on grounds. Wastewater is referred as the water which is transported off the campus. The wastewater includes sewerage, residence, hall waters used in cooking, showering, clothes washing as well as wastewater from chemical and biological laboratories which ultimately going down in sink or drainage system

Water Audit Process



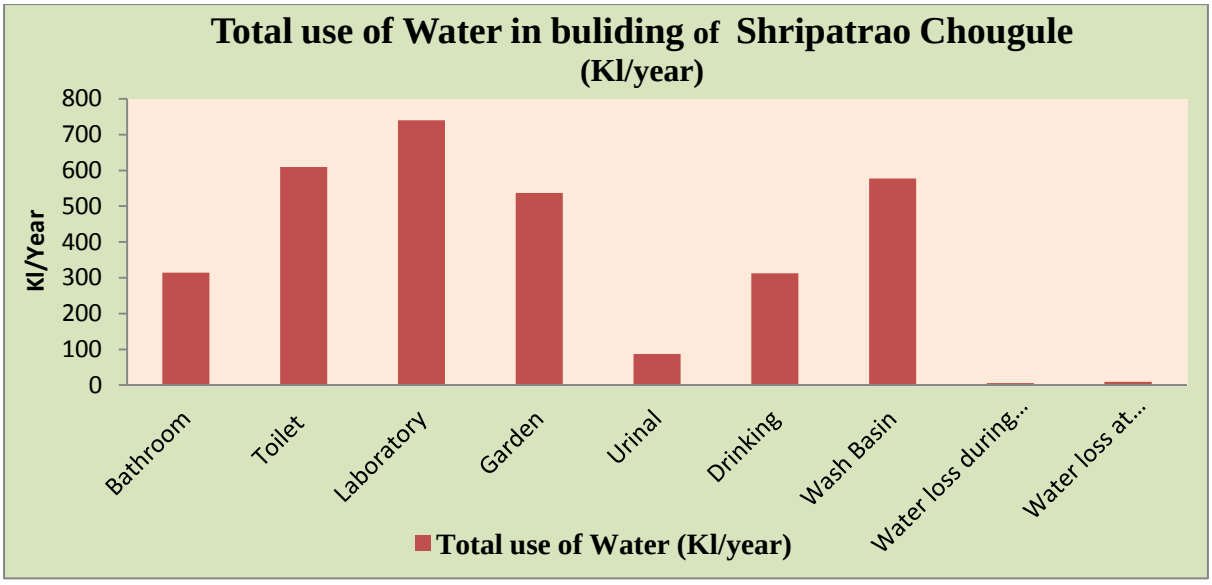
3.2.2 Water consumption in college:

From the data collected for water audit of Shripatrao Chougule Arts and Science College, Malwadi-Kotoli the water distribution and water consumption pattern is noticed. For the water audit purpose, the college building is divided in to the different sectors including Main office, Principal cabin, Laboratories with all Departments such as Arts and Science. Along with Library, Gymkhana, Canteen, Garden and Support services

3.2.2. a The water consumption at Shripatrao Chougule Arts and Science College, Malwadi-Kotoli:

Table No. 3.2.1: Sector wise calculated use of water in Shripatrao Chougule Arts and Science College, Building.

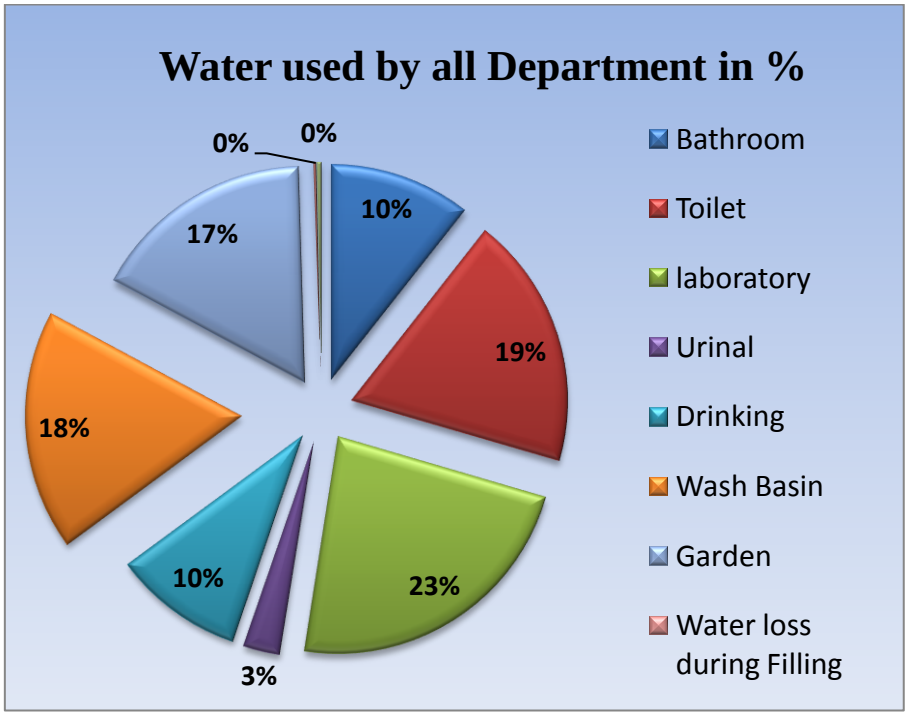
Sr. No.	Sector	Total daily use (Kl/day)	Total yearly use (Kl/year)	Percentage %
1	Bathroom	2.73	341.25	10.59
2	Toilet	4.875	609.38	18.92
3	Laboratory	5.9	740.62	22.99
4	Garden	4.3	537.5	16.69
5	Urinal	0.7	87.5	2.72
6	Wash Basin	4.62	577.5	17.93
7	Drinking	2.5	312.5	9.70
8	Water loss during Filling	0.048	6	0.19
9	Water loss at Discharge	0.072	9	0.28
		25.77	3221.25	100



Graph No. 3.2.1 Total water consumption yearly by Shripatrao Chougule Building

It is revealed from the data given in Table No. 3.1 and Graph No. 3.2.1 that total 25.77 Kiloliter daily and yearly 3221.25 Kiloliter water is used. In the College building having Main office, Principal cabin, Laboratories with all Departments such as Arts and Science. Along with Library, Gymkhana, Canteen, Garden and Support services where use of water is seen for bathrooms, toilet, drinking, wash basin, Garden and urinal purpose for daily and also calculated yearly. From above data, it is observed that the maximum water consumption was for Laboratory which is 5.9 Kilolitre/day i.e. 740.62 Kilolitre/year. Water loss during filling of water in tank was noted as 0.048 Kilolitre/day i.e. 09 Kilolitre/year and water losses at discharge were found to be 0.072 Kilolitre/day i.e. 06 Kilolitre/year.

3.2.2. Average daily water consumption by Shripatrao Chougule Arts and Science College, Malwadi-Kotoli.



Graph No. 3.2.2 Average Daily Water consumption by Shripatrao Chougule Arts and Science College, Malwadi-Kotoli.

Graph No. 3.2.2 shows the total percent of water consumed by Shripatrao Chougule Arts and Science College, Malwadi-Kotoli in the 2020-21. As per the graph Laboratory is the major source of utilization of water comprising 23 % while other sources like toilets, wash basins, Garden and bathrooms comprising 19%, 18 %, 10%, and 17 % respectively. The other use namely drinking and Urinal purpose consume relatively less water with daily water requirement of 10 % and 3% respectively in the year 2020-21.

3.2.3 Sustainable Water Practices (SWP):

3.2.3.a. Rain water harvesting for Ground water recharging:

In Shripatrao Chougule Arts and Science, Malwadi-Kotoli College rain water collection pipes transfer underground for water harvesting.. This is one of the most important rainwater harvesting method run by Shripatrao Chougule Arts and Science College, Malwadi-Kotoli College.

3.2.3.b **Soak Pit**

Shripatrao Chougule Arts and Science College, Malwadi-Kotoli has constructed soak pit near laboratory as after practical huge amount of water containing different types of chemicals goes in to municipal drainage line. Soak pit helps to remove solids and helps in filtration. These smaller particles are digested by the microorganisms which are a sustainable process of degradation. The filtered water is then discharged out through the porous wall of the soak pit.

3.2.3. c Water coolant:

Shripatrao Chougule Arts and Science College, Malwadi-Kotoli has water cooler facility which helps to get pure and cool water for drinking to all members of college. It will help to minimize the water born disease occurrence in college.

Key Observations:

- The calculation revealed that highest water use sector is Laboratory which consumes average 23% water and remaining 77% water consumption further divided into other sectors in such Toilet, Urinals, Washbasins and Garden etc.
- College has sustainable water practices such ground water recharging, Soak pit and facility of drinking water etc.
- To enhance the operating efficiency and reduce the water wastage, College should include more sustainable water practices (SWP) such as Rain Water Harvesting project for whole college, Wastewater treatment plant, Composting activity, drop or sprinkling irrigation for garden to minimize water use and Water sub metering.

3.3 Solid waste audit of the college:

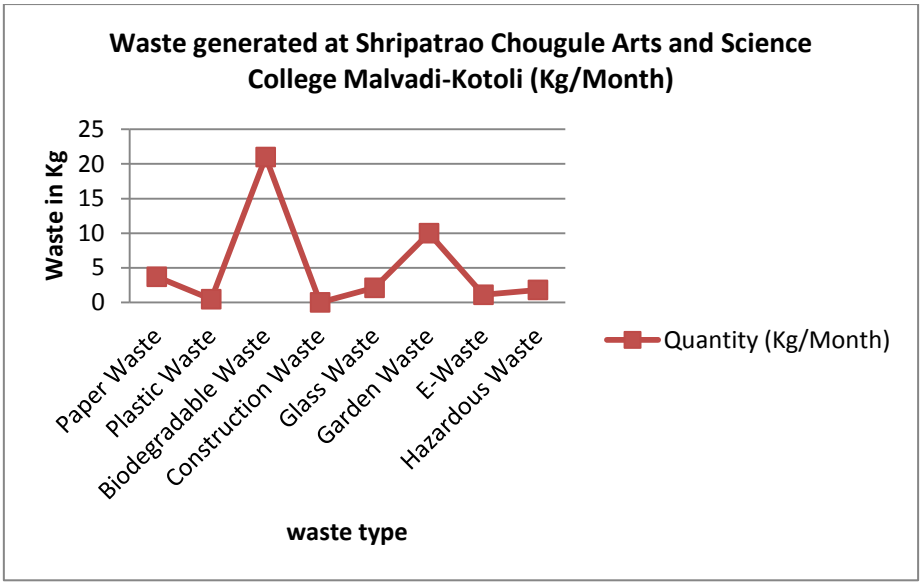
Solid waste management is a term that refers to the process of collecting and treating solid wastes. As long as people have been living in settlements, garbage and solid waste has been an issue. In recent years, it is observed that per capita waste generation has increased due to the changing life style. Improper disposal of solid waste is responsible for pollution of air, water and soil. Disposal of solid waste on open area leads to develop bad odour in the surrounding also it may develop unhygienic conditions. Improper waste disposal is root cause for spreading the infectious diseases among the human and animal. So, it is important to take some steps for the proper management of solid waste followed by reduce, reuse and recycle 3R principle. The intention of this inventory is to find out the quantity of waste generation and disposal methods which are currently followed at Shripatrao Chougule Arts and Science College Malvadi-Kotoli, Maharashtra.

Solid waste audit of Shripatrao Chougule Arts and Science College, Malvadi-Kotoli was conducted by grouping the college into administrative office, science section, arts section, IT/ computer section, Gymkhana, common facility centre, canteen and garden premises of college. Different types of waste are generated in the college campus. Dustbins are fixed in the college, which is used for collection of waste.

3.3.1 Generation of solid waste in college:

Table No. 3.3.1: Category wise solid waste generation in college (kg/month)

Department	Paper Waste	Plastic Waste	Biodegradable Waste	Construction Waste	Glass Waste	Garden Waste	E-Waste	Hazardous Waste	Other waste
Quantity (Kg/Month)	3.7	0.46	21	0	2.1	10	1.1	1.8	3.9
Quantity (Kg/ Year)	14.8	1.84	85	0	8.4	40	4.4	7.2	15.6



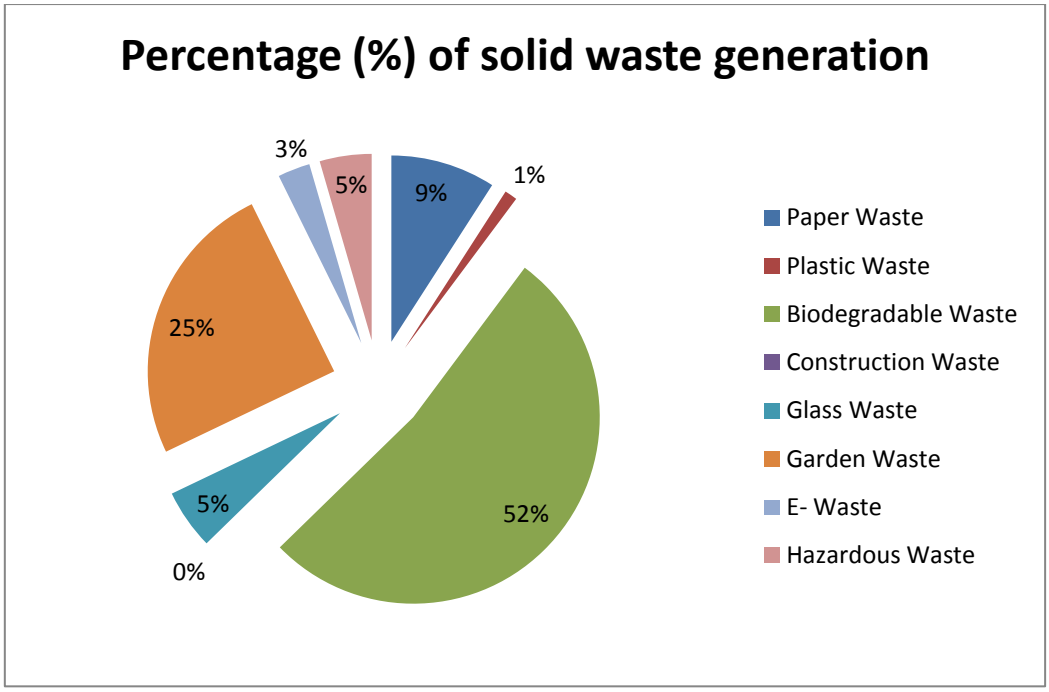
Graph No. 3.3.1: Category wise solid waste generation in college (kg/month)

The average amount of solid waste generated per month in College is approximately 40.36 kg/month. On the basis of observations the highest quantity of solid waste generated is biodegradable waste which is about 21 kg/month. The leaf litter produced in the garden and premises is 10 kg/month.

The glass waste is produced in minimum quantity i.e. 2.1 kg/month which is generally in the form of broken glassware, cups and glasses used in laboratories. Besides, the above-mentioned waste, plastic waste is generated in the form of plastic wrappers of food items is approximately 0.46 kg/month. Paper waste is generated in the institution about 3.7 kg/month and that is given to the local vendor.

Table No. 3.3.2: Percentage of category wise solid waste in the college (kg/month)

Category	Paper Waste	Plastic Waste	Biodegradable Waste	Construction Waste	Glass Waste	Garden Waste	E-Waste	Hazardous Waste	Other Waste	Total Solid Waste in %
Percentage (%)	9.1	1.1	52.5	0	5.2	24.8	2.8	4.5	3.9	100



Graph No. 3.3.4: Percentage of solid waste generation in the college (kg/month)

Percentage wise distribution of different sources of solid waste is shown in the above graph. The maximum percentage of solid waste generated is of biodegradable waste which is approximately 52 % and minimum percentage of plastic waste generated is about 1 %. There is no any construction activity in college premises so there is no generation of construction waste. Paper waste generation is about 9 %.

3.3.3 Status of solid waste generation in various departments and campus (kg /month):

For solid waste audit, the college campus and buildings are grouped into 8 different areas and the data was collected using questionnaire, actual site visit and discussion with the concern faculty members.

Table No. 3.3.3: Category wise solid waste generation in the college (kg/month)

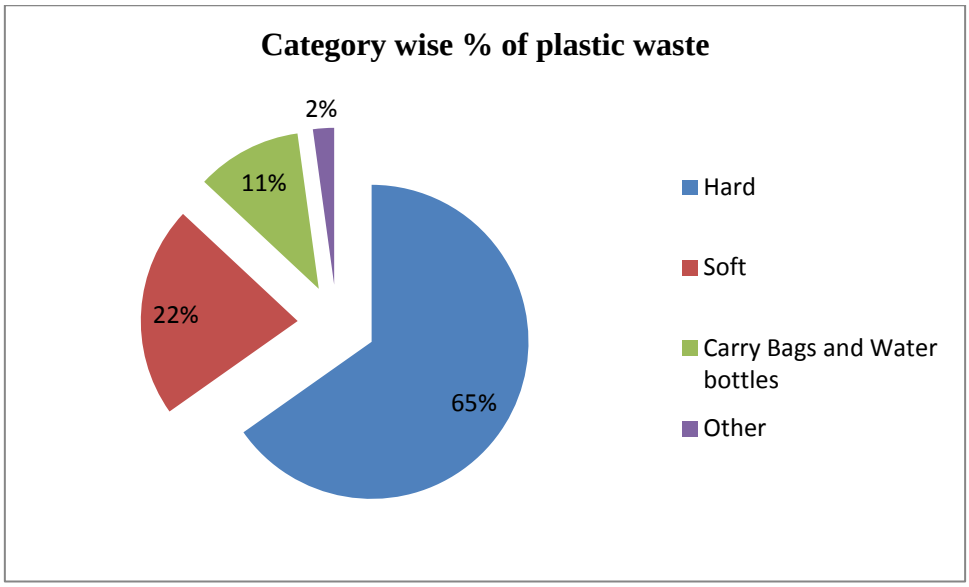
Building and categories of waste	Paper waste	Plastic waste	Biodegradable waste	Construction waste	Glass Waste	Garden Waste	E-waste	Hazardous waste	Other waste
Administrative office	0	0.06	1	0	0.2	0	0.5	0	0.6
Science section	1.2	0.06	1	0	1.4	0	0.1	1.8	1
Arts section	0	0.06	0	0	0.1	0	0	0	0.6
IT/Computer section	0	0.06	0	0	0.1	0	0	0	0.2
Common facility centre	2	0.07	0	0	0.1	0	0.5	0	0.3
Gymkhana	0	0	1	0	0	0	0	0	0
Canteen	0.5	0.07	14	0	0.1	0	0	0	0
Garden and college premises	0	0.08	4	0	0.1	0	0	0	1.2
Total solid waste generated (Kg/Month)	**3.7**	**0.46**	**21**	**0**	**2.1**	**10**	**1.1**	**1.8**	**3.9**
Total solid waste generated (Kg/Year)	**14.8**	**1.84**	**85**	**0**	**8.4**	**40**	**4.4**	**7.2**	**15.6**

3.4.1 Plastic Waste:

Table No. 3.3.4: Plastic waste generation and its distribution in the college

Category	Plastic Kg/month				Total
	Hard	Soft	Carry Bags and Water bottles	Other	
Quantity	0.3	0.1	0.05	0.01	0.46
Percentage	65.2	21.7	10.9	2.2	100

Plastic waste in the form of packaged food wrappers, old broken chairs, old broken water tanks, etc and plastic water bottles is approximately 0.46 kg/ month. Plastic wastes are difficult to dispose because it is non-biodegradable waste or it takes many years to degrade naturally. It can cause adverse impacts on environment.



Graph No. 3.3.3 Categorization of plastic waste at (kg/month)

Graph No. 3.3.3 shows that the hard plastic in the form of broken chairs, tables produces higher amount of hard plastic that is 65%. The soft plastic accounts 22 % of plastic while the carry bags, water bottles and packaged food items in canteens are present about 11 %.

3.4.2 Hazardous waste audit of the college:

Hazardous waste is waste that has substantial or potential threats to public health or environment. The sources of hazardous waste in the college are very less. The amount of hazardous waste generated in the college is 1.8 kg/month. The major source of hazardous

waste in campus is laboratories from science section. Very less quantity of hazardous waste and effluent are generated through chemical laboratories during the use of acids and various chemicals, fumes in the practical's.

3.4.3 E-waste generation in the college:

Generation of e-waste is found in every educational institute. All discarded electronic appliances are called as E-waste. E-waste requires special treatment for disposal so it is also called as special waste. It is observed that the e-waste generated at College, Kotoli is of Schedule II category. Computers, printers, scanners, internet routers, CPU's, UPS, fused bulbs and tubes are used for administrative and laboratory work. The wire required for the connectivity also gets included in the E-waste. The college has its own computer laboratory. Besides this computer lab, each department and administration use computers for their routine work.

3.4.5 Construction waste:

Construction waste is generated from construction of new buildings and demolition activities consisting of concrete, tiles, bricks, drywall, asphalt, plastics, metals, wood, rock and more. These construction waste materials are often inert and non-biodegradable, heavy, bulky and responsible for overload landfills. There is no any generation of construction waste in this academic year as there is no any construction activity done.

Key Observations:

- The average waste generated in the college is app. 40.16 kg /month
- Highest quantity of solid waste is biodegradable waste around 21 kg/month.
- Plastic waste is generated 0.46 kg/month in the college campus.
- Paper waste generated at college premises, handed over to the local vendor.

3.5.1. Shripatrao Chougule Arts and Science College Malvadi-Kotoli

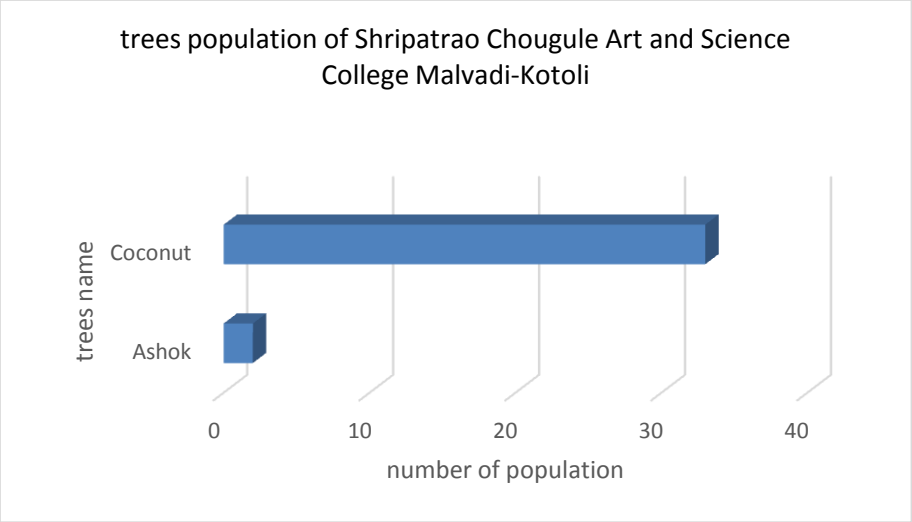
Shripatrao Chougule Arts and Science College Malvadi-Kotoli campus is in Maharashtra's Kolhapur district. The college is located at longitude 74^0 02'.76" E and latitude 16°46'.20" N. The Institute's campus is approximately 2054 m^2 in size. A total of 53 trees were counted, each having a girth of more than 10cm and a height of more than 4 ft. Based on data supplied by the Institution, a total of 19 species of woody trees were recognised during the visit. The campus has a higher concentration of native woody tree species, which is good for biodiversity. During the inventory, the most Cocus nucifera was discovered on campus. The college has planted trees that have a better capability for carbon sequestration. The Institute took the initiative to plant native plants, which is the best way to protect the area's biodiversity.

1. Species with highest population:

Table No 2.1 Species with Highest population at Shripatrao Chougule Art and Science College Malvadi-Kotoli

Sr. No.	Botanical Name	Common Name	Number
1	*Cocus nucifera L.*	Coconut	33
2	*Polyalthia Longifolia*	Ashok	2

During the inventory, Cocus nucifera was discovered to have the greatest population on campus.



Graph No 2.1 Highest population trees, Shripatrao Chougule Arts and Science College Malvadi-Kotoli

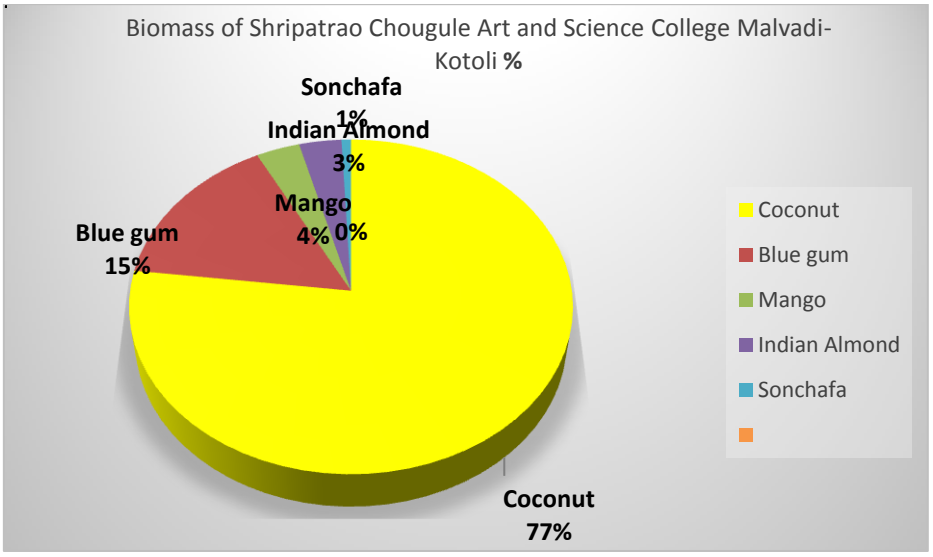
2. Total biomass:

Biomass in ecology refers to the amount of ecology in a certain place or ecosystem at a given time. The mass of one or more species is referred to as species biomass, whereas the mass of all species in a community is referred to as community biomass. Animals, plants, and microorganisms can all be included. The mass can be expressed as the community's overall mass or as the average mass per unit area. A single tree's biomass consists of its branches, stem, fruits, roots, and flowers. On the Shripatrao Chougule Art and Science College Malvadi-Kotoli College campus, 3.6 tonnes of total biomass of woody vegetation were reported during the current tree census.

Table No 3.1 Total Biomass of trees in tonnes on the campus, Shripatrao Chougule Art and Science College Malvadi-Kotoli

Sr.No.	Botanical Name	Common Name	Total Biomass (Tons)
1	Cocus nucifera L.	Coconut	2.6573
2	Eucalyptus globulus Labill	Blue gum	0.5324
3	Mangifera Indica	Mango	0.1206
4	Terminalia catappa	Indian Almond	0.1169
5	Magnolia champaca	Sonchafa	0.0262

Cocus nucifera recorded highest biomass on the campus. Followed Eucalyptus globulus Labill and Mangifera Indica are rank at second and third places.



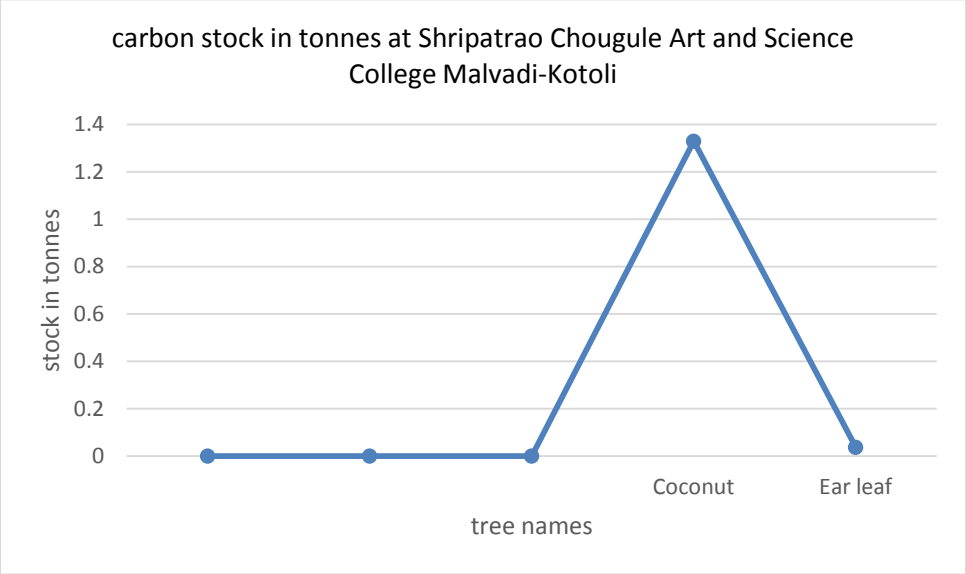
Graph No 3.1 Highest Total Biomass in tonnes Shripatrao Chougule Art and Science College Malvadi-Kotoli

3. Carbon stock:

Forests and trees act as natural carbon sinks, but the carbon is released when the trees are cut down and the area is deforested. Depending on the plant cover, the amount of carbon stored in a particular area of land varies. The carbon stock is the amount of carbon stored in a tree throughout the photosynthetic process. The total carbon stock of the campus is 1.821 tonnes.

Table No 4.1 Carbon stock of Trees in tones on the Campus, Shripatrao Chougule Art and Science College Malvadi-Kotoli

Sr.No.	Botanical Name	Common Name	Carbon stock (Tones)
1	Cocus nucifera L.	Coconut	1.3286
2	Acacia auriculiformis	Ear leaf	0.0369
3	Eucalyptus globulus Labill	Blue gum	0.2662
4	*Mangifera Indica*	Mango	0.0603
5	Terminalia catappa	Indian Almond	0.0585



Graph No. 4.1 Highest carbon stock in tonnes, Shripatrao Chougule Art and Science College Malvadi-Kotoli

The highest carbon stock is recorded in Cocus nucifera followed by Eucalyptus globulus Labill and Mangifera Indica respectively on the institute campus.

4. **Carbon Sequestration:**

Carbon sequestration is the long-term storing of carbon dioxide or other forms of carbon with the purpose of preventing or delaying dangerous climate change. It has been proposed as a method for limiting the build-up of greenhouse gases in the atmosphere and seas caused by the combustion of fossil fuels. The plant carbon pool can store 560 petagrams (Pg: petagram=billion tonne) of carbon globally. By enumerating every tree species in Shripatrao Chougule Art and Science College Malvadi-Kotoli College, Kolhapur, the current study aims to assess the existing carbon stock stored in the form of woody vegetation. A total of 0.310 tonnes of CO_2 has been captured and stored by the woody plants on the college campus. Every year, a single tree emits around 0.0218 tonnes of CO_2.

Table No. 5. 1 Carbon Sequestrate of Trees in tones on the Campus, Shripatrao Chougule Art and Science College Malvadi-Kotoli

Botanical Name	Common Name	Carbon Sequestration (Tones)
Cocus nucifera L.	Coconut	4.8761
Eucalyptus globulus Labill	Blue gum	0.9769
Mangifera Indica	Mango	0.2213
Terminalia catappa	Indian Almond	0.2146
Acacia auriculiformis	Ear leaf	0.1356
Terminalia catappa	*Wild Badam*	16.9140

Graph No 5.1 Highest carbon sequestrate in tons, Shripatrao Chougule Art and Science College Malvadi-Kotoli

Cocus nucifera is the highest tree species in the campus to sequestrate carbon over 0.230 tons per year. Eucalyptus globulus Labill 24% and 39% respectively which illustrate the second and third highest carbon sequester in the campus.

5. **Oxygen released:**

Until date, the College campus's woody vegetation has released 0.282 tonnes of oxygen. Released oxygen is directly proportional to CO_2 sequestration in the ratio 32/12. As a result, it will only emit oxygen once a year. A single tree is thought to be capable of meeting the oxygen demands of two people for the rest of their lives. As a result, the 53 trees on the college campus support 106 persons on and around the campus.

7. Future carbon sequestration potential of the campus:

Shripatrao Chougule Art and Science College Malvadi-Kotoli College now looks for 200 trees with a girth of less than 10cm and a height of less than 4 ft. This will remove 3.45 tonnes of CO_2 per year from the atmosphere. In the future, the campus's entire carbon potential will be 15.55 tonnes per year. The college has plantedbeautiful indoor plants that will help store more carbon in the future.

1. **Threats to the Green campus**

The institution has done a good job of keeping the campus green. Even if all of the elements that contribute to a healthy environment are in good working condition, the Institute must consider them in order to avoid future ecological harm.

2. **Plant diversity on the campus:**

The campus has a wide variety of plants. According to statistics supplied by the school, the campus area has around 23 distinct plant, herb, and shrub species. There are a total of 15 herb plant species on campus, including Amaranthus spinoso, Datura inoxia, Blumera lacera, Justicia glauca, and Mimosa pudica, among others. Fruit-bearing plant such coconut can be found on campus. These fruit-bearing plants can provide excellent habitat for the campus's native biodiversity.

3. **Scope of Area:**

The institute is spread out across a large area with plenty of vegetation. The endemic plants should be planted more in the campus.

Key Observation:

- Diversity of indoor plants.
- The Institute take good initiative for green cover by fruit bearing plants.
- Fire events near woody vegetation will be threat to vegetation on the campus as well as direct anthropogenic source of CO_2 emission.
- Well maintained vegetation on campus.

3.6 Electricity Audit:

Energy auditing is a tool for identifying energy efficiency potential and measures. Proper management of energy efficient systems can lead to significant cost savings and energy savings as well as increased comfort, lower repair costs, and extended machine life. An effective energy management program begins with a thorough energy audit. Energy audit evaluates the efficiency of all building and process systems that use energy. The auditor of the power starts at the meter used, finding all the energy sources that go into space. The auditor then identifies the streams of energy in each fuel, balances the distribution of energy into different functions, evaluates the efficiency of each of those functions, and identifies energy efficiency and cost-effectiveness.

❖ Audit activities, in general order, include:

- Identify all energy systems
- Check system status
- Analyze the impact of improvements to those systems
- Write up an energy audit report

The report documents the use and occupancy of the building and building systems equipment. The report also recommends ways to improve efficiency through improvements in operation and maintenance items, and through installation of energy conservation measures.

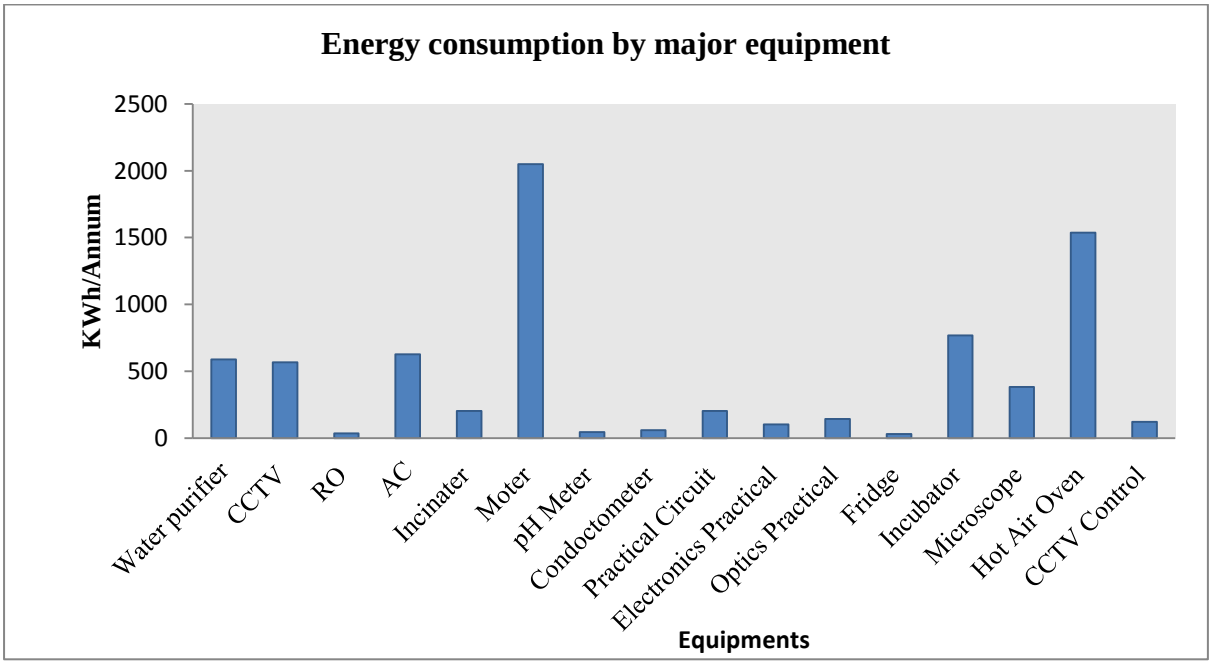
Energy sources utilized by all the departments, support services of Shripatrao Chougule Arts and Science College Malwadi- Kotoli include electricity. Major use of the energy is at computer laboratories, for lighting, instruments. Electricity is supplied to the college campus by Maharashtra State Electricity Board.

3.6.1 Energy consumption:

Electricity is utilized at all departments like Administrative building, Science department, Arts Department, Common facility centre, Gymkhana present several types of Electronic Appliances are used in laboratory and some of them are run every day. The calculations are based on the data provided by the college and actual observations taken at the site. The collected data shows all departments in the college have an energy consumption is 7,472.96 kWh/ Annum.

Table No.3.6.1: Energy consumed per annum by major instruments in all the departments and Administrative room of college

Sr. No.	Equipment	Number	KWh/Annum
1	Water purifier	1	588.8
2	CCTV	37	568.32
3	RO	1	35.84
4	AC	1	627.2
5	Sanitary Napkin	1	204.8
6	Motor	2	2,048
7	pH Meter	1	46.4
8	Condoctometer	1	61.44
9	Practical Circuit	20	204.8
10	Electronics Practical	10	102.4
11	Optics Practical	4	143.36
12	Fridge	1	30.72
13	Incubator	1	768
14	Microscope	5	384
15	Hot Air Oven	1	1,536
16	CCTV Control	4	122.88
	Total	**91**	**7,472.96**



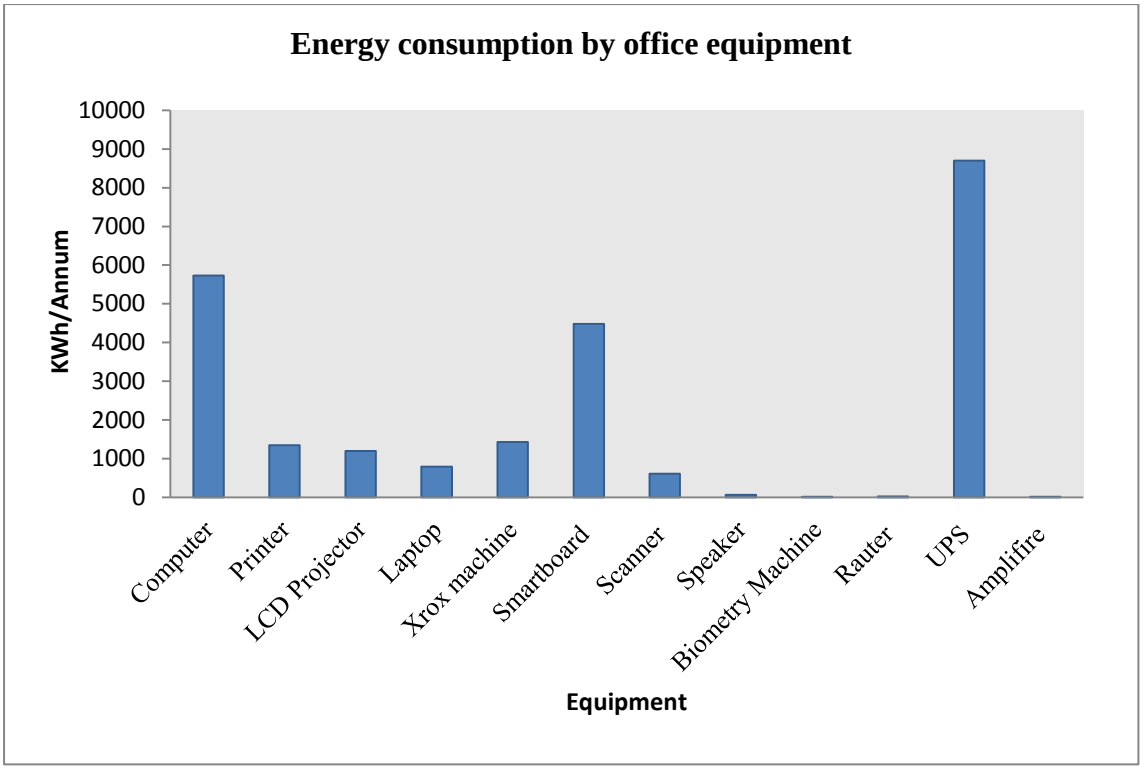
Graph No.3.6.1: Energy consumed per annum by major instruments at all departments and Administrative room in the college

Major energy consuming equipment's at all departments consume electricity 7,472.96 kWh/Annum. As major energy consuming equipments, number of Moter is 1 than other equipment's and hence, energy consumed by major energy consuming equipments is also maximum i.e. 7,472.96 kWh/ Annum. During the analyses, it is observed that number of Moter including all departments is 1 and it consumes energy i.e. 2,048 kWh/ Annum. Followed by Hot Air Oven 1,536 kWh/Annum, Incubator (1) 768 kWh/Annum, AC 627.2 kWh/Annum, Water purifier 588.8 kWh/Annum, CCTV 568.32 kWh/Annum respectively.

Similarly, to analyse the electricity consumption of office equipment's computers, printers, laptops were also considered for the calculation.

Table No. 3.6.2: Electronic Appliances and their energy consumption (kWh/Annum) at all departments, Computer Laboratories and Administrative room in the college

Sr. No.	Equipment	Number	KWh/Annum
1	Computer	32	5734.4
2	Printer	6	1344
3	LCD Projector	4	1196.8
4	Laptop	4	792.96
5	Xerox machine	1	1433.6
6	Smart board	2	4480
7	Scanner	3	614.4
8	Speaker	6	69.888
9	Biometry Machine	1	18.432
10	Router	2	23.04
11	UPS	10	8704
12	Amplifier	1	12.288
	Total	**72**	**24,423.81**



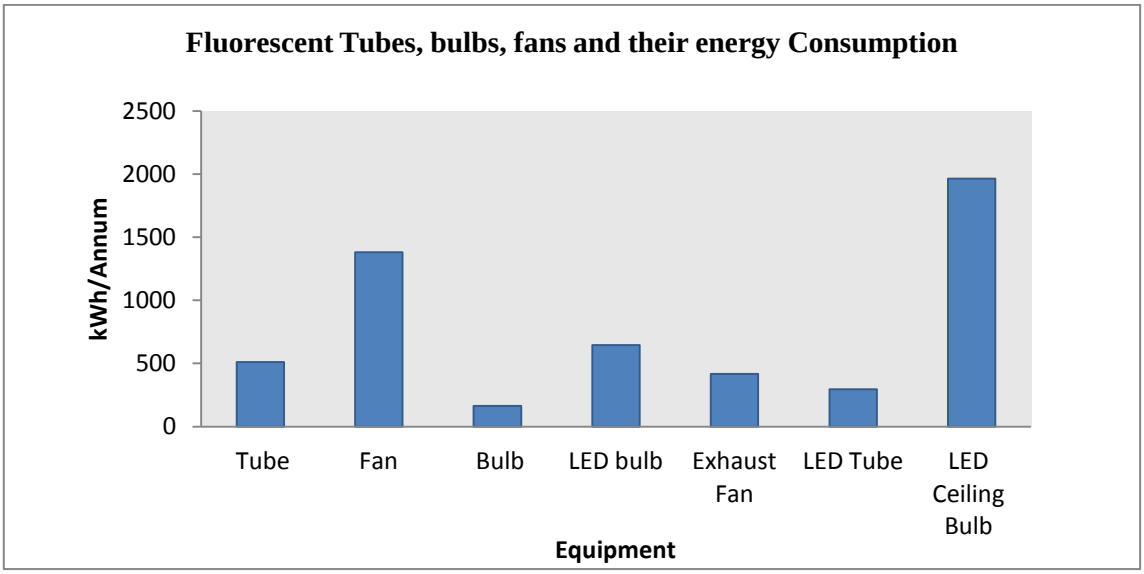
Graph No. 3.6.2: Electronic Appliances and their energy consumption (kWh/Annum) at all departments, Computer Laboratories and Administrative room in the college.

In this section included the Administrative room, all departments and computer laboratories etc. of the college and their energy consumption. All the electronic appliances in every department's consume energy is 24,423.81 kWh/Annum. In electronic appliances, number of UPS is (10) than Computer, Printers, Laptops, LCD projectors and Xerox machine hence the energy consumed by UPS is also maximum i.e. (10) 8704 kWh/Annum. Followed by Computers (32) 5734.4 kWh/Annum, Smart board (2) 4,480 kWh/ Annum, Printer (6) 1,344 kWh/Annum, Xerox Machine (1) 1,433.6 KWh/Annum, LCD Projector (4) 1,196.8 kWh/Annum, respectively. Similarly, to analyze the electricity consumption, lights and fans were also considered.

Table No. 3.6.3: Number of fluorescent tubes, bulbs and fans and their energy consumption (KWh/ Annum) at all departments in the college

Sr. No.	Equipments	Number	KWh/Annum
1	Tube	25	512
2	Fan	18	1,382.4
3	Bulb	10	163.84
4	LED bulb	21	645.12

5	Exhaust Fan	6	417.79
6	LED Tube	18	294.91
7	LED Ceiling Bulb	20	1,966.08
	Total	**118**	**5,382.14**

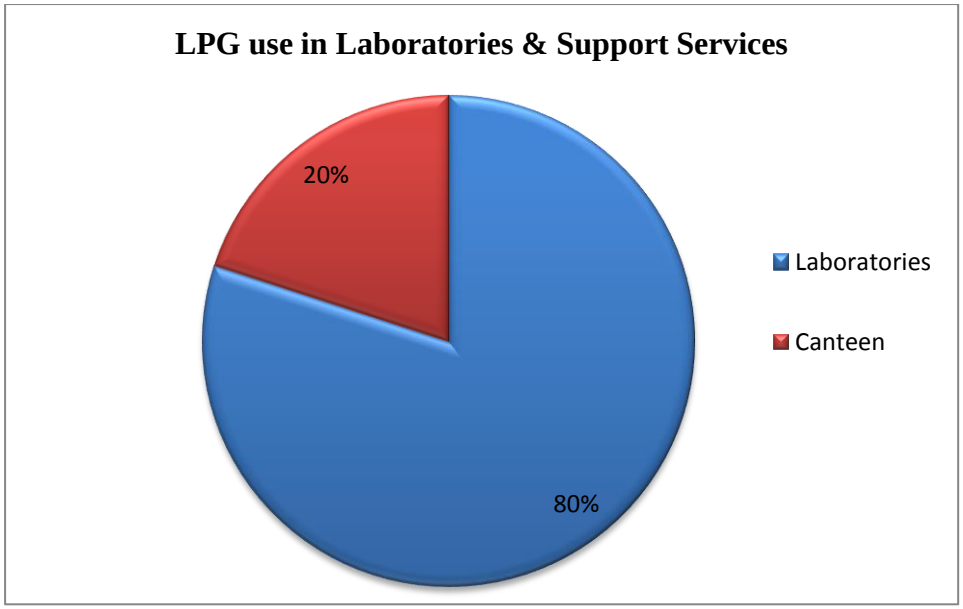


Graph No.3.6.3: Number of fluorescent Tubes, bulbs and fans and their energy Consumption (KWh/ Annum) at all departments in the college

Maximum use of energy is for lightning and fans in all the buildings. The total number of LED Ceiling Bulb is 20 and their electricity consumption is 1,966.08 kWh/Annum. In the building, total number of ceiling fans 18 and LED bulbs are 21 and their electricity is consumption 1,382.4 kWh/Annum, 645.12 kWh/Annum. Followed by Tube (25) 512 kWh/Annum, Exhaust Fan (6) 417.79 kWh/Annum, respectively.

Table No.3.8.3g LPG Use in Laboratories & Support Services

Sr. No.	Laboratories & Support Services	No of Cylinder kg	kg/annum
1	Laboratories	2	56
2	Canteen	2	14
	Total	**4**	**70**



Graph No.3.8.3g LPG use in Laboratories & Support Services

Maximum LPG is used in Support services i.e Laboratories, Canteen etc. LPG is used as a fuel for cooking purpose in canteen and practical purpose in Laboratories. The total number of LPG Cylinder required was 4 and their consumption is 70 kg/Annum. In the Support services, LPG Gas consumption respectively i.e. in Laboratories 56 kg/Annum (80%), Canteen 14 kg/Annum (20%) respectively. This is might be effect of lockdown days. During lockdown period hostels and college canteen was closed.

Key Observations:

- The total energy consumption of college is 37,278.912 kWh/Annum
- Highest consumption of energy is by Electronic appliances i.e. 24,423.80 kWh/Annum.
- The energy consumption of Electronic appliances like computers, printers, etc. is more than major equipment and fluorescent lamps.
- Electricity consumption is less because college, canteen, and hostel were closed due to the Covid-19 pandemic situation

Chapter IV

CONCLUSION AND MANAGEMENT PLAN

The Department of Environmental Science, Shivaji University, Kolhapur has conducted a Green Audit of Shripatrao Chougule Arts and Science College Malwadi-Kotoli, Dist. Kolhapur Maharashtra in the academic year 2020-21. Green auditing is the process of identifying and determining whether institution practices are eco-friendly and sustainable. The main objective is to carry out green audit is to check green practices followed by college and to conduct a well formulated audit to understand where we stand on a scale of environmental soundness.

Conclusions:

From the green audit conducted by team following are some of the conclusions which can be taken for improvement of the college campus to become environment friendly college campus:

1. College takes hard work to dispose majority waste by using proper methods.
2. Confidential paper waste is disposed properly.
3. Glass waste is to be disposed properly.
4. Electricity consumption is more at Science departments.
5. Use of CFL lamps in the college is minimum. Its use should be encouraged and now converted to LED lights.
6. Wash basin and Laboratory are consuming more water.
7. Roof top and ground rain water harvesting should be expanded which is useful for filling up of tanks on campus.
8. E-waste segregation, handling and disposal are properly done.
9. Dustbins should be provided in adequate number for collection of waste.
10. College can conduct more seminars, group discussions and eco-friendly activities on environmental education and awareness

Recommendations:

Following are some of the key recommendation for improving campus environment.

1. College should develop its own Environmental Policy by using guidelines given in Green Audit document.
2. The data related to all measured environmental parameters should be monitored and recorded regularly and information be made available to administration.
3. The college should develop internal procedures to ensure its compliances with environmental legislation and responsibility be fixed to carry out it in practice.
4. Wherever possible the waste should be reused or recycled.
5. All street lighting should be changed to LED lights to save electricity.
6. Rain water harvesting facility must be implemented and expanded.
7. Drip irrigation for gardens and vegetable cultivation can be initiated.
8. Practice of waste segregation to be initiated.

ENVIRONMENT MANAGEMENT PLAN:

By understanding the dynamics of present situation of resource utilization and current practices of waste disposal we have prepared an Environment Management Plan (EMP) for the Shripatrao Chougule Arts and Science College Malwadi-Kotoli, Dist. Kolhapur Maharashtra This plan not only will provide the strengths, weaknesses and remedies for the green and clean campus but also give priority of the sector where the college has to give more efforts to improve its environment.

Environment Management Plan 2020-21

Sector	Strengths	Weakness	Suggestions	Priority
Solid Waste				
Paper	• Use of one-sided papers in many departments and main building	• Multiple numbers of copies required for office work.	• Towards paperless office: More use of e-mails, e-money transfer and advance IT technology for communication.	Medium
Plastic	Reuse of plastic at some departments	• Plastic thrown with general waste in some departments	• Segregation of waste at the source and sending plastic waste for recycling. • Ban on Plastic carry bags in College premises.	Medium
Biodegradable waste	• Solid waste generated .	• Solid waste is to be segregated at the source	• Segregation of solid waste help in composting process • College can prepare its vermicomposting plant	Medium
Energy				
Electricity		• Unnecessary use of lights, fans and computers at some places when no one is using it. • More awareness is required	• Employment of more solar panels and other renewable energy sources. • Electrification of street lights by solar power. • Use of solar	Medium

		among students.	pumps for water tanks. • General awareness about electricity saving.	
Fuel	• Use of public Transport system is comparatively more by staff and students	• More awareness is required among students.	• Initiation of No vehicle day on campus • 'Cycle on rent' service for student • General awareness about efficient use of fuel.	Medium
Water				
Water utilization	• College has done watershed management in there premises .	• Overflowing of tanks at some places • Overuse of water for wash basin .	• Installation of automatic water pumps to avoid overflowing losses • Proper and timely maintenance of plumbing at all departments • Installation of roof top rain water harvesting assembly for whole college.	Medium
Waste water	• Septic tanks present for sewage treatment • Soak pit is present near laboratory	• Untreated laboratory effluent and other waste - water. It percolates into soil and may contaminate ground water.	• Installation of small scale STP to treat laboratory waste and toilet flushing.	High
Hazardous Waste				
E-waste	• E waste is sent to E waste collection centre at Bengaluru.	• E waste related to computer and its parts are only collected.	• There must be segregation of e-waste from regular waste and also among the e-waste. • E-waste in all forms not only computers, should	High

			be collected properly	
Tree Census				
Tree Vegetation	• There is lots of space for plantation	• require plantation on campus • The fire lines are absent in the campus	• Avoid monoculture, variety of species should be planted in campus area • Fire lines should be marked to avoid forest fire .	Medium
Air				
Air	• Air quality is in good condition. There is no sound pollution	• Considering the future student population, there may be air and noise pollution	• The plantation can be increased by vertical gardening.	Medium

Sustainable and Social practices followed by Shripatrao Chougule Arts and Science College Malwadi-Kotoli, Dist. Kolhapur Campus

Members of Shripatrao Chougule Arts and Science College Malwadi-Kotoli, Dist. Kolhapur Maharashtra.

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