GREEN AUDIT REPORT

2020-21

DEPARTMENT OF ENVIRONMENTAL SCIENCE,
SHIVAJI UNIVERSITY, KOLHAPUR

ISBN: 987-93-85190-25-4

Prepared by

DEPARTMENT OF ENVIRONMENTAL SCIENCE,
SHIVAJI UNIVERSITY, KOLHAPUR.

ISBN: 987-93-85190-25-4

Published by:
Dr. V. N. Shinde
Registrar,
Shivaji University, Kolhapur.
Phone: (0) 0231-2609063
(R) 0231-2609059
(M) +91-9421918134
Email: registrar@unishivaji.ac.in

Prof. (Dr.) M.S. Deshmukh
Co-ordinator,
Internal Quality Assurance Cell,
Shivaji University,
Kolhapur- 416 004.
(Maharashtra), India.
Phone: (O) 0231-2609087
Email: iqac@unishivaji.ac.in

Photo credits:
Cover page by
Chetan Bhosale, Amit Mane.

Printed by:
Shivaji University Press,
Kolhapur-416 004.

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(with Environment and Energy)
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Department of Environmental Science,

Shivaji University, Kolhapur.

ISBN: 987-93-85190-24-4

प्रा. (डॉ.) डी. टी. शिर्के
एम.एस्सी., पीएच.डी.
कुलगुरू
Prof. (Dr.) D..T..Shirke
M.Sc.,Ph.D.
Vice-Chancellor

Estd. 1962
NAAC 'A++' Grade

शिवाजी विद्यापीठ,
विद्यानगर, कोल्हापूर - ४१६ ००४.
SHIVAJI UNIVERSITY,
Vidyanagar, Kolhapur - 416 004.

दूरध्वनी : कार्यालय - (०२३१) २६०९०६०
निवास - (०२३१) २६०९०५३
Tel. : Office - (0231) 2609060
Resi. - (0231) 2609053
E-mail : vcoffice@unishivaji.ac.in
Web : www.unishivaji.ac.in

FOREWORD

Environmental degradation has crossed the boundaries of resilience capacity of our mother earth. Today, the world is actually experiencing the effects of unplanned voracious use of natural resources. This condition has led to unending consequences like climate change, global warming, deforestation, biodiversity loss or a range of pollution are outcomes of unsustainable activities.

On the background of this scenario, higher education institutions have more responsibility to create knowledgeable and skilled manpower for tackling the environmental issues. Universities are expected to take lead role in environmental conservation and protection for sustainable society. Such institutions are expected to prepare long lasting and innovative solutions which will be helpful for generating eco friendly lifestyles in human society.

Environmental and Energy auditing is systematic tool to assess the day to day activities responsible for resource utilization and waste generation. Such audit is an integral requirement for good functioning of institution. The objective of green auditing is taking good care of all the natural resources which utilized on the campus and avoid the practices which are posing harm to the environment.

Shivaji University is one of the premier higher educational institutes in Maharashtra. University has implemented eco-friendly practices to manage the available resources like watershed management, wastewater recycling, solar electricity project, roof top rain water harvesting, biogas generation, electrical vehicles and RO water purification system for clean drinking water to all on the campus. Plantation of local and endemic plant species is encouraged on campus. The tree cover on campus has reduced the carbon foot print of urban environment.

Over the last two years we all are experiencing Covid pandemic situation. Such circumstances has also affected the presence and functioning of every stakeholder on the University campus. As a part of such voluntary practices, internal environmental audit is conducted by Department of Environmental Science of the University. I am very happy to forward this Environment and Energy Audit Report 2020-21 of Shivaji University, Kolhapur. I appreciate the efforts taken by Dr. (Mrs.) Aasawari Jadhav and her team to complete the report. I hope the report will be useful for making the University more green and sustainable and will guide to other institutes, also.

13 JAN 2022

(D.T. Shirke)
Vice Chancellor

प्रा. (डॉ.) पी. एस. पाटील
एम.एस्सी., पीएच्.डी.
प्र-कुलगुरू
Prof. (Dr.) P. S. Patil
M.Sc.,Ph.D.
Pro-Vice-Chancellor

Estd. 1962
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Vidyanagar, Kolhapur - 416 004.

दूरध्वनी : कार्यालय - (०२३१) २६०९०७०
Tel. : Office - (0231) 2609070
E-mail : pvcoffice@unishivaji.ac.in
: psp_phy@unishivaji.ac.in
Web : www.unishivaji.ac.in

Message

Environmental issues are increasing day by day everywhere in the world. There is no doubt that human activity is hugely responsible for such damage to the environment. The problems like climate change and global warming are serious threats to entire ecosystem.. Therefore, positive and steady steps towards sustainable development.have to be taken. The efforts should also be taken in order to overcome the environmental damage.

The universities are apex educational institutes which are having the prime responsibility to educate and aware the students for environmental conservation and management. Such higher educational institutes are also playing important role through its research and extension activities for environmental protection. Shivaji University is one of them spreading the knowledge and awareness related to sustainable environmental practices through its various programmes and courses. The university PG departments and affiliated colleges are always engaged in clean and green environmental practices and extension activities like plantation and nurturing drives, cleanliness campaigns, workshops and lecture series for biodiversity conservation, etc.

As a part of NAAC AQAR, the Environmental and energy audit of Shivaji University was undertaken by Department of Environmental Science for the year 2020-21. Considering the Covid pandemic rules and regulations, the data related to use of resource utilization was collected and analysed by the audit team. The audit team has covered the aspects related to water audit, energy audit, solid waste audit, green initiatives of university, social extension activities during flood and Covid situation, Carbon sequestration potential and Environmental Management plan, etc.

I congratulate the audit team of Department of Environmental Science, Shivaji University. This will definitely provide important insights to facilitate effective and sustainable ecofriendly practices on university campus.

13 JAN 2022

(Prof.(Dr.) P.S. Patil)
Pro- Vice Chancellor

SHIVAJI UNIVERSITY, KOLHAPUR
DEPARTMENT OF ENVIRONMENTAL SCIENCE
Vidyanagar, KOLHAPUR - 416 004, Maharashtra, India
Tel. : 0231-2609333 / 9304, Gram:"UNISHIVAJI"
Fax : 0091-0231-2691533/2333
E-mail : envsc@unishivaji.ac.in

Estd : 1962
NAAC 'A' Grade

Ref. No./SUK/ENV

Date:

Certificate

This is to certify that the Department of Environmental Science, Shivaji University, Kolhapur has conducted detailed "Green Audit" of "Shivaji University, Kolhapur" 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.

Department of Environmental Science, Shivaji University, Kolhapur

Head

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NAAC 'A' Grade

SHIVAJI UNIVERSITY, KOLHAPUR
DEPARTMENT OF ENVIRONMENTAL SCIENCE
Vidyanagar, KOLHAPUR - 416 004, Maharashtra, India
Tel. : 0231-2609333 / 9304, Gram:"UNISHIVAJI"
Fax : 0091-0231-2691533/2333
E-mail : envsc@unishivaji.ac.in

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SHIVAJI UNIVERSITY, KOLHAPUR
DEPARTMENT OF ENVIRONMENTAL SCIENCE
Vidyanagar, KOLHAPUR - 416 004, Maharashtra, India
Tel. : 0231-2609333 / 9304, Gram:"UNISHIVAJI"
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Department of Environmental Science, Shivaji University, Kolhapur

Head

EDITORIAL

Today, more than ever before, the environmental degradation is increasing and there is a great need of environmental awareness in society. Considering the global problems of Climate Change and Global warming, countries are strengthening their carbon neutral policy and net zero resource utilization. Many countries have increased their pace for environmental conservation and ecosystem rejuvenation. It is now an inconvenient truth that environment and sustainable development are interlinked and should be regarded as national priorities. There is necessity of full participation of society in the mitigation of environmental issues.

As higher education institutes are like lighthouse for society, the responsibility of such institutes increases for knowledge dissemination and research but also for taking care of environment. In fact, the Government, environmental monitoring agencies, NGOs, academic institutions and the media can work synergistically to combat environmental degradation and thus create a healthy environment.

By realizing the responsibility towards environment, NAAC, an autonomous body under UGC has added the concept of environmental audit in accreditation methodologies of universities and colleges. The objective behind such environmental audit is to nurture environmentally friendly management in academic institutions and to recognize the initiative taken by organization towards environment.A green audit of any academic institution revels ways through which we can reduce energy consumption, water use, enlist biodiversity, reviews solid waste generation and other ecofriendly practices. This process of green audit enables us to assess our life style, action and assess its impact on the environment. Keeping the importance of environmental audit in view, the present study focuses on reviewing the process of environment audit and the major to be taken by academic institutes to contribute towards environment.

Shivaji University has been one of the premier university in Maharashtra catering the educational needs of not only urban but rural areas. The university has always having its green approach towards any developmental activity. As an outcome of this, university has taken green steps to reduce its carbon foot prints by using electrical vehicles on campus, solar electrical panels and green computing in the administration and examination. The responsibility of carrying out the scientific green audit was given to Department of Environmental Science. Earlier the department has conducted green audit of university for two times i.e. 2013-2014 and 2018-19 under the leadership of Prof. (Dr.) P.D.Raut. Present audit report is done for the year 2020-21 considering the earlier data as base. Since academic year 2020-21, was under the shadow of Covid-19 pandemic, a number of activities like teaching, examinations, meetings, seminars, administrative work, etc. in the university were through online mode. Very less population was present on the university campus with the absence of largest stakeholder i.e. students. Therefore, as compared to earlier data, this audit report shows drastic reduction in consumption of all resources in university.

During the preparation of the ‘Green Audit Report-2020-21,’ Hon Vice-Chancellor, Hon. Pro-Vice Chancellor encouraged us with their support. Registrar, Director, IQAC, Deans of faculties, and other officers of the university were also given support I am also thankful to former Head of Department, Prof. P.D. Raut who prepared the earlier Green Audit Reports which became helpful for us. I am thankful to garden department and Electrical engineering section of the university who also gave co-operation during data compilation. I must also thank all my Faculty, Research Scholars and M.Sc. students of the Department of Environmental Science without whom this report could not have been completed. I hope the efforts made will be helpful for making our university greener and more sustainable.

Dr. (Mrs.) Aasawari Jadhav
I/C Head and Assistant Professor,
Department of Environmental Science,
Shivaji University, Kolhapur.

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Abbreviations

Kl	Kiloliter
Ml	Megaliter
SWP	Sustainable Water Practices
CCT	Continuous contour trenches
STP	Sewage Treatment Plants
MIT	Mini Irrigation Tanks
WTP	Water Treatment Plant
RO	Reverse Osmosis
MLD	Millions of liter /day
E.C	Electrical Conductivity
TDS	Total Dissolved Solids
MPN	Most Probable Number
CFC	Common facility Centre
E-waste	Electronic waste
CPU	Central Processing Unit
CFC	Common facility Centre
CO_2	Carbon dioxide
SUK	Shivaji University, Kolhapur
IPCC	Intergovernmental Panel on Climate Change
AGB	Above Ground Biomass
Pg	Pentagram
GHGs	Greenhouse Gases
GWP	Global Warming Potential
CF	Carbon Footprint
LPG	Liquefied Petroleum Gas
CDM	Clean Developmental Mechanism
MW	Megawatt

EXECUTIVE SUMMARY

The Department of Environmental Science, Shivaji University, Kolhapur conducted a "Green Audit with Enegy and Environment audit" of Shivaji University, Kolhapur in the academic year 2020-21. Green auditing is the process of identifying and determining whether institutions practices are eco-friendly and sustainable. The main objective to carry out green audit is to check green practices followed by university and to conduct a well formulated audit report to understand where we stand on a scale of environmental soundness.

This is third attempt of Shivaji University to conduct green audit of university campus.The year 2020-21 was under the effect of Covid -19 pandemic. Students were totally absent on campus. Most of the academic and administrative activities were done through online mode. Therefore, ample amount of resources were seen to be conserved specially water and energy during the audit. The data was compiled by using earlier Questionnaires prepared to conduct the green audit whichwere based on the guidelines, rules, acts and formats set by Government of India, Ministry of Environment and Forest, New Delhi and Central Pollution Control Board, New Delhi. Data was taken solid waste, energy, water, hazardous waste and e-waste. As per the earlier methodology, the study area was grouped as Building Block A including administrative buildings, Building Block B including Science and Technology Departments, Building Block C including Language and Humanities departments and Building Block D including Support Services. The audit was carried for solid waste, electricity and energy, water and wastewater, hazardous waste, air and noise quality and green initiatives like calculation of carbon sequestration potential, Miyawaki plantation and environment friendly activities done by University departments. Thisaudit also gives a 'Environmental Management Plan'.

1. **Energy audit:**

Major use of electricity was at office, teachers cabins and laboratories for lighting, laboratory work. Electricity consumed by laboratory equipments is 50838.36KW/week. Air conditioners used in the university consume 706.36 KW/week. Many of the departments and other services are using a LED lamps and tube lights which is reducing consumption of electricity. The street lights in front of main building is LED types which also save electricity.

1. **Solid waste audit :**

The university has developed good facilities in the form of two biogas plants at Vidyarthi Bhawan and Department of Technology. The University has declared plastic free campus Bio-composter facility for food waste is established in the girl's hostel and Vermi-composting plant is near main canteen. Old metallic components waste given to authorized vendors for further processing.

The day care treatmentand clinical laboratory at Health Centre of university generates Biomedical waste management waste. It is includingintravenous sets, syringes, hand gloves, dressing material, cotton balls, gauze, burned needles, scalpels, empty injection vials, ampulesetc. It is collected as per the MPCB norms and sent to Kolhapur Municipal Corporation's authorized *SS SERVICES* approved by MPCB every week.

The damaged parts of computers, printers and xerox machines, scientific equipments,connectivity wires are included in e-waste. Through tendering process it is given to authorized e-waste disposal agency. Department of Electronics has also established a centre for E waste collection. E-waste handled by university is 45.16 kg/month and E-waste treated and disposed is 45.16 kg/month.

2. Water audit:

A water audit is an on-site survey and assessment to determine and improve efficiency of water use. The water used at bathrooms, toilets, laboratory, kitchen, garden, wash basins, shower and other uses as well as leakages and over flow of water from overhead tanks is also been evaluated. The total use of water is 3427 Kl/ year**.** The major use of water is in bathrooms and washbasins.

Shivaji University is the only university from the state of Maharashtra which is self-sufficient in water. There are three tanks on the campus which supply water for regular use where as well on the campus supplies drinking water. There is also water filtration plant for filtration of water which supplies water for all facilities. For drinking purpose university has set up a Reverse Osmosis Plant (RO Plant) for clean drinking water for everybody on the campus. During flood situation in the month of August, 2021, university has supplied RO water to needy people from city free of cost. Roof top rain water harvesting is also been practiced and water collected been sent to water tanks on campus.

.3. Air and Noise quality audit:

Air quality on the academic institute is very important for health of students, faculty and staff of university. The air pollution sources in the university campus are wind storm, pollen grains, natural dust, vehicular emissions, generators, fires and laboratory fumes. All these pollutants are measured by the Department of Environmental Science under the National Ambient Air Quality Monitoring Program (NAAQMP) of Central Pollution Control Board, New Delhi. The air pollutants monitored on regular basis are Sulphur dioxide (SO_2), Oxides of Nitrogen as NO_2, Repairable Suspended Particulate Matter (RSPM) and Suspended Particulate Matter (SPM)by High Volume Sampler (HVS) as well as records of temperature, relative humidity are also been recorded for comparison. All the air quality parameters are within the standard limits of CPCB, New Delhi, suggesting ambient air quality of university campus is good.

As an academic institute university comes under silent zone where noise should be below 45 dB during day time. Therefore, the noise on the campus is also measured and found within the standard limits. Sometimes construction activities and highway road traffic near main gate increase the noise level on the campus.

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Environmental Management Plan:

Environmental Management Plan gives the strength, weaknesses and suggestions on the environmental issues of Shivaji University, Kolhapur. It also suggests about which area is to be given priority to improve upon. This audit of university campus reveals that the university administration should take care of glass waste, wastewater, chemical waste, e-waste management, fire lines for controlling forest fires on high priority as the ignorance to these will deteriorate the environment on the campus.

The entire exercise of Environmental audit concluded that the university is paying attention towards environmental conserve on which the University has to take care.

Chapter I

Introduction

1.1 Green Audit, a Tool for Environmental Protection and Conservation:

Universities are playing a key role in development of human resources worldwide. Higher education institutes campus run various activities with aim to percolate the knowledge along with practical dimension among the society. Likewise, different technological problems higher education institutes also try to give solution for issues related to environment. Different types of evolutionary methods are used to assess the problem concerning environment. It includes Environmental Impact Assessment (EIA), Social Impact Assessment (SIA), Carbon Footprint Mapping, Green audit etc.

"Green audit is a tool to assess general practices implemented by organization in term of its impact on environment". Green audit also throws a light on adverse practices which are responsible for degradation of environment. Green audit shows strength and weakness of organization towards conservation of environment. It also pinpoints the disturbing practices of natural resources utilization. It shows the path to build, implement and test new innovative system for better utilization of resource and minimization of waste generation. It helps to achieve the goal of university to become a role model in higher education of sustainable campus in social, economical and environmental views.

Green Audit is the most efficient ecological tool to solve such environmental problems. It is a process of regular identification, quantification, documenting, reporting and monitoring of environmentally important components in a specified area. Through this process the regular environmental activities are monitored within and outside of the concerned sites which have direct and indirect impact on surroundings. Green audit can be one of the initiatives for such institutes to account their energy, water resource use as well as wastewater, solid waste, E-waste, hazardous waste generation. Green Audit process can play an important role in promotion of environmental awareness and sensitization about resource use. It can create consciousness towards ecological values and ethics. Through green audit one can get direction about how to improve the condition of environment.

1.2 Need of Green auditing:

Green auditing is the process of identifying and determining whether institutions practices are eco-friendly and sustainable. Traditionally, we are good and efficient users of natural resources. But over the period of time excess use of resources like energy, water, chemicals are become habitual for everyone especially, in common areas. Now, it is necessary to check whether our processes are consuming more than required resources? Whether we are handling waste carefully? Green audit regulates all such practices and gives an efficient way of natural resource utilization. In the era of climate change and resource depletion it is necessary to verify the processes and convert it in to green and clean one. Green audit provides an approach for it. It also increases overall consciousness among the people working in institution towards an environment.

1.3 Goals of Green audit:

University has conducted a green audit with specific goals as:

1. Identification and documentation of green practices followed by university.
2. Identify strength and weakness in green practices.
3. Conduct a survey to know the ground reality about green practices.
4. Analyze and suggest solution for problems identified from survey.
5. Assess facility of different types of waste management.
6. Increase environmental awareness throughout campus.
7. Identify and assess environmental risk.
8. Motivates staff for optimized sustainable use of available resources.
9. The long-term goal of the environmental audit program is to collect baseline data of environmental parameters and resolve environmental issue before they become problem.

1.4 Objectives of Green audit:

1. To examine the current practices which can impact on environment such as of resource utilization, waste management etc.
2. To identify and analyze significant environmental issues.
3. Setup goal, vision and mission for Green practices in campus.
4. Establish and implement Environmental Management in various departments.

5. Continuous assessment for betterment in performance in green practices and its evaluation.
6. To prepare an Environmental Statement Report on green practices followed by different departments, support services and administration building.

1.5 NAAC criteria VII Environmental Consciousness:

Universities are playing a key role in development of human resources worldwide. Higher education institutes campus run various activities with aim to percolate the knowledge along with practical dimension among the society. Likewise different technological problems higher education institutes also try to give solution for issues related to environment. Different types of evolutionary methods are used to assess the problem concerning environment. It includes Environmental Impact Assessment (EIA), Social Impact Assessment (SIA), Carbon Footprint Mapping, Green audit etc

National Assessment and Accreditation Council (NAAC) which is a self-governing organization that declares the institutions as Grade according to the scores assigned at the time of accreditation of the institution. Green Audit has become mandatory procedure for educational institutes under Criterion VII of NAAC. The intention of green audit is to upgrade the environmental condition inside and around the institution. It is performed by considering environmental parameters like water and wastewater accounting, energy conservation, waste management, air, noise 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 natural resources in students. Many environmental activities like plantation and nurturing saplings and trees, Cleanliness drives, Bird watching camps, No vehicle day, Rain water harvesting, etc. will make the students good citizen of the country. Through Green Audit, higher educational institutions can ensure that they contribute towards the reduction of Global warming through Carbon Footprint reduction measures.

1.6 Benefits of Green Audit to an Educational Institute:

There are many advantages of green audit to an Educational Institute:

- 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 built positive impression for through green initiatives the upcoming NAAC visit.

1.7 Shivaji University, Kolhapur Maharashtra at a Glance:

Shivaji University has been accredited "A^{++}" grade with CGPA 3.52 in the fourth cycle assessment by NAAC. Shivaji University, established in 1962, is named after the Great Maratha Warrior and founder of the Maratha empire Chhatrapati Shivaji. It was inaugurated on 18th November, 1962 by Dr. Radhakrishnan, the then President of India. One of the major objectives behind foundation of this University was to cater to the regional needs of South Maharashtra. The jurisdiction of the University is spread over three districts viz. Kolhapur, Sangli and Satara with strength of about 3,00,000 students studying in 280 affiliated colleges and recognized institutes. This region of Maharashtra boasts of rich and varied socio-cultural heritage. Under the innovative and socially reformist leadership of Chhatrapati Shahu Maharaj, the princely ruler of Kolhapur, the city had become at the beginning of this century, a focal point of educational opportunities for all classes and communities of South-Western Maharashtra, and northern parts of neighboring Karnataka. This is also land of Karmaveer Bhaurao Patil, who struggled for taking education to the masses by his innovative 'Earn and Learn' scheme. When the University was founded by the Shivaji University Act of 1962, the objectives set before the University included making opportunities of higher education accessible to rural youth, conducting fundamental and applied research in the field of science and humanities to ensure regional growth and development.

In 1962, the University started functioning with 34 affiliated colleges and about 14,000 students with 5 Post-graduate Departments on the campus. Today, the number of affiliated colleges has gone up to 276 and student's strength up to 3,00,000 with 34 Postgraduate Departments on campus, 10 Chairs and 19 Centres. The University imparts education in 10 major faculties of Arts, Social Science, Science, Commerce, Education, Fine Arts, Law,

Medicine, Ayurvedic Medicine, Engineering and Technology. The University consolidated its base in this phase by 'taking education to the people'. The recent phase of the University can be termed as "a pursuit of academic excellence". Since last 4-5 years, several attempts are being made to overcome the image of University as a regional University. Several steps have been taken to raise the standards of teaching and research so as to measure up to global standards. This is being achieved by exploring new areas of higher learning and research in rapidly emerging fields like Industrial Chemistry, Space Science, Environmental Science, Bio-Chemistry, Sericulture, Polymer Chemistry and Computer Science, in addition to basic science disciplines. The University Department of Physics has been recently identified by UGC for its Special Assistance Programme and recognized as Department of Research Support. New research areas in these departments are Super conductors Energy, Bio-diversity and Bio-technology. The University has also established the University-Industry Interaction.

The faculties of Arts and Social Sciences are also gearing up to meet the demands of changing time. Establishment of Centre for Women's Studies and extension activities through Adult and Continuing Education and Shramik Vidyapeeth are indicators of this change. Department of Economics has been selected by UGC for its Special Assistance Programme. Departments of Sociology, Education, Geography, Physics and Economics are offering special courses in emerging areas like Environmental Science is also functioning actively. The University's efforts towards excellence are being recognized by the substantial grants received from funding agencies like UGC, DST, DBT etc. The indicator of recognition of University is collaborations with premier institutes in the country. Shivaji University has recently signed MoU with Bhabha Atomic Research Centre, Mumbai for research in Material Science. It has also joined hands with Indian Institute of Geo-Magnetism, Mumbai and industries like Phyto-Pharma. Prestigious institutes like Maharashtra Police Academy, Nashik and Centre for Social Studies, Surat have sought affiliation with the Shivaji University.

To sum up, the University which was founded primarily to cater to the regional aspirations has now geared up to transcend this regional image and emerging as one of the premier institutes of higher education and research in India.

Chapter II

Methodology

2.1 Background of Shivaji University Green Audit preparation:

Shivaji University has prepared its first Green audit report in the year 2013- 14 and 2019-20 during NAAC accreditation period.

Department of Environmental Science has prepared the Green Audit Report of Shivaji University in 2013-14 and 2019-20 under the guidance of Prof. (Dr.) P. D. Raut, former Head of Department of Environmental Science, SUK. Both of these reports, have been well appreciated by the NAAC Pear Team visited Shivaji University. This was the third attempt to prepare the audit report for University. Department of Environmental Science has also prepared the Green Audit Report for more than 18 colleges under Shivaji University territory.

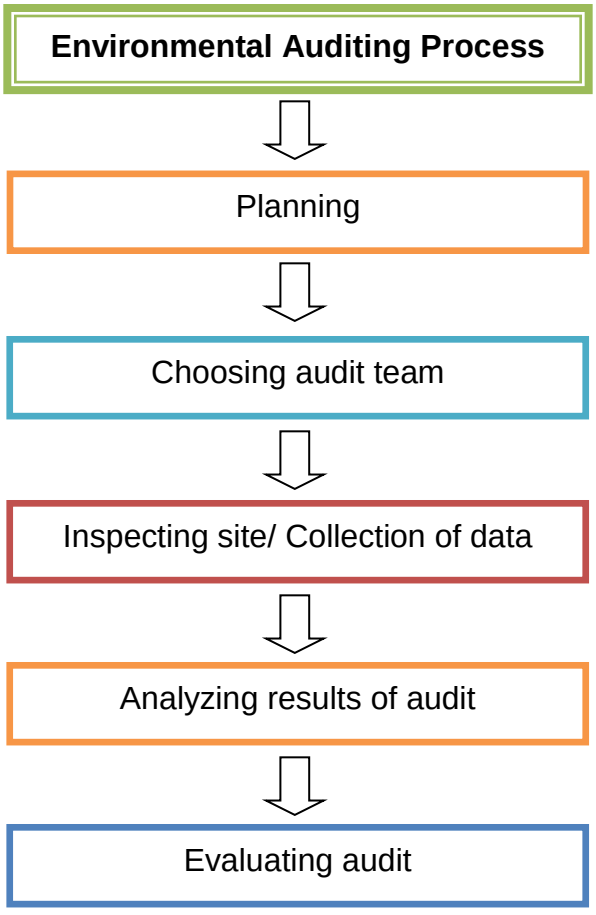
This is being the third attempt to conduct Green Audit of Shivaji University, Kolhapur campus for the year 2020-21; the report not only includes the data regarding the use of resources but also highlights the biodiversity status of University. The resource utilization of Water and Electricity, Solid waste generation, E waste, Hazardous waste, Noise and Air monitoring, wastewater generation etc. on university campus are studied through this Green Audit process. Besides, these observations, the report also includes the information about the social responsibility taken by Shivaji University during the flood and Covid-19 pandemic situation in Kolhapur.

Due to Covid-19 pandemic situation during the year 2020-21, a number of activities on the campus occurred through online mode. As per the rules and regulations of Government of Maharashtra, more than 4 to 5 months, the teaching and nonteaching staff was doing work from home. The University was totally closed. After some relaxation of Covid-19 pandemic norms, all staff was allowed to come on the campus in 50% attendance or rotation. Later, all the staff was allowed to work on the campus but major stakeholders. i.e. students were absent for all the academic year 2020-21. Boys Hostels and Technology ladies hostel were converted into Covid-19 Centers and hand over to Kolhapur Municipal Corporation as per the directions of Hon. Collector, Kolhapur District.

Considering all this situation and adding national holidays in the total closed days,the audit process wascarried out in three phases. For preparation of audit, the earlier data was

compared with the present. At first, all the secondary data required for the study was collected from various sources, like concerned departments and engineering, garden etc. A broad reference work was carried out to clear the idea of green auditing. Different case studies and methodologies were studied and the following methodology was adopted for present audit.

The methodology of present study is based on onsite visits,the personal observations and questionnaires survey tool. Initially, based on data requirement, sets of questionnaires were prepared. The surveyors then visited all the departments of the university and the questionnaires were filled. The generated data is subsequently gathered through various sections of university and used for further analysis. From the outcome of the overall study, a final report is prepared.



2.2 Survey by Questionnaire:

Baseline data for green audit report preparation was collected by questionnaire survey method. Questionnaires prepared to conduct the green audit in the university campus is based on the guidelines, rules, acts and formats prepared by Ministry of Environment, Forest and Climate Change, New Delhi, Central Pollution Control Board and other statutory organizations. Most of the guidelines and formats are based on broad aspects and some of the issues or formats were not applicable for University campus. Therefore, using these guidelines and formats, combinations, modifications and restructuring was done and sets of questionnaires were prepared as solid waste, energy, water, hazardous waste, and e-waste.

All the questionnaires comprise of group of modules. The first module is related to the general information of the concerned department, which broadly includes name of the department, month and year, total number of students and employees, visitors of the department, average working days and office timings etc. The next module is related to the present consumption of resources like water, energy, or the handling of solid and hazardous waste. Maintaining records of the handling of solid and hazardous waste is much important in green audit.

There are possibilities of loss of resources like water, energy due to improper maintenances and assessment of this kind of probability is necessary in green audit. One separate module is based on the questions related to this aspect. Another module is related to maintaining records, like records of disposal of solid waste, records of solid waste recovery etc. For better convenience of the surveyor, some statistics like, basic energy consumption characteristics for electrical equipment etc. was provided with the questionnaires itself.

2.3 Onsite visit and observations:

The Shivaji University has vast built up area comprising of various departments, administrative building, teachers and staff quarters, student hostels, guest house, sports complex and health centre. All these amenities have different kind of infrastructure as per their requirement. All these buildings were visited by the surveyors and the present condition is checked with the help of the questionnaires. Personal observations were made during the onsite

visit. All the amenities were clubbed in as per their similarities and differences, which makes the survey and further analysis easier.

For the data compilation purpose the University Departments and support services were clubbed into Four Blocks and given coding asBuildingBlock A, Building Block B, Building Block C and Building Block D. The details of the Blocks are as follows:

Table No. 2.1 Details of each block including the various departments.

Sr. No.	Name of the Building Block	Code
1.	Administrative and Facilities Block	Building Block A
2.	Science and Technology	Building Block B
3.	Commerce, Humanities and Social Sciences	Building Block C
4.	Support Services	Building Block D

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.

2.4 Data analysis and final report preparation:

A proper analysis and presentation of data produced from work is a vital element. In case of green audit, the filled questionnaires of the survey from each group, were tabulated as per their modules, in Excel spreadsheets. The tabulated data is then used for further analysis. For better understanding of the results and to avoid complications, averages and percentages of the tables were calculated. Graphical representation of these results was made to give a quick idea of the status. Interpretation of the overall outcomes was made which incorporates all the primary

and secondary data, references and interrelations within. Final report preparation was done using this interpretation.

Table No. 2.1 Categorization of university departments and support services at Shivaji University Campus.

BuildingBlock A	Administrative Building, Annex Building, Student Facility Centre, Distance Education.
BuildingBlockB	Chemistry, Zoology, Botany, Physics, Electronics, Mathematics, Statistics, Biochemistry, Environmental Science, USIC, Geography, Industrial Chemistry, Applied Chemistry, Computer Science, Technology, Food Science and Technology, Biotechnology, Microbiology, School of Nanoscience and Technology.
BuildingBlock C	Political Science, Sociology, Economics, History, Journalism and Mass Communication, Centre of Women studies, Adult and Continuing Education, Marathi, English, Hindi, Foreign Languages, Music and Dramatics, Education, Commerce and Management, Law, Gandhiyan Studies, Neharu studies, Dr. Ambedkar Studies, Community Development Centre, Social Exclusion and Inclusive Policies, Shahu Sanshodhan, YCSRD, Shivaji Maharaj Maratha History Centre, Bank of India Adhyasan, Bhagawan Mahavir Adhyasan, Vitthal Ramaji Shinde Adhyasan, Shardabai G. Pawar Adhyasan, Yashwantrao Chavan Adhyasan, Balasaheb Desai Adhyasan .
BuildingBlock D	Library and Information Science, Barrister Khardekar Library, Sports, Internet, Ladies Hostel, Boys Hostel, Ladies Hostel, (Technology), Boys Hostel (Technology), Vidyardhi Bhawan, Guest house, Health Centre.

Chapter III

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. Narendra Modi as 'Jal Shakti Abhiyan' 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.

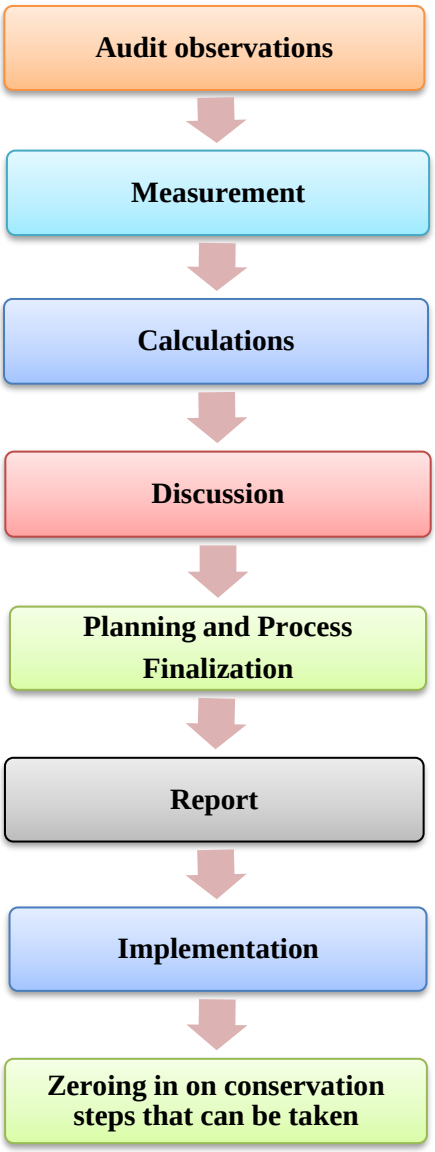
3.1 Importance of Water Audit:

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 1,00,000 requires 100 to 150 liters per person (capita) per day. The communities with a population can consume over 1,00,000 requires 150 to 200 liters person (capita) per day. As per the standards provided by WHO Regional office for South East Asia Schools require 2 liters per student; 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 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



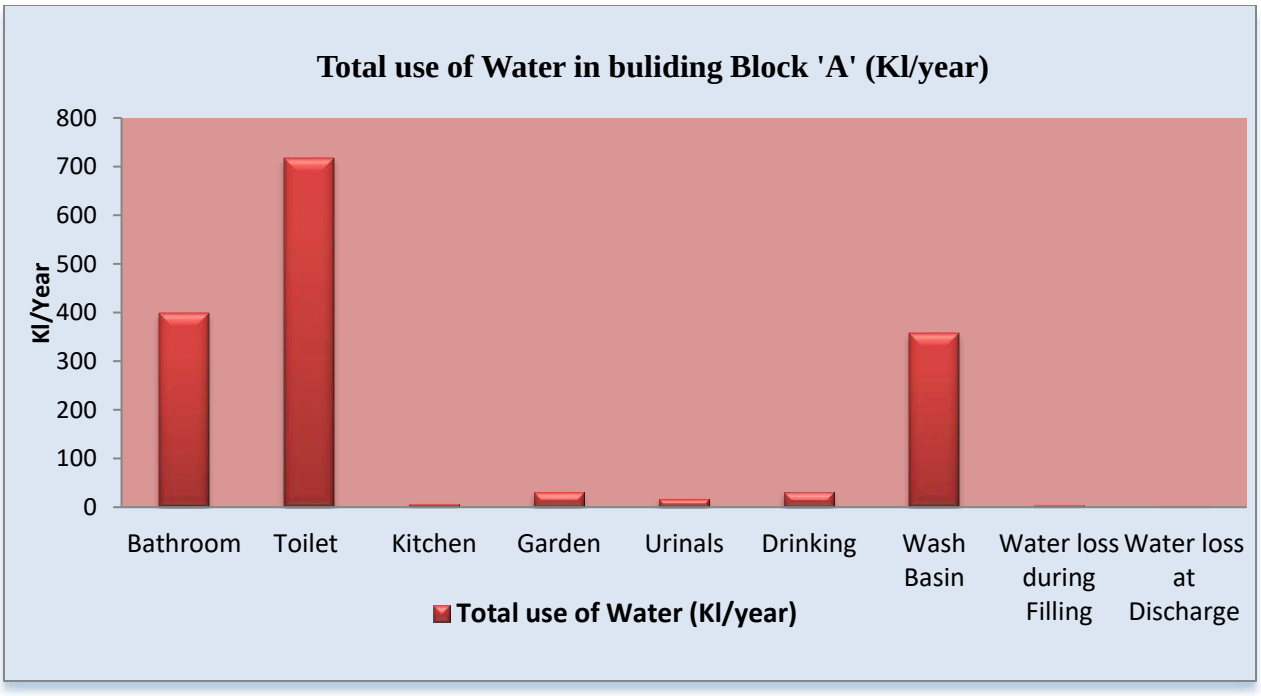
3.3Water consumption in University:

From the data collected for water audit of Shivaji University, Kolhapur for 2020-2021 the water distribution and water consumption pattern is noticed as follows. The University departments are grouped in different groups as given in the methodology such a) Building Block A (Administrative Facilities) b) Building Block B (Science and Technology) c) Building Block C (Commerce, Humanities and Social science) and d) Building Block D (Support Services)

3.3.1 The water consumption at Building Block A:

Table No. 3.1: Sector wise use of water in Building Block A.

Sr. No.	Sector	Total daily use (Kl/Day)	Total yearly use (Kl/Year)	Percentage %
1	Bathroom	3.98	397.65	25.5
2	Toilet	7.18	717.89	46.0
4	Kitchen	0.05	4.99	0.3
5	Garden	0.30	29.96	1.9
6	Urinals	0.17	17.01	1.1
7	Drinking	0.31	31.21	2.0
8	Wash Basin	3.75	357.23	22.9
9	Water loss during filling	0.03	3.12	0.2
10	Water loss at discharge	0.02	1.56	0.1
Total		**15.61**	**1560.62**	**100**



Graph No. 3.1 Total yearly water consumption at Building Block A

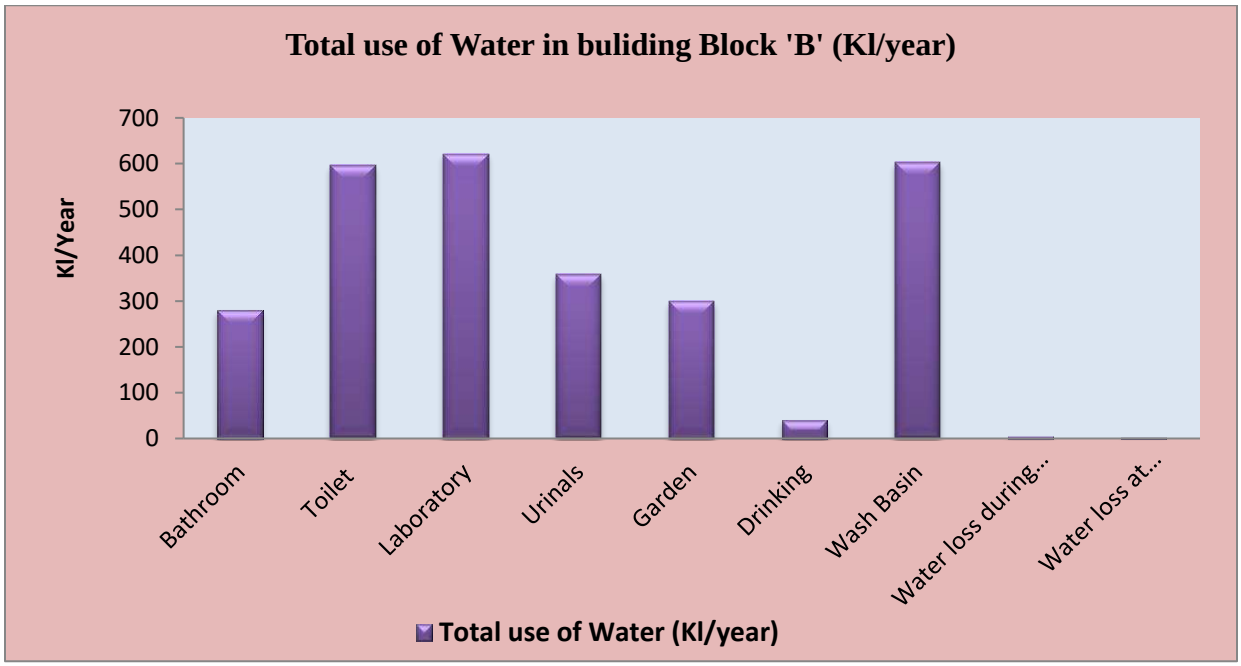
It is revealed from the data given in Table No. 3.1 and Graph No. 3.1 that total 15.61Kl of water is used daily and 1560.62Kl yearly. In the Building Block A total five departments are involved which use water for bathrooms, toilet, drinking, washbasin, kitchen and garden purpose. From above data it is observed that the maximum water consumption for toilet purpose is 7.18 Kl / day i.e. 717.89 Kl/year. Water for Bathrooms, Urinal and Kitchen consumed 397.65Kl/year, 17.01Kl/year and 4.99 Kl/year respectively. In case of Garden, water used yearly is 29.96 Kl while for drinking purpose less amount of water is required which is provided by R.O. water plant is 31.21 Kl per year. Water loss during filling of water in tank was noted as 3.12 Kl/year and water losses at discharge were found to be 1.56 Kl/ year.

3.2.2. Water consumption at Building Block B:

Table No. 3.2 Sector wise use of water in Building Block B.

Sr. No.	Sector	Total daily use (Kl)	Total yearly use (Kl)	Percentage %
1	Bathroom	2.79	279.03	9.96
2	Toilet	5.97	597.00	21.32

3	Laboratories	6.21	621.25	22.19
4	Urinal	3.57	357.15	12.75
5	Garden	2.99	299.00	10.68
6	Drinking	0.39	39.37	1.41
7	Wash Basin	6.02	601.90	21.50
8	Water loss during filling	0.04	3.71	0.13
9	Water loss at discharge	0.02	1.70	0.06
Total		**28.00**	**2800.11**	**100**



Graph No. 3.2 Total water consumption at Building Block B yearly

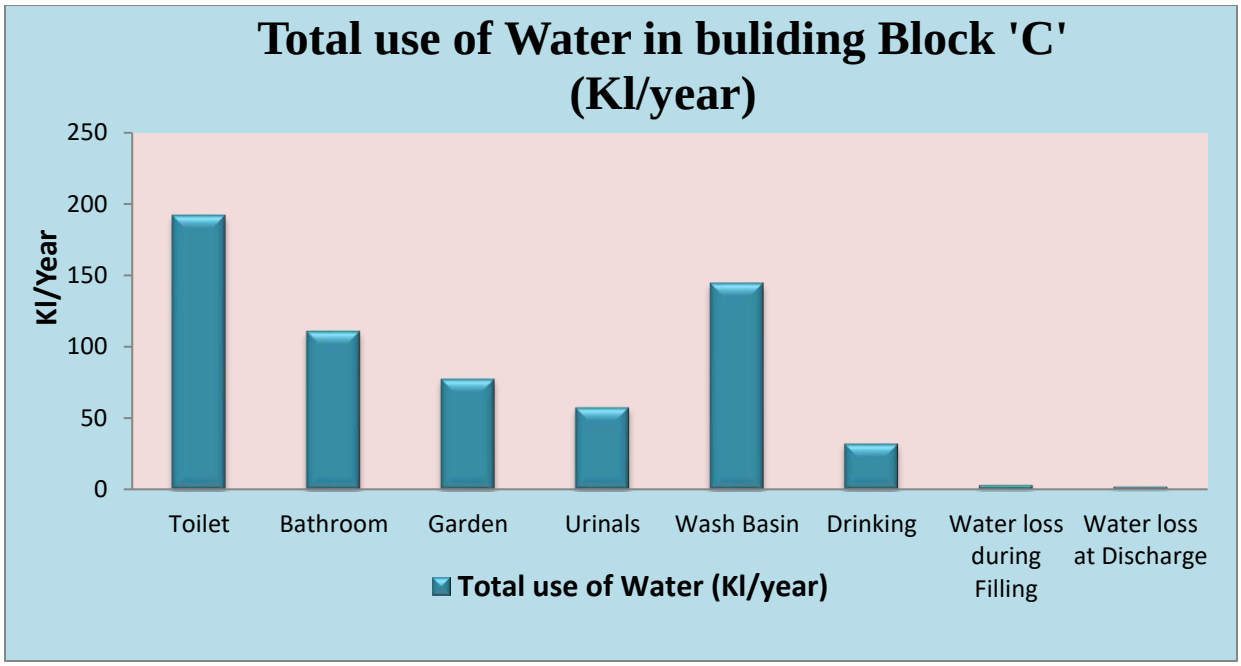
It is shown from the data given in table no. 3.2 and Graph No. 3.2 that total 28.00 Kl water is used daily in Building Block B and 2800.11 Kl yearly. In Building Block B water is used for bathroom, toilets, drinking, washbasin, laboratory, urinal and garden etc. purpose daily and yearly. From above data it is observed that the maximum water consumption was for

laboratory purpose which is 6.21 Kl/ day i.e. 621.25 Kl/year. The next water requirement is for wash basin and toilet. For washbasin and toilet purpose water used is 6.02 Kl and 5.97 Kl of water required daily while 601.90 and 597.00 Kilo litres yearly. Other sectors like bathroom, urinal and garden shows daily water consumption 2.79, 3.57 and 2.99 Kl and yearly 279.03, 357.15 and 299.00 Kilolitres respectively. In case of drinking purpose only 0.39 Kl while yearly 39.37 Kilolitres water is required . Water loss during filling of water in tank was also noted which was 0.04 Kl/day i.e. 3.71 Kilolitres/year and water losses at discharge were found to be 0.02 Kl /day i.e. 1.70 Kl/ year.

3.2.3 Water consumption at Building Block C.

Table No. 3.3: Sector wise use of water in Building Block C.

Sr. No.	Sector	Total daily use (Kl)	Total yearly use (Kl)	Percentage %
1	Toilet	1.92	191.80	31.02
2	Bath room	1.11	110.85	17.93
3	Garden	0.77	77.55	12.49
4	Urinal	0.57	57.23	9.25
5	Wash Basin	1.44	144.35	23.34
6	Drinking	0.31	32.00	5.17
7	Water loss during Filling	0.03	3.01	0.49
8	Water loss at Discharge	0.02	1.86	0.30
Total		**6.18**	**618.35**	**100**



Graph No. 3.3 Total water consumption at Building Block C.

It is revealed from the data given in table no. 3.3 and Graph No. 3.3 shows that total 6.18 Kl water is used daily and 618.35 Kl yearly. The Building Block Ctotal nine departments are involved which use water for bathrooms, toilet, drinking, wash basin and garden purpose for daily and also calculated yearly. From above data, it is observed that the maximum water consumption is for toilet purpose which is 1.92 Kl / day i.e. 618.35 Kl/year. Next use of water is for wash basin and then bathrooms which consumed 144.35 Kl/year and 110.85 Kl/year respectively. In case of urinal and garden water used yearly is 57.23 Kl and 77.55 Kl while for drinking purpose less amount of water is required which is provided by R.O water plant is 32.00 Kl per year. Water loss during filling of water in tank was noted as 3.01 Kl/year and water losses at discharge were found to be 1.86 Kl/ year.

3.2.4Water consumption at Building Block D:

Table No. 3.4 Sector wise use of water in Building Block D.

Sr. No.	Sector	Total daily use (Kl)	Total yearly use (Kl)	Percentage %
1	Toilet	10.08	1007.55	11.17

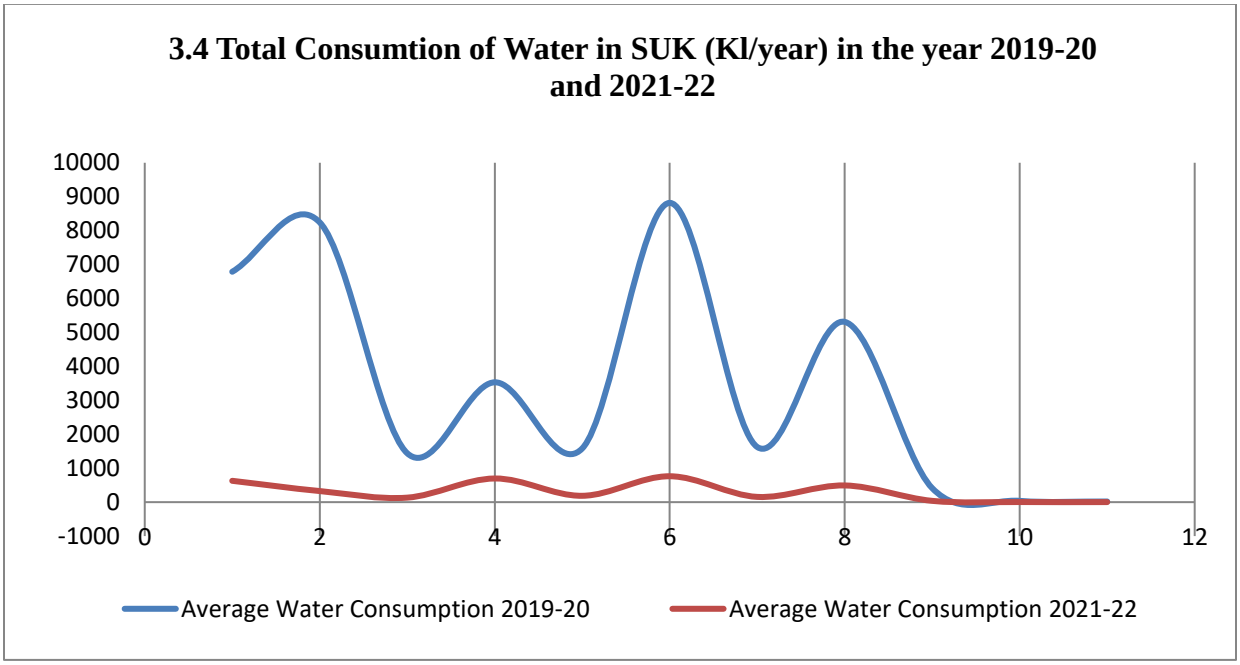
2	Bathroom	11.42	1142.77	14.46
3	Kitchen	5.29	528.8	5.86
4	Garden	9.02	901.5	9.99
5	Urinal	1.55	154.5	1.71
6	Wash Basin	21.43	2265.425	27.12
7	Shower	19.67	1967.35	21.80
8	Drinking	0.50	50.0185	0.55
9	Water loss during Filling	0.04	4.178	0.05
10	Water loss at Discharge	0.02	2.061	0.02
Total		**79.02**	**7901.503**	**100**

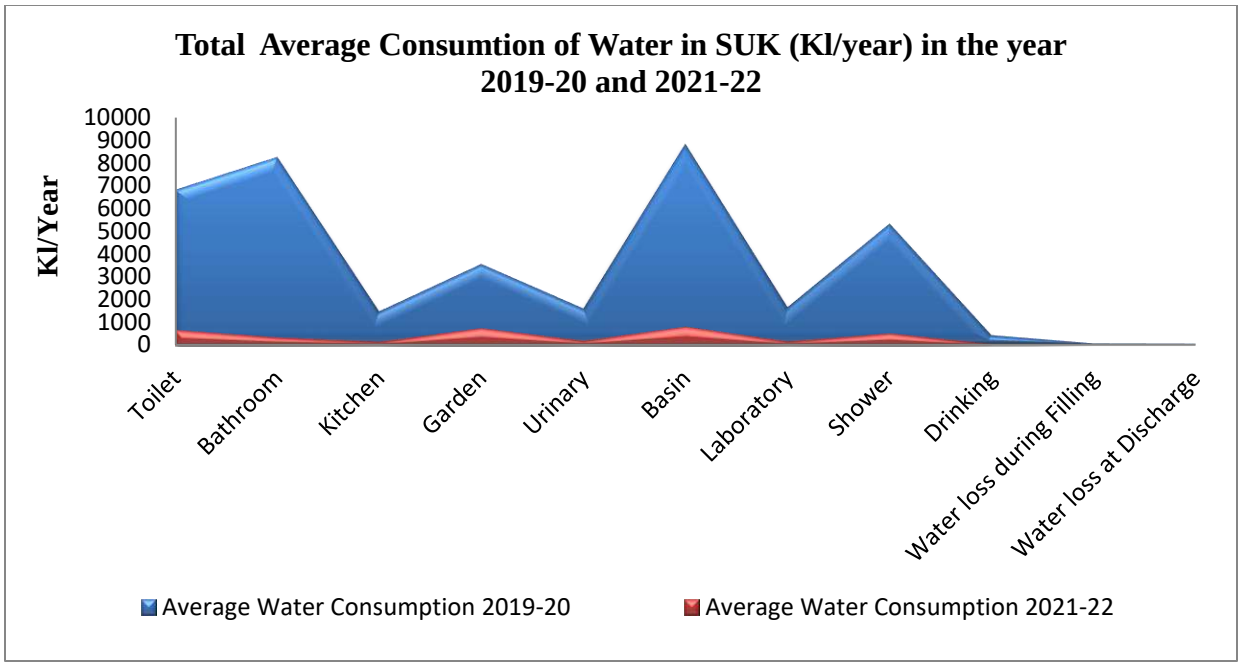
It is shown from the data given in table No. 3.4 that total 90.24Kl water is used daily in Building Block D and 9024.15 Kl yearly. In Building Block D total 21 department data is collected excluding Hostels as due to pandemic situation hostels were handover to covid centres. In Building Block D water is consumed for bathroom, toilets, drinking, wash basin, kitchen, shower, urinal and garden purpose daily. From above data it is observed that the water consumption is for bathroom purpose which is 14.46 Kl/ day i.e. 1142.77 Kl/year. The next water requirement is for wash basin and shower. For wash basin and shower purpose 21.43 Kl and 19.67 Kl per day while 2142.775 and 1967.35 Kilo litres respectively per year water is required. Other sectors like toilet, urinal and kitchen shows daily water consumption 10.08, 1.55 and 5.29 kilo litres and yearly 1007.55, 154.5 and 528.8 Kilolitres respectively. In case of garden purpose only 9.02 Kl and yearly 901.5 Kilolitres. For drinking purpose water is required 0.50 kilolitres per day while 4.178 Kilolitre per year. Water loss during filling of water in tank was also noted as 0.04 Kilolitres/day i.e. 4.178 Kilolitres/year and water losses at discharge were found to be 0.02 Kilolitres /day i.e. 2.061 Kl/ year.

3.2.5 Yearly water consumption at Shivaji University:

Table No. 3.5 Sector wise Average water consumption in Shivaji University.

Sites	Toilet	Bathroom	Kitchen	Garden	Urinary	Wash Basin	Laboratory	Other	Total
Water used in Kl/Year in 2019-20	6788.87	8242.97	1441.25	3530.83	1581.89	8817.13	1625.13	5781.14	37809.21
Water used in Kl/Year in 2021-22	628.56	327	133.45	697.08	187.08	763.24	155.31	535.28	3427
%	18.34	9.54	3.89	20.34	5.46	22.27	4.53	15.62	100





Graph No. 3.5Average yearly water consumption at Shivaji University, Kolhapur in the year 2019-20 and 2021.

Graph No. 3.5 shows the total amount of water consumed by all the Building Block of Shivaji University, Kolhapur in the year 2019-20 and year 2020-21. The graph shows Due to Covid-19 pandamic situation the teaching was done through online mode. More than four to five months students, teachers and administrative were working from home in the year 2020-21, because of lockdown more than 50 to 75 % reduction occurs in the use of water in all sectors. Wash basins, Toilets, shower and Garden are the major sources of water utilization comprising 22.27 %, 18.34 %, 14.35 % and 20.34 % respectively. The other uses namely Bhathrooms, urinals, laboratory and shower consume water with yearly water requirement of 9.54 %, 5.46 %, and 4.53 % respectively. In case of others includes water required for drinking purpose, water required for kitchen activity and loss of water during filling and during discharge. It was observed that the water required for drinking purpose is 1.11% while for kitchen it is 3.89%. In case of filling and discharging water loss is very much less, it is 0.1 and 0.05 % respectively.

3.3 Sustainable Water Practices (SWP):

3.3.1 Watershed management practices at Shivaji university campus.

Shivaji University, Kolhapur has become a front runner in water conservation and management of water available on the campus. Now university is self reliant through

decentralized water conservation and management practices. Following table shows the capacity of water reservoirs on campus in litres.

Table No. 3.6 Total capacity of Water Reservoirs on campus in Litre:

Sr.No	Sources	Capacity in Litres.
1	Bhasha Bhavan Lake	22.15 cr
2	Music Department Lake	5.20 cr
3	Sutar well	4 lakh
4	Well near sports department	4.87 lakh
5	Well near chemistry department	3 lakh
6	Well near synthetic track	5 lakh
7	Shinde well	3 lakh
8	Three farm ponds	40 lakh

Besides that the University has fulfil the suggestions given for water management by the Green Audit report 2019-20.

3.3.2 Desedimentation and rejuvenation of wells:

Out of five wells on campus, the 2 wells, i.e. a well near Synthetic Track and another near Sutar well, were sedimented completely containing very less water. It was decided to remove their sediment completely and to rejuvenate them, as they were having the underground water resources. Nearly 60 ft sludge was removed from them to open the all the water resources beneath it. During summer few of streams started flowing into wells, though in little. After desedimentation those wells were constructed with compound wall to avoid any mishap. The total cost of desedimentation and construction was nearly Rs.6 lac.

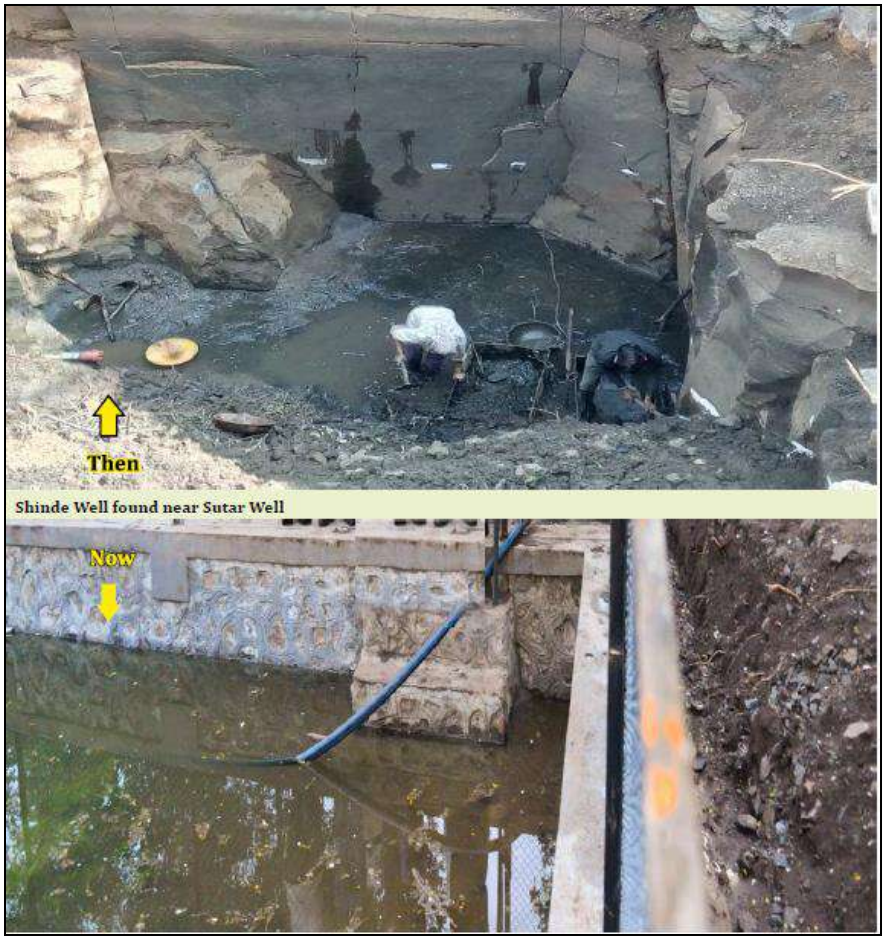


Plate No. 3.1 Shinde well found near Sutar well.

3.3.3 Construction of Wells through RUSA funding

University received funding from RUSA. Then Pro vice Chancellor and present Vice Chancellor of the university Prof. D. T. Shirke were able to please RUSA funding committee to approve grants for the ongoing rain water harvesting project. A well of 100 ft. Diameter and 55 ft. depth was constructed near the border of Rajendrnagar. The well is having maximum storage capacity of 50 lacs liters. Solar pump to lift the water from this well to central collection point at Sutar well is made operational. Also good quality water is supplied to the Boys Hostel from this well. In 2019 another point, at the west side of Meghnad Nageshkar Krida Sankul was indentified for well under RUSA funds. This well, with 66 ft. Diameter and 35 ft. depth was constructed. Even in the summer, this well is observed with full of water presently. The

maximum storage capacity of the well is 18 lac liters. The water from this well is used for RO plant, Gymkhana and Vidyarthi Bhavan.

Plate No. 3.2 Construction of new well near Gymkhana

3.3.4 Benefits to the Society

In 2019, this region faced heavy rain fall resulting into worst flood situation. All pump houses lifting water from reservoir for Kolhapur city were under water. With Flood water around the city, scarcity of drinking water was observed in Kolhapur city. During this difficult situation, University came forward by running its filter house round the clock and supplying around 40 lac litersof water to citizens and potable water to the Kolhapur Municipal Corporation.

Efforts of rain water harvesting by the University are also well appreciated by citizens. Due to these efforts of university, the level of underground water is increased considerably in nearby areas of University campus.

Plate No. 3.3 Water supply for Kolhapur city during flood situation

- The important benefit of water conservation practices is that the storage of nearly 31 cr. liters water is created on campus.
- The water supply from KMC is totally stopped which resulted into saving of money . University campus become self reliant for water.

- Ground water level in the University campus and nearby region is increased with such water conservation practices. With continued efforts, the storage capacity enhanced and university will be able to use its own stored water even if unfortunate drought and flood situation occurs in future.
- All stakeholders are getting pure and good quality water filtered at University Campus.

Chapter IV

Energy 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 are used in the premises. 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.

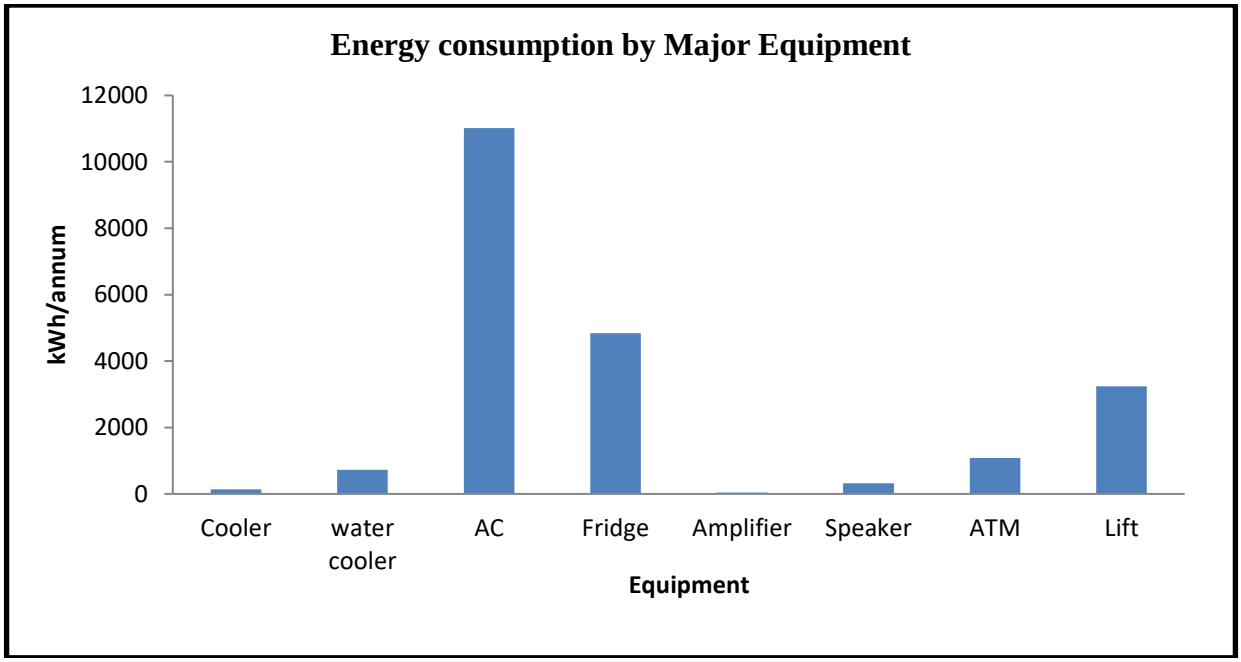
Energy sources utilized by all the departments, support services of Shivaji University, Kolhapur include electricity. Major use of the energy is at office, canteen, hostel and laboratories, for lighting, transportation, instruments. Electricity is supplied to the college campus by Maharashtra State Electricity Board also.

4.1.1 Electricity consumption in the Building Block A:

Building Block A includes Main building, Annex, Examination centre I, Examination centre II and Distance Education. The calculations are based on the data collected from all these buildings and actual observations taken at the site. The collected data shows that Building Block A has a number of major electricity consuming equipments which are 21,405.6 kWh/annum.

Table No. 4.1: Electricity consumption by major equipments in the Building Block A.

Sr. No.	Equipment	Number	kWh/annum
1	Cooler	4	135
2	Water cooler	3	729
3	AC	34	11,016
4	Fridge	2	4,838.4
5	Amplifier	2	43.2
6	Speaker	4	324
7	ATM	2	1,080
8	Lift	3	3,240
	Total	**54**	**21,405.6**



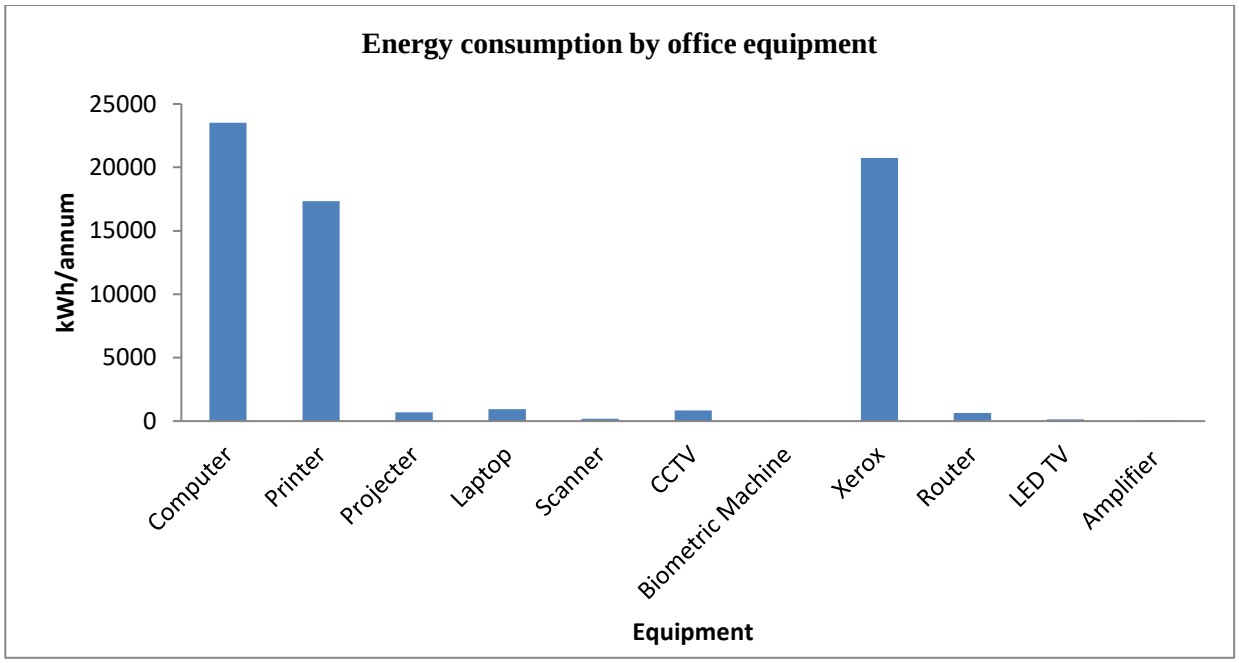
Graph No. 4.1: Electricity consumed by major equipments in the Building Block A.

Total Electricity consumption by major electricity consuming equipments in BuildingBlock A is 21,405.6 kWh/annum. As major electricity consuming equipments are AC is 34 in number which are consuming highest electricity i.e. 11,016kWh/annum. Number of fridges is 2 and the electricity consumption by them is 4,838.4 kWh/annum. It is followed by Lift 3,240 kWh/annum, ATM 1,080 kWh/annum, Water cooler 729 kWh/annum and Speaker 324 kWh/annum respectively.

Similarly, to analyze the electricity consumption of office equipments like computers, printers, laptops were also considered.

Table No. 4.2: Office equipments and their electricity consumption in Building Block A.

Sr No.	Equipment	Number	kWh/annum
1	Computer	498	23,530.5
2	Printer	102	17,334
3	Projector	5	688.5
4	Laptop	30	933.12
5	Scanner	3	194.4
6	CCTV	332	836.64
7	Biometric Machine	6	9.72
8	Xerox	40	20,736
9	Router	20	648
10	LED TV	8	138.24
11	Amplifier	2	69.98
	Total	**1,046**	**65,119.10**



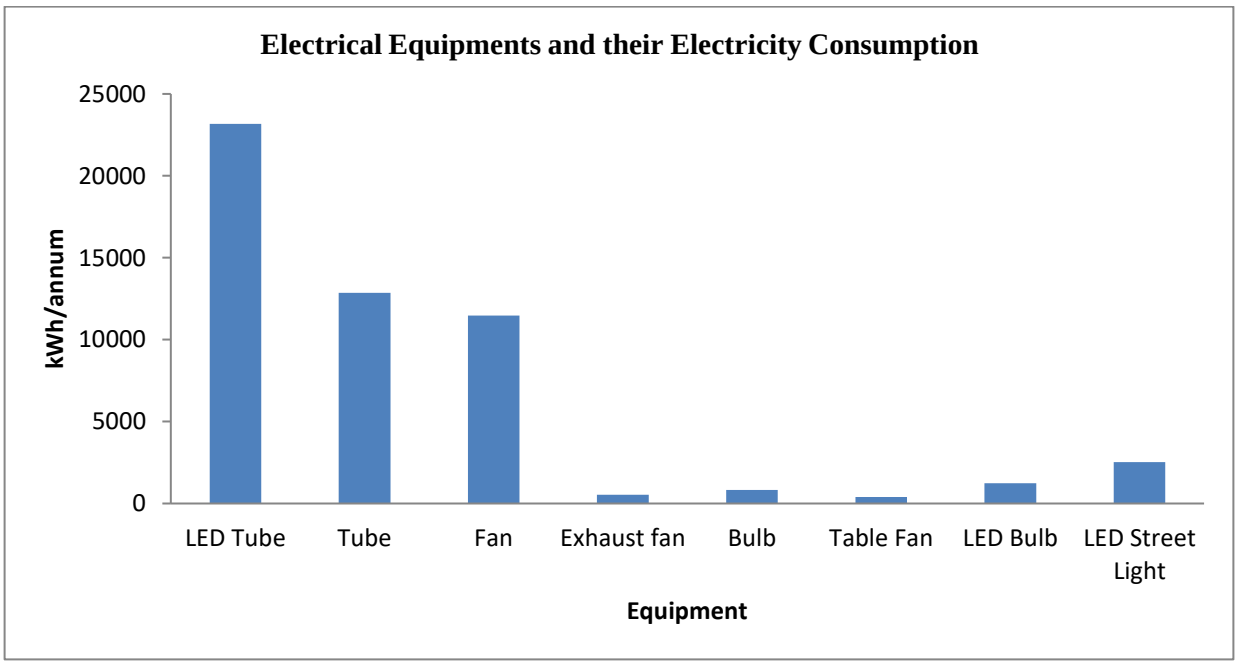
Graph No. 4.2: Office equipments and their electricity consumption in Building Block A.

Total number of office equipments consuming electricity at all departments is 65,119.10 kWh/annum. As office equipment, and number of computers is highest i.e. 498 than Printers, Laptops, LCD projectors and Xerox machine, the electricity consumed by computers is maximum i.e. (498) 23,530.5 kW/annum followed by Xerox machine (40) 20,736 kWh/annum, Printers (102) 17,334 kW/annum, Laptop (30) 933.12 kW/annum, CCTV (332) 836.64 kW/annum, respectively. Other equipments like biometry machine, scanner, amplifier, router etc, number is less and therefore, their consumption is also less.

Similarly, to analyze the electricity consumption, lights and fans and other illumination equipments were also considered.

Table No. 4.3: Number of fluorescent tubes, bulbs and fans and their electricity consumption in Building Block A.

Sr. No.	Equipment	Number	kWh/annum
1	LED Tube	745	23,172.48
2	Tube	850	12,852
3	Fan	590	11,469.6
4	Exhaust fan	37	543.45
5	Bulb	55	831.6
6	Table Fan	25	405
7	LED Bulb	320	1,244.16
8	LED Street Light	502	2,530.08
9	Lamp	32	117.504
	Total	**3,156**	**53,165.88**



Graph No.4.3: Electrical Equipments and their Electricity Consumption in Building Block A.

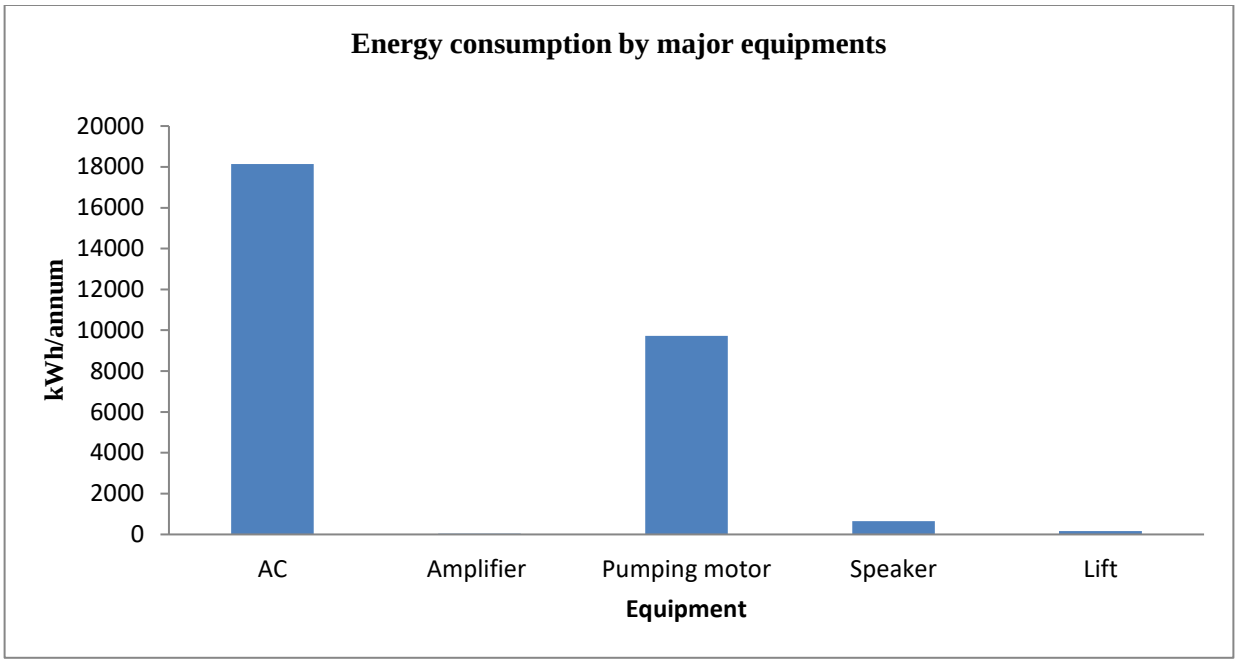
The maximum use of electricity is for lighting and fans in all the buildings in Building Block A. The total number of LED tubes is 745 and their consumption is 23,172.48 kWh/annum. The total number of ceiling fans is 590 and their electricity consumption is highest i.e. 11,469.6 kWh/annum and also the electricity consumed by LED Street light of 502 is 2,530.08 kWh/annum, LED bulb is 320 and their consumption is 1,244.16 kWh/annum, Bulb 55 and electricity consumption is 831.6 kWh/annum respectively. The consumption of other equipments such as table fan, lamp and exhaust fan number is very small as compared to other equipments.

4.1.2 Electricity Consumption in Building Block B.

Electricity is utilized at all Science Departments as many types of equipment are used in laboratory and some of them are run every day. Total 28,706.4kWh/annum of electricity is consumed in the laboratories alone.

Table No. 4.5: Electricity consumption by major electricity consuming equipments.

Sr. No.	Equipment	Number	kWh/annum
1	AC	56	18144
2	Amplifier	1	32.4
3	Pumping motor	20	9720
4	Speaker	20	648
5	Lift	1	162
	Total	**98**	**28,706.4**



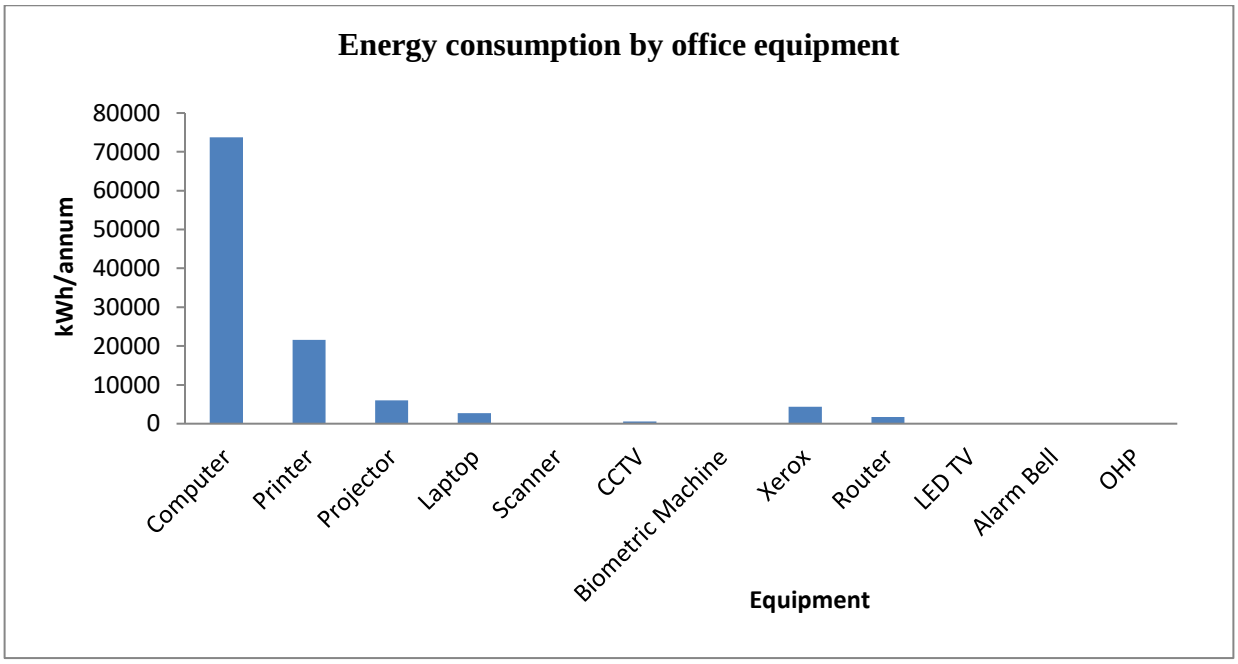
Graph No. 4.5: Electricity consumption by major electricity consuming equipments.

Total 28,706.4 kWh/annum of electricity is consumed by all Air Conditioners, Pumping Motors, Amplifiers, Speakers and Lift in Building Block B. In this block 56 Air conditioners utilize maximum electricity of 18,144 kWh/annum. Also, 20 pumping motors consume 9,720 kWh/annum. This is followed by 20 Speakers which are consuming 648 kWh/annum, 1 Lift which are consuming i.e. 162 kWh/annum, 1 Amplifiers consuming i.e. 32.4 kWh/annum respectively.

Table No. 4.6: Office equipments and their electricity consumption in Building Block B.

Sr. No.	Equipment	Number	kWh/annum
1	Computer	910	73,710
2	Printer	133	21,546
3	Projector	37	5,994
4	Laptop	67	2,713.5
5	Scanner	5	64.8

6	CCTV	225	567
7	Biometric Machine	12	19.44
8	Xerox	10	4,320
9	Router	54	1,749.6
10	LED TV	10	172.8
11	Alarm Bell	10	1.62
12	OHP	1	89.1
	Total	**1,474**	**1,10,947.86**



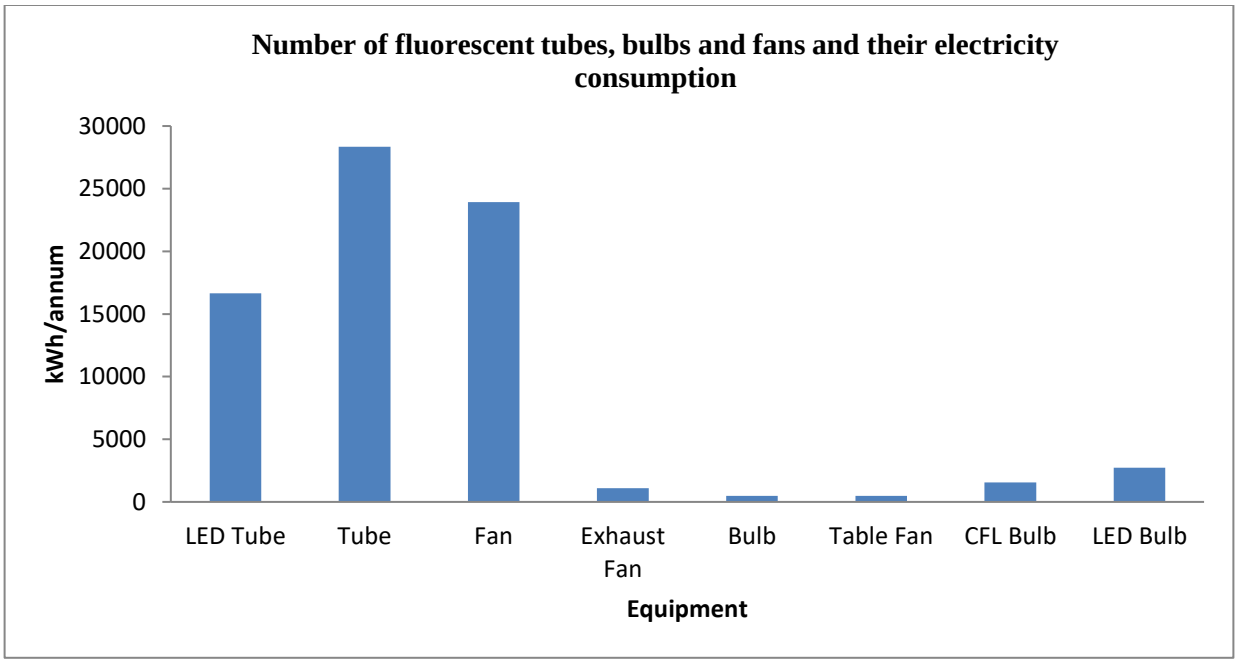
Graph No.4.6: Office equipments and their electricity consumption in Building Block B.

The total number of office equipments at all Science departments i.e. Building Block B electricity consumption is 1,10,947.86 kWh/annum. As office equipments, number of computers is highest i.e. 910 than Printers, Laptops, LCD projectors and Xerox machines. The electricity consumption by computers is also maximum i.e. 73,710 kWh/annum followed by 133 Printers

energy consumption is 21,546 kWh/ annum, 37 Projector and consumption i.e. 5,994 kWh/annum, 10 Xerox machines electricity consumption is 4,320 kWh/annum, 67 Laptop and their electricity consumption is 2,713.5 kW/annum respectively and other equipments like biometry machine, scanner and routers etc. consumption is less.

Table No. 4.7: Number of fluorescent tubes, bulbs and fans and their electricity consumption in Building Block B.

Sr No.	Equipment	Number	kWh/annum
1	LED Tube	428	16,640.64
2	Tube	1,500	28,350
3	Fan	985	23,935.5
4	Exhaust Fan	60	1,101.6
5	Bulb	21	476.28
6	Table Fan	25	486
7	CFL Bulb	80	1,555.2
8	LED Bulb	280	2,721.6
	Total	**3,379**	**75,266.82**



Graph No.4.7: Number of fluorescent tubes, bulbs and fans and their electricity consumption in Building Block B.

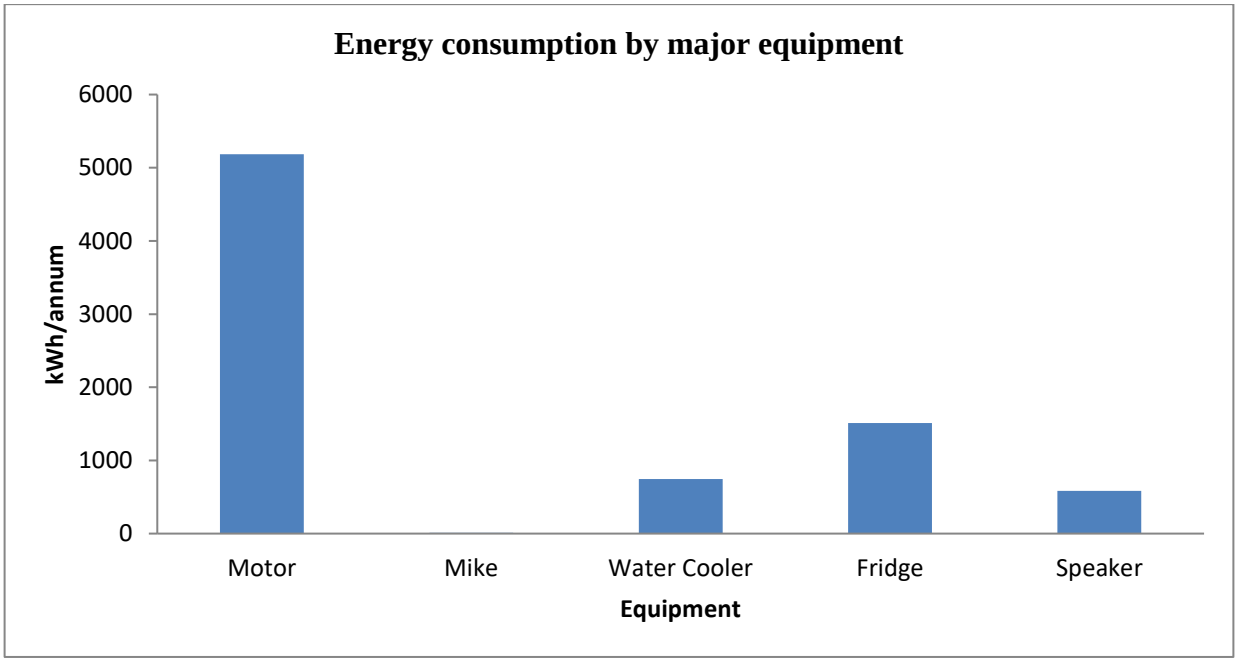
The total number of fluorescent tubes is highest i.e. 1500 and their electricity consumption is also highest i.e. 75,266.82 kWh/annum. In the Building Block B total number of fans is 985 and their electricity consumption is maximum i.e. 23,935.5 kWh/annum. Followed by LED tubes i.e. (428)16,640 kW/annum, LED bulb i.e. (280) 2,721.6 kWh/annum, CFL bulb i.e. (80) 1,555.2 kWh/annum, Exhaust fan i.e. (60) 1,101.6 kWh/annum respectively and other equipment i.e. table fan, table lamp, bulb etc. but their electricity consumption is less.

4.1.3 Electricity consumption in Building Block C.

Table No. 4.8: Electricity consumption by major electricity consuming equipments in Building Block C.

Sr. No.	Equipment	Number	kWh/annum
1	Motor	8	5184
2	Mike	4	12.96

3	Water Cooler	4	745.2
4	Fridge	15	1512
5	Speaker	18	583.2
	Total	**49**	**8037.36**

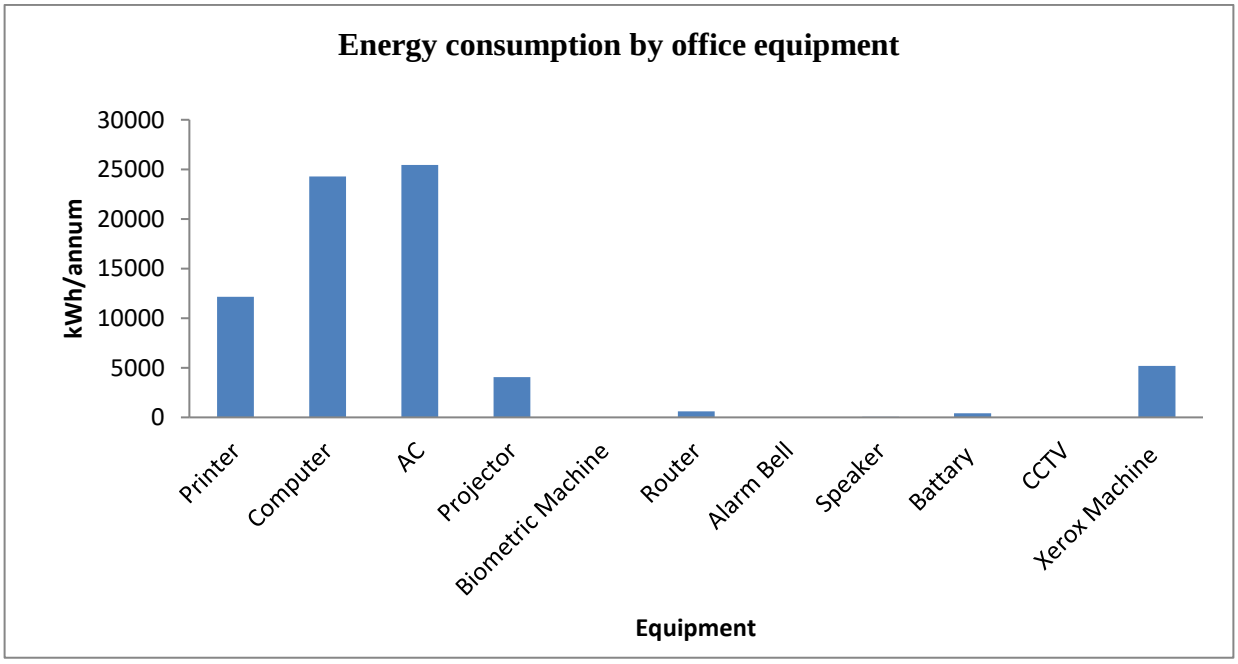


Graph No. 4.8: Electricity consumption by major electricity consuming equipments in Building Block C.

Total 8,037.36kWh/annum of electricity is consumed by all fridge, pumping motor, water cooler, speaker and mike in Building Block C. In this Block 8 motors utilize maximum electricity of 5,184 kWh/annum, which is followed by fridges i.e. (15) 1,512 kW/annum, 4 water cooler consume 745.2 kWh/annum, and speakers i.e. 387.6 kW/annum respectively.

Table No. 4.9: Office equipments and their electricity consumption in Building Block C.

Sr. No.	Equipment	Number	kWh/annum
1	Printer	75	12,150
2	Computer	300	24,300
3	AC	23	25,461
4	Projector	30	4,050
5	Biometric Machine	2	3.24
6	Router	19	615.6
7	Alarm Bell	2	0.18
8	Speaker	10	54
9	Battery	20	408.24
10	CCTV	15	37.8
11	Xerox Machine	10	5,184
	Total	**506**	**72,264.06**

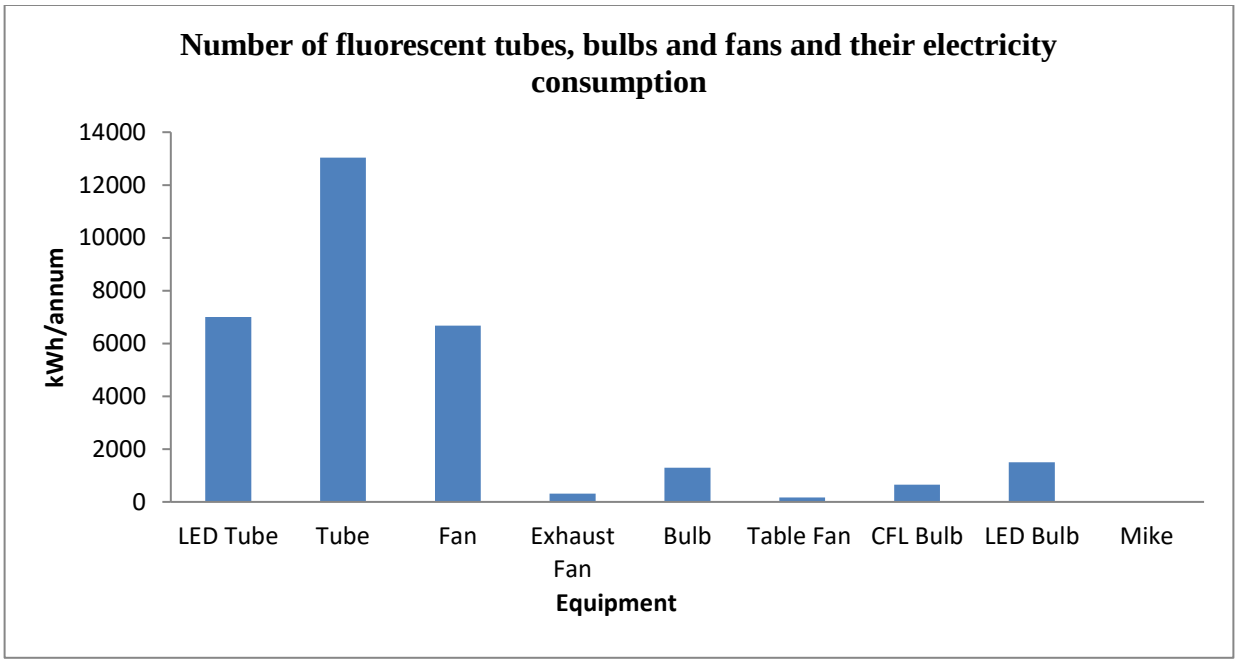


Graph No.4.9: Office equipments and their electricity consumption in Building Block C.

The electricity consumption of office equipments at all buildings from Building Block C is 72,264.06 kWh/annum. In the office equipments the number of computers is highest i.e. 300 than Printers, Laptops, Projectors and Xerox machine. The electricity consumed by AC is also maximum i.e. (23) 25,461 kWh/annum followed by Computer (23) 24,300 kWh/annum, Printers (75) 12,150 kWh/annum, Xerox machine (10) 5,184 kWh/annum, Projector (30) 4,050 kWh/annum respectively and other equipment like biometry machine, CCTV, Laptop, scanner and number is less and therefore, their consumption is less.

Table No.4.10: Number of Fluorescent Tubes, Bulbs and Fans and their electricity consumption in Building Block C.

Sr. No.	Equipment	Number	kWh/annum
1	LED Tube	180	6,998.4
2	Tube	690	13,041
3	Fan	412	6,674.4
4	Exhaust Fan	17	312.12
5	Bulb	80	1,296
6	Table Fan	10	162
7	CFL Bulb	135	656.1
8	LED Bulb	185	1,498.5
9	Mike	4	10.8
	Total	**1,713**	**30,649.32**



Graph No.4.10: Number of fluorescent tubes, bulbs and fans and their electricity consumption in Building Block C

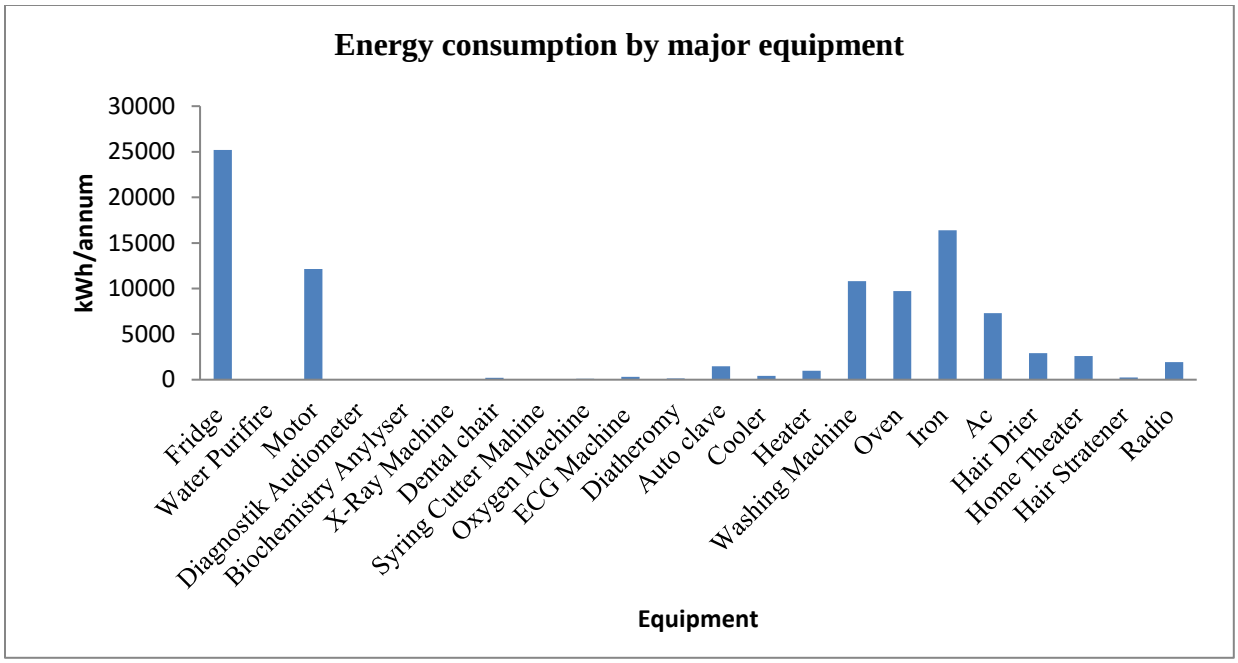
The total number of fluorescent tube is highest i.e. 690 and their electricity consumption is 13,041 kWh/annum. Total number of LED Tube in Building Block C is 180 and their electricity consumption is maximum i.e. 6,998.4 kWh/annum. It is followed by Fan i.e. (412) kWh/annum, LED Bulb i.e. (185) 1,498.5 kWh/annum, Bulb i.e. (80) 1,296 kWh/annum, CFL bulb (135) 656.1 kWh/annum respectively. The equipments like table fan, table lamp, are less in number and their consumption is less as compared to other equipments.

4.1.4 Electricity consumption at Building Block D:

Building Block D includes Support services like Ladies hostel, Boy's hostel, Canteen, Gymkhana, Library , Quarters, Guest House and Health centre the collected data shows that the Support services has maximum number of major electricity consuming equipments and electricity consumption is 93,010.93 kWh/**a**nnum.

Table No. 4.11. Electricity consumption by major electricity consuming equipment in building block D.

Sr. No.	Equipment	Number	kWh/annum
1	Fridge	25	25,200
2	Water Purifier	4	58.32
3	Motor	25	12,150
4	Diagnostic Audiometer	1	8.1
5	Biochemistry Analyzer	1	2.59
6	X-Ray Machine	1	74.52
7	Dental chair	1	194.4
8	Siring Cutter Machine	1	32.4
9	Oxygen Machine	1	113.4
10	ECG Machine	1	324
11	Diathermy	1	129.6
12	Auto clave	1	1,458
13	Cooler	10	405
14	Heater	2	972
15	Washing Machine	29	10,805.4
16	Oven	10	9,720
17	Iron	46	16,394.4
18	AC	10	7,290
19	Hair Drier	6	2,916
20	Home Theater	5	2,592
21	Hair Stratener	7	226.8
22	Radio	40	1,944
	Total	**228**	**93,010.93**



Graph No.4.11: Electricity consumption by major instruments in Building Block D.

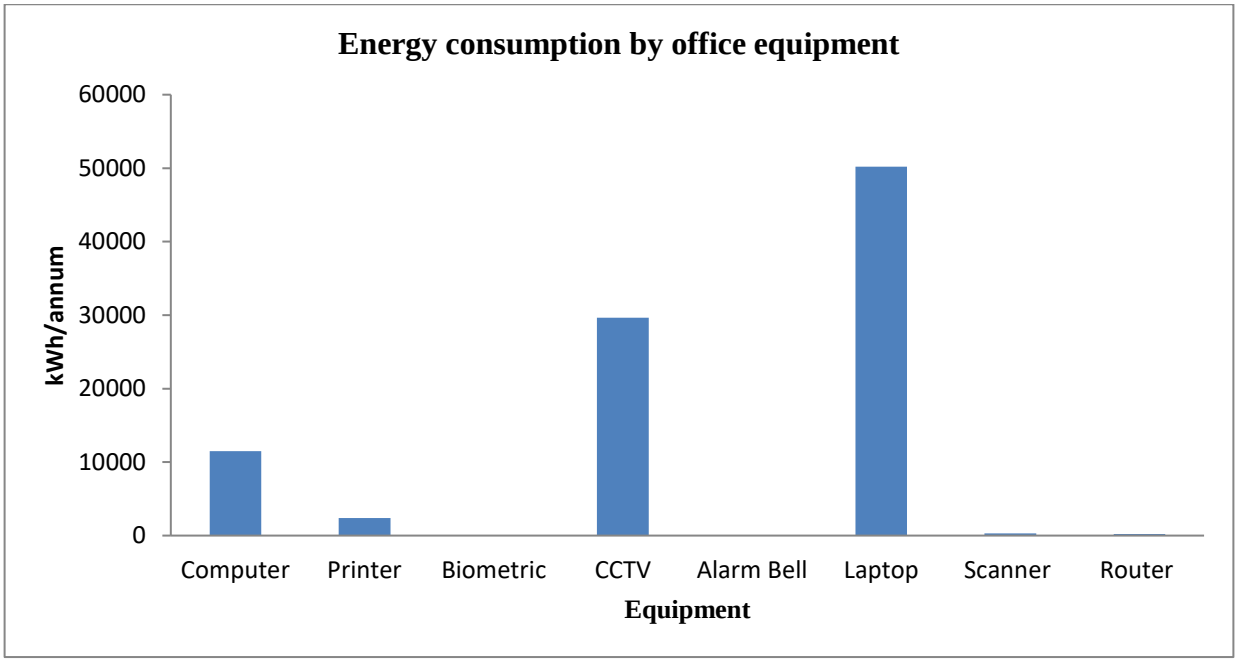
Total number of major electricity consuming equipments in Building Block D is 228 and electricity consumption is 93,010.93kWh/annum. Major electricity consuming equipments, number of Fridge is 25 and electricity consumption is highest i.e. 25,200 kWh/annum. Number of Iron is 46 in Building Block D but the electricity consumption is maximum i.e. 16,394.4 kWh/annum which is followed by Motors i.e. (25) 12,150 kWh/annum, Washing machine (29) i.e. 10,805.4 kWh/annum, oven i.e.(10) 9,720 kWh/annum respectively.

Similarly, the electricity consumption of office equipments like computers, printers, laptops were also considered.

Table No. 4.12: Office equipments and their electricity consumption in Building Block D.

Sr. No.	Equipment	Number	kWh/annum
1	Computer	170	11,475
2	Printer	44	2,376
3	Biometric	12	69.98
4	CCTV	490	29,635.2

5	Alarm Bell	15	32.4
6	Laptop	310	50,220
7	Scanner	7	302.4
8	Router	59	191.16
	Total	**1,107**	**94,302.14**



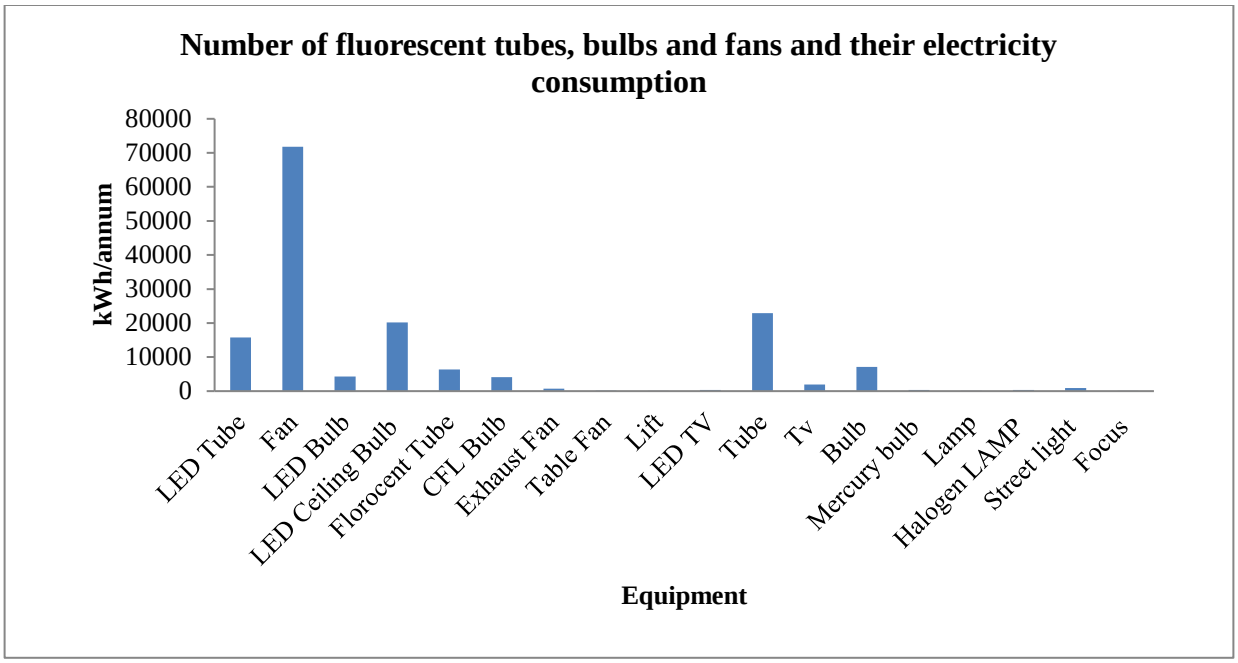
Graph No. 4.12: Office equipments and their electricity consumption in Building Block D.

Total number of office equipments in Building Block D electricity consumption is 94,302.14kWh/annum. Laptop number is 310 and electricity consumption is maximum i.e. 50,220 kWh/annum, followed by CCTV i.e. (490) 29,635.2 kWh/annum, computer (170) 11,475 kWh/annum, Printer (44) 2,376 kWh/annum respectively and the equipment like biometry machine, scanner, router etc. as their number is less and consumption is respectively less.

Similarly, to analyze the electricity consumption, lights and fans were also considered.

Table No. 4.13: Number of fluorescent tubes, bulbs and fans and their electricity consumption in Building Block D.

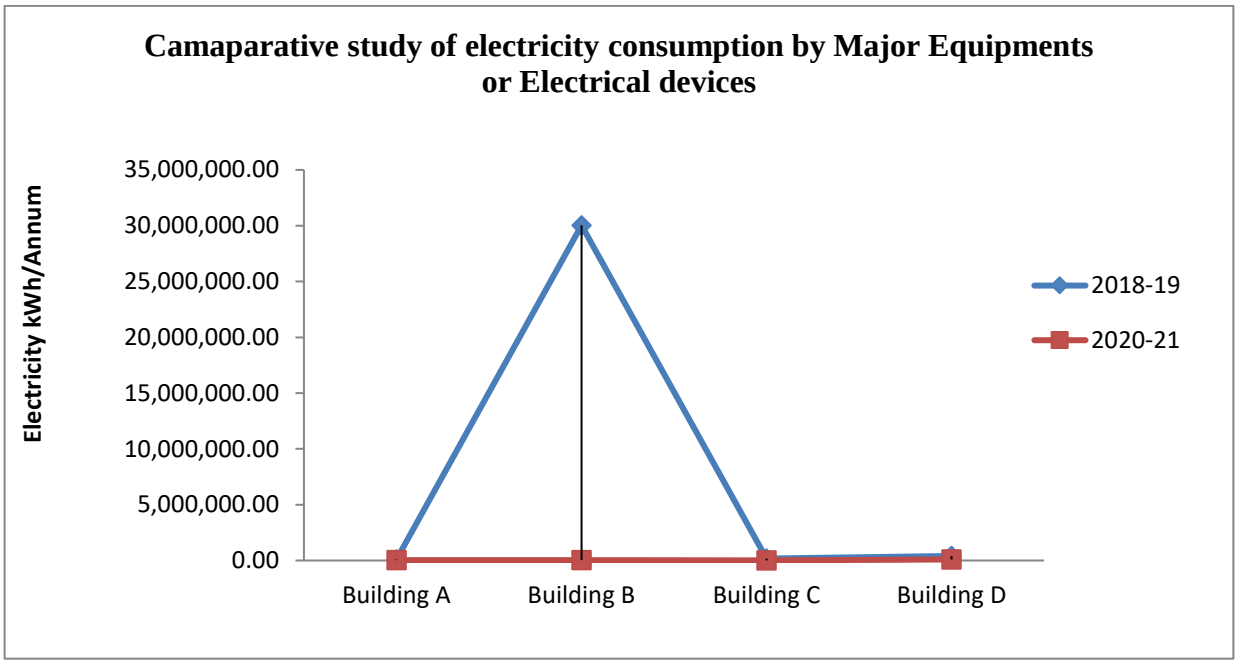
Sr. No.	Equipment	Numbers	kWh/annum
1	LED Tube	156	15,724.8
2	Fan	1,900	71,820
3	LED Bulb	300	4,320
4	LED Ceiling Bulb	1,400	20,160
5	Florescent Tube	548	6,312.96
6	CFL Bulb	188	4,060.8
7	Exhaust Fan	105	756
8	Table Fan	24	172.8
9	Lift	1	17.92
10	LED TV	10	345.6
11	Tube	4,233	22,858.2
12	TV	92	1,987.2
13	Bulb	1,100	7,128
14	Mercury bulb	25	324
15	Lamp	41	88.56
16	Halogen Lamp	20	388.8
17	Street light	40	921.6
18	Focus	1	4.32
	Total	**10,184**	**1,57,391.56**



Graph No.4.13: Number of fluorescent tubes, bulbs and fans and their electricity consumption Building Block D.

The total number of Fan is 1,900 and their electricity consumption is 71,820 kWh/annum. The total number of Tubes are 4,233 and their electricity consumption is 22,858.2 kWh/annum, which is followed by LED ceiling bulb i.e. (1,400) 20,160 kWh/annum, LED Tube i.e.(156) 15,724.8 kWh/annum, Florescent tube (548) 6,312.96 kW/annum respectively and equipments like mercury bulb, table fan, lamp, halogen lamp, street light, and focus etc. number is less and therefore, their consumption is comparatively less.

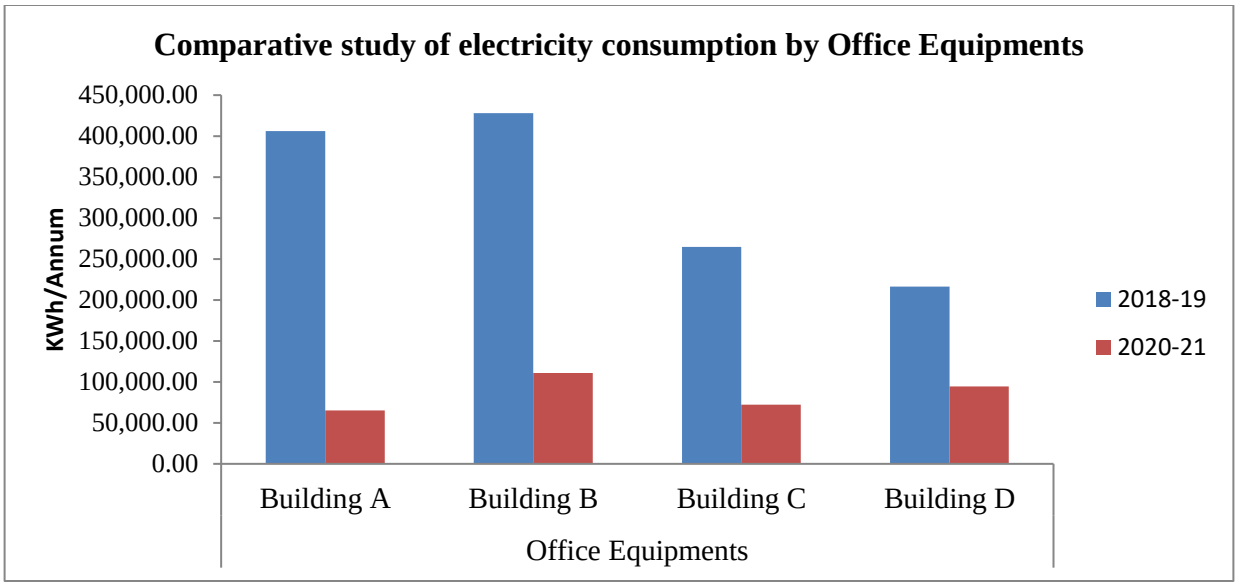
4.1.5 Comparative study of electricity consumption by electric equipments:



Graph No.4.14: Electricity consumption by electrical devices in Shivaji University premises during 2018-19 and 2020-21

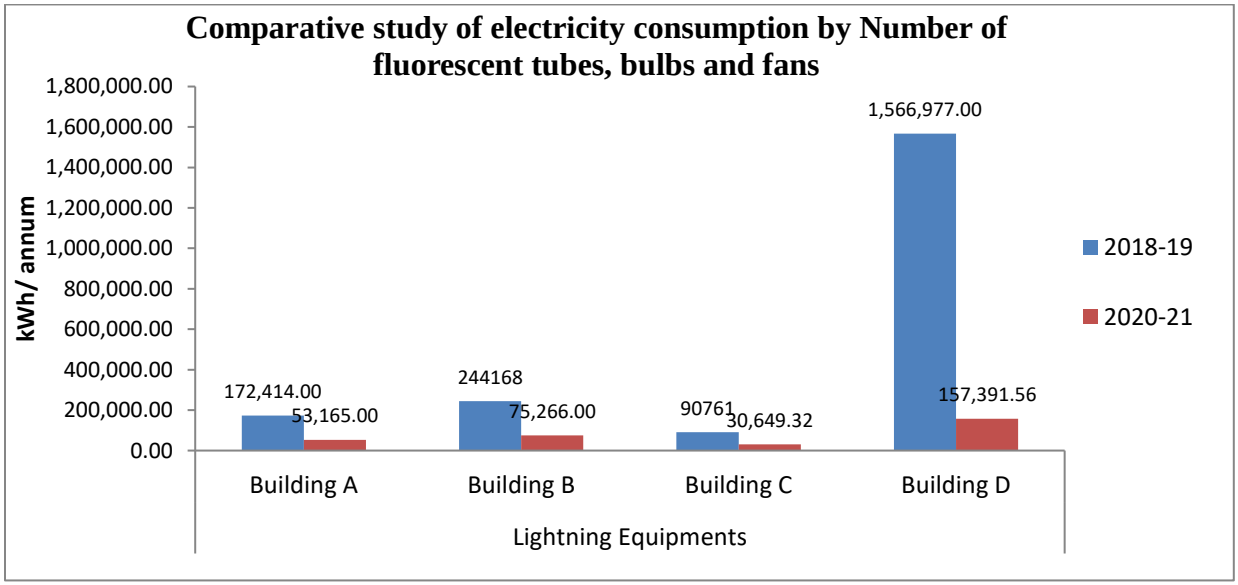
As per the data of 2018-19, highest consumption of electricity was observed in building B. This is because of Building B includes all science departments which have major electricity consumptive equipments. These equipments are majorly used for research, analysis and consultancy purpose. In year 2020-21, the Covid - 19 situations is accountable for less use of these equipments; as less manpower was present on the campus. Hence the graph shows drastic decrease in electricity consumption of building B.

Overall all buildings blocks on SUK showed or recorded less consumption of electricity due to lockdown period. Some hostels, guest house, canteens were closed during 2020-21. Therefore, drastic change is seen in use of electricity. Building D recorded highest consumption of electricity i.e., 93,010.00 kWh/annum. The building D includes all support systems including hostels, Quarters, Health Centre etc., among these support systems, hostels are acquired by Government Organization for covid-19 centre.



Graph No.4.15: Comparative study of electricity consumption by office Equipments

According to 2018-19 data, Office equipments from building B and Building A consume more electricity i.e 428082 kWh/annum and 4,06,200.00 kWh/annum respectively, because of computer, printers, Xerox machine, CCTVs etc. During 2020-21, electricity consumption of building B is reduced by 20 %. The attendance notification by Government of Maharashtra causes less consumption of electricity, on contrary online lectures and practicals consume more electricity at a same time.



Graph No. 4.16Comparative study of electricity consumption by Number of fluorescent tubes, bulbs and fans and their electricity consumption

The 2018-19 data shows that the Building D which is hostels, guest house, quarters, etc. this are included in the support services. The higher energy consumption rate is 15, 66,977.00 kWh/annum. Because of Tube light, Bulb, Fan etc. While in 2020-21, electricity consumption of building D is reduced by 9.12 %.

4.1.5 Solar Panel:

Solar energy is the radiation of the Sun capable of producing heat, causing chemical reaction or generating electricity. The total amount of solar energy incident on Earth is vastly in excess of the world's current and anticipated energy requirement. If suitably harnessed, this highly diffused source has the potential to satisfy all future energy needs. In 21st century solar energy is accepted to become increasingly attractive as a renewable energy source because of its inexhaustible supply and its non polluting character, in stark contrast to the finite fossil fuels, coal, petroleum, natural gas. The potential for solar energy is enormous, since about 200,000 times the world's total daily electric- generating capacity is received by earth every in the form of solar energy.

Photo Plate No. 4.1. Administrative building and chemistry department has installed the solar panel

Shivaji University has installed two solar panels 100 kW in Administrative Building, and 80 kW in Chemistry Department for converting to renewable energy resource. In addition, 4 inverters with the capacity of 25 kW and 3 others with the capacity of 27 kW are installed for energy storage purposes, which is a great initiative taken by the institute for sustainable future. This electricity produced is fed to MSEB feeder line with electric meter and the same units of electricity will be deducted from the electricity bill of university. There is ample scope to generate solar electricity on the campus. This will help the University for Energy Generation purposes.

- **Use of LED lights**

The time university has taken a policy decision to replace all road side street light lamps. These LED bulbs and tube lights will reduce consumption of electricity.

- **Awareness programme on use of renewable energy on University campus:**

The energy conservation programmes are conducted in various departments like Environmental Science, Energy Technology, and Department of Technology etc. A unique programme of Petroleum ministry named PCRA energy conservation programme is conducted in Department of Environment Science and Department of Energy Technology. The electricity week is also observed in the university through Engineering Section.

4.1.6 Key Observation:

- University has replacing old computers and an instrument with ones having energy efficiency certifications is the easiest way to conserve energy at university.
- The energy consumption of equipments is more than office equipments and fluorescent lamps.
- Electricity consumption is less because college, canteen, and hostel were closed due to the Covid-19 pandemic situation.
- In Covid -19 Boys Hostel1 and 2 given to the Government organization for Covid patient.
- As per the 2018-19 year the less electricity consumption in year 2020-21, the Covid - 19 situations is accountable for less use of equipments; hence drastic decrease in electricity consumption.

Chapter V

5.1 Solid waste audit of the university:

Solid waste management is a term that refers to the process of collecting and treating solid wastes. Solid waste generation and its management is a burning issue in current days. As long as people have been living in settlements, garbage and solid waste has been an issue.The rate of generation of solid waste is very high and yet we do not have adequate technology to manage the generated waste. Unscientific handling of solid waste can create threats to public health and environmental safety issues. 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.

There are two basic sources of solid waste: Non municipal and municipal. Non municipal solid waste is the discarded solid material from industry, agriculture, oil mining and gas production, construction materials, ash scrubber, sludge and pesticides containers. Municipal solid waste is material from residences and city building. It consists of garbage, wooden pieces, plastic bottles and carry bags, food wrappers, paper waste food waste etc.

There are main three types:

1) Sources based-Municipal solid waste, Industrial waste, Institutional, Commercial waste, biomedical waste, Agricultural waste
2) Type based-Garbage, Rubbish, bulk waste, ashes, street wastes, Dead animals, construction and demolition wastes, sewage waste, sludge, plastics, mining wastes radioactive waste.
3) Property based –Biodegradable /Organic waste non-biodegradable, inorganic waste, hazardous waste, nonhazardous waste.

Solid waste management reduce or eliminates the adverse impact on the environment and public health. A number of processes are involved in efficiently managing waste for a municipality. These include monitoring collection, transport, processing, open dumping and

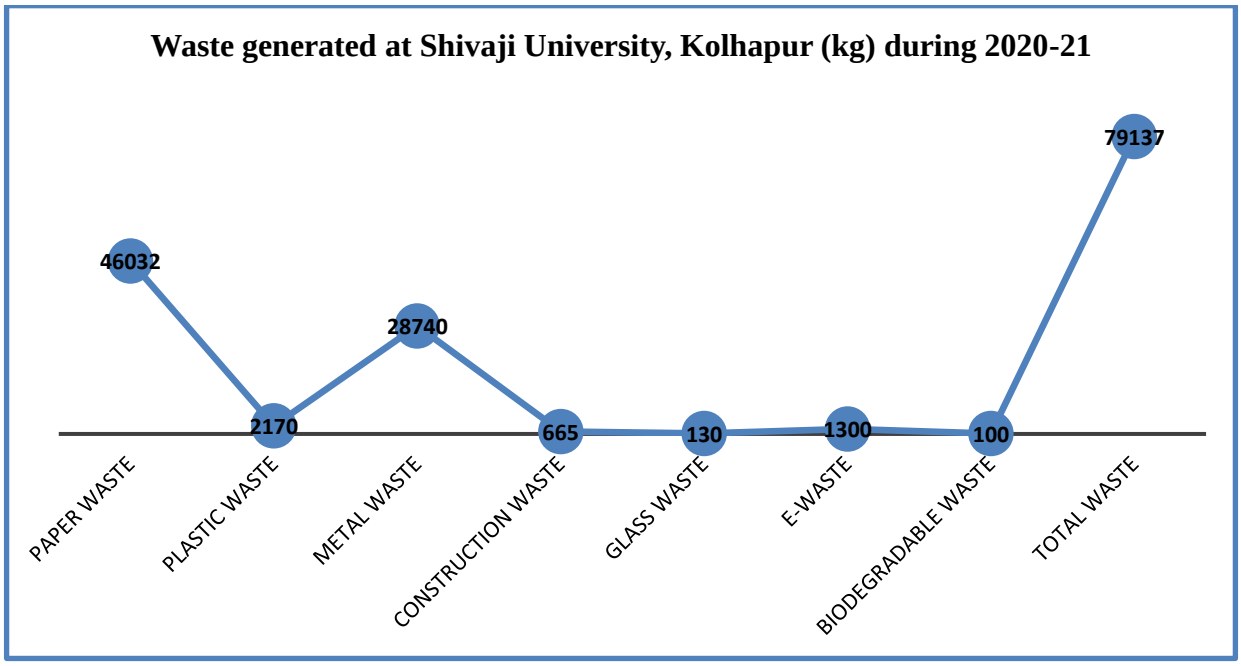
burning, land filling, incineration, pyrolysis, composting, reusing, recycling and reducing.It is necessary to manage the solid waste properly to reduce the load on waste management system.

The purpose of this audit is to find out the quantity volume, type and current management practice of solid waste generation in shivaji university campus during 2020-21.For the audit purpose, data was collected from store section of Shivaji University.

5.1.1 Generation of solid waste in university:

Table No.5.1: Category wise solid waste generation in university in the year of 2020-21

Category of waste	Paper waste	Plastic waste	Metal Waste	Construction waste	Glass waste	E-waste	Biodegradable waste	Total waste
Quantity (Kg)	46,032	2,170	28,740	665	130	1,300	100	79,137



Graph No. 5.1: Category wise solid waste generation in universityduring 2020-21.

The average amount of solid waste generated during 2020-21 in Shivaji University, Kolhapur was approximately 79,137kg. On the basis of observations, the highest quantity of solid waste generated is paper waste which is about 46,032 kg. It includes newspapers, used office work papers, press cuttings, thesis after their preservation period. Metal waste constitute

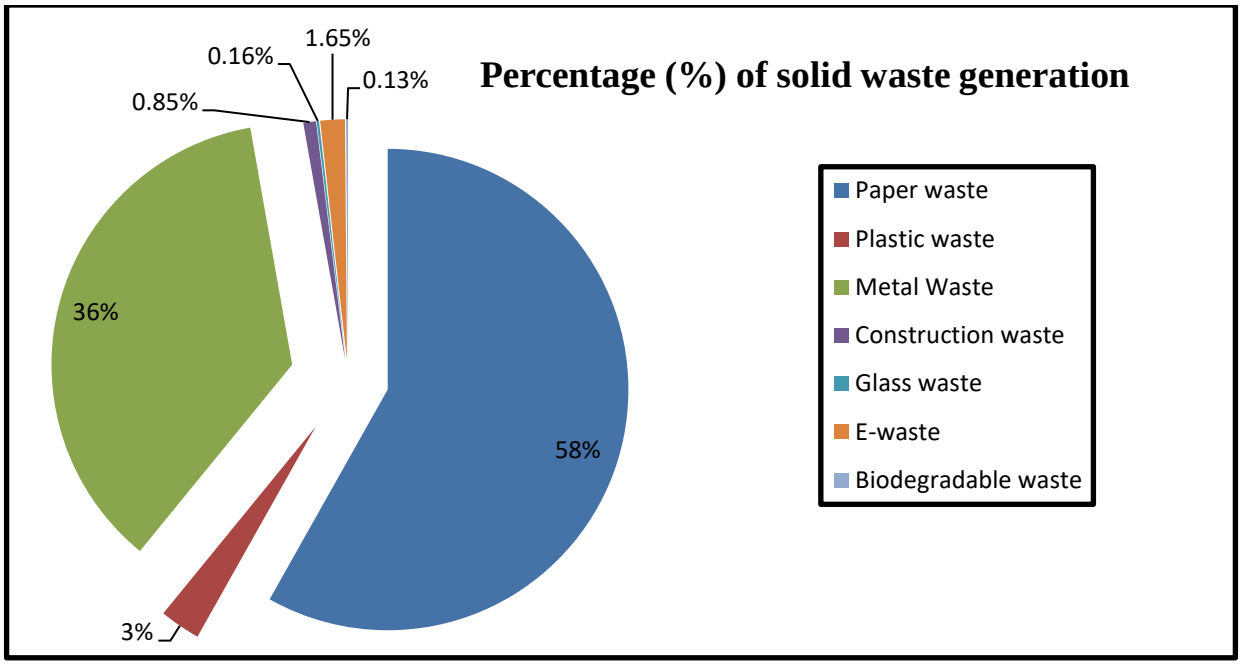
second highest place it includes various scrap instruments from laboratories that are made up of metals, geysers from hostels etc. It accounts about 28,740 kg. Plastic waste accounts about 2170 kg. It includes broken tables and chairs made up of plastics, wrappers used for covering equipment and chemicals, plastic bottles etc. Average E-waste generation is approximately 1300 kg. It includes all the waste which is generated from electrical equipment's, capacitors, wires, fused tube lights and bulbs etc.

Generation of construction waste is approximately 665 kg during 2020-21. It includes all the waste generated from renovation and demolition activities in campus. The glass waste generated in minimum quantity i.e. 130 kg, which is in the form of broken glassware from laboratories, cups and glasses used in canteens. Generation of biodegradable waste is negligible in the academic year 20-21 because of canteens are under shut down due to pandemic situations.

Waste generation for the academic year 2020-21 is lesser in quantity because in pandemic situation institution was under shut down. But waste disposal quantity which is mentioned in table is high as university has used to dispose 2-3 years stored waste in 2021.

Table No. 5.2: Percentage of category wise solid waste in university (kg)

Category of waste	Paper waste	Plastic waste	Metal Waste	Construction waste	Glass waste	E-waste	Biodegradable waste	Total waste
Percentage	58.16	2.74	36.31	0.85	0.16	1.65	0.13	100



Graph No. 5.2: Percentage of solid waste generation inuniversity during 2020-21 (kg)

Percentage wise distribution of different sources of solid waste in Shivaji University is shown in the above graph. The maximum percentage of solid waste is paper waste which is 58 % and minimum percentage of biodegradable waste is approximately 0.13 %. The biodegradable waste is produced mostly through canteens. Glass waste constitutes approximately 0.16 % of all the waste generated in campus.

The plastic waste generation is approximately 2.74 %. Construction and metal waste constitutes approximately 0.85 % and 36.31 % respectively. The E-waste generated from electrical equipment's constitutes1.65 %.

5.2 Waste types generated in Major Quantity

5.2.1 Paper Waste

Paper waste is a highest generation of waste due to academic and administrative activities. It is generated in all departments including administrative buildings. Most of the departments including administrative building are using one sided paper for printing and writing.

Paper waste generated in Shivaji University includes Administrative office paper waste, Printing press waste, answer sheets from exam department, paper waste from library and newspapers. All this paper waste is sent for shredding, pulping and recycling after completion of their preservation period.

In academic year 20-21 this paper waste from Shivaji University Kolhapur is handed over to PruthviTreding Company for disposal.

5.2.2. Metal waste

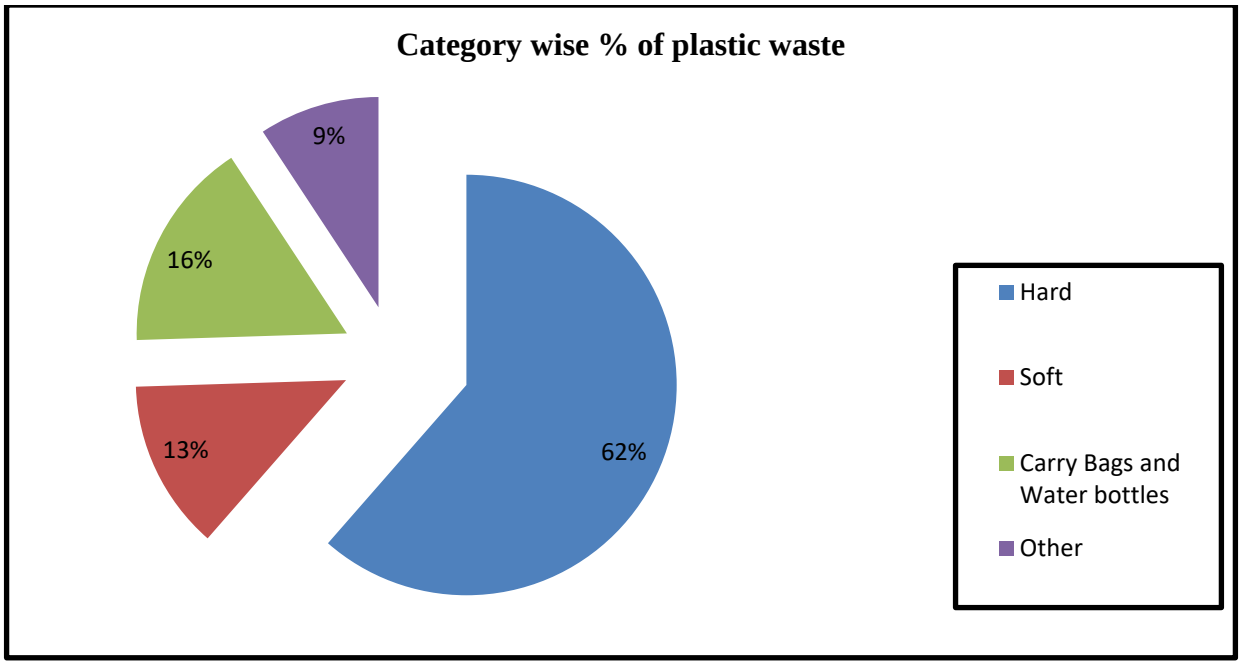
Metal waste is generated through various activities.The good thing about metal is they can be recycled over and over without changing its properties. Metal waste includes scrap of benches, table, cupboard, cots and other things which are made up of metals.

Metal waste which is generated in the Shivaji University campus is listed out and quotations from recycling vendors are taken and metal waste is handed over for recycling to the vendor which is with highest quotation. In academic year 20-21, this metal waste is handed over to the M/S Mahat steel industries.

5.2.3. Plastic Waste:

Table No. 5.3: Plastic waste generation and its distribution in university during 2020-21

Category	Plastic Kg/year				Total
	Hard	Soft	Carry Bags and Water bottles	Other	
Quantity	1833	94	168	75	**2170**
Percentage	61.44	13.06	16.23	9.27	**100**



Graph No. 5.3 Categorization of plastic waste at university during 2020-21 (kg)

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 62%. The soft plastic accounts 13% of plastic while the carry bags, water bottles are present about16 %.

5.2.4. E-waste:

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 University 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. In the university number of computer laboratories are present. Each department and administration use computers for their routine work.

University list out all the scrap electronic equipment or e-waste and takes quotation from e-waste recycling vendors and to selected vendor university used to hand over E-waste for disposal.

5.2.5. Construction waste:

Construction and demolition waste is generated whenever any construction activity takes place. Such 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. Most of the construction waste generated in campus is reused in campus for construction activities.

5.2.6. Biodegradable waste:

Biodegradable waste generated in campus is mostly from canteen, hostels and guest house kitchens. Canteen waste is collected and some biodegradable waste is treated with vermicomposting process.

In academic year 2020-21 due to the pandemic situation out of 6 canteens in the university campus only one was operational only for 2 months so very less quantity of biodegradable waste generated during audit period.

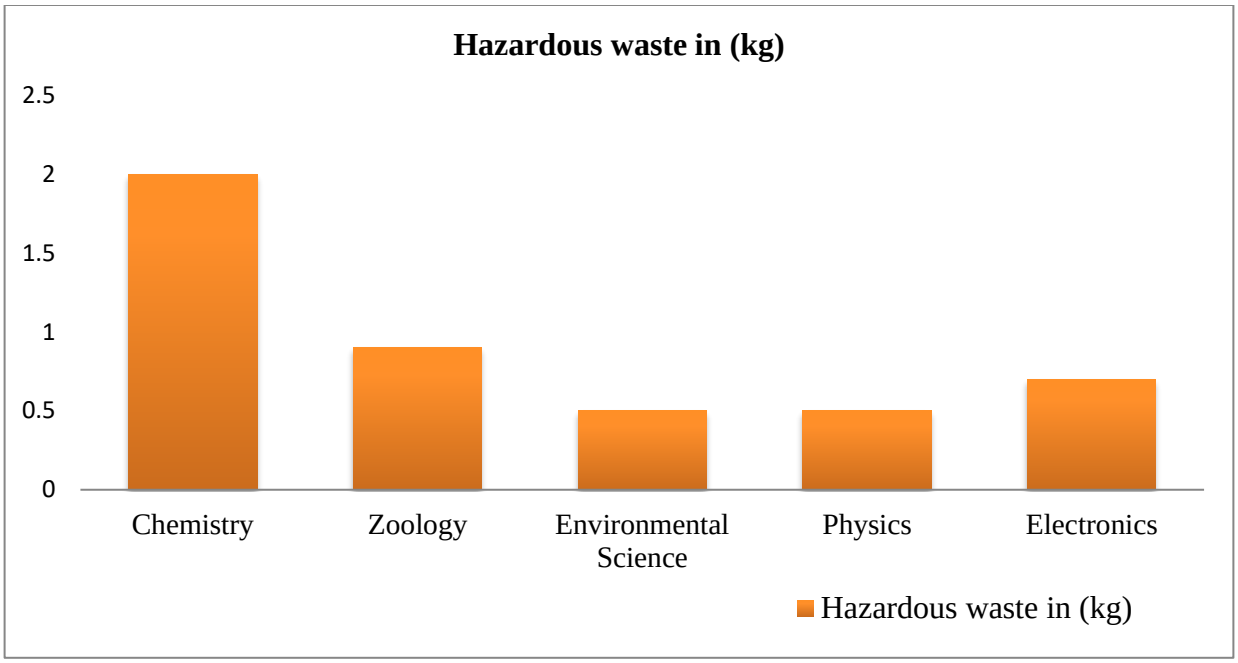
The leaf litter is also biodegradable waste. This leaf litter generated through daily sweeping is composted in the campus.

5.3. Hazardous waste audit of the university:

Hazardous waste is waste that has substantial or potential threats to public health or environment. The sources of hazardous waste in the university are very less. The amount of hazardous waste generated in the university is 4.6 kg/month. The major source of hazardous waste in campus is the laboratories from science departments from use of various chemicals forpracticals and research purpose.Improper disposal of such waste can cause serious health effects.

Table No. 5.4: Hazardous waste generation and its distribution in the university

Sr. No.	Department Name	Type of Hazardous Waste	Hazardous waste in (kg)
1	**Chemistry**	laboratory chemicals and other	2
5	**Zoology**	laboratory chemicals and other	0.9
3	**Environmental Science**	laboratory chemicals and other	0.5
4	**Physics**	laboratory chemicals and other	0.5
5	**Electronics**	laboratory chemicals and other	0.7
Total			**4.6**



Graph No. 5.4: Hazardous waste generation and its distribution in the university

5.3.1Biomedical waste:

Biomedical waste or hospital waste is any kind of waste containing infectious material. This waste is distinct from normal trash or general waste and differs from other types of hazardous waste such as chemical or industrial waste.

In Shivaji University there is Health centre which is an out patient department type of clinic designed specially as per need of residing students and teaching and administrative staff and their relatives. Biomedical waste generated here is from medical use (day care treatment) and clinical use. This waste is collected in special specific coloured leak proof plastic bags and containers which are provided by collecting agency.

1. Red coloured bin is used for intravenous sets, used syringes without needles, used hand gloves.
2. Yellow coloured container used for dressing material like used cotton balls and gauze.
3. White coloured container used for needles, burned needles scalpels.
4. Blue coloured container is used for empty injection vials and ampuls.

This BMW is collected weekly by Kolhapur municipal carporationsauthorised agency SS Services which is approved by Maharashtra Pollution Control Board. It is further transferred to

main disposal unit at KasabaBawada where it is often incinerated, autoclaved, disinfected and plastic material is degraded into reusable plastic threads.

In academic year 2020-21 due to the pandemic situations health center was closed so biomedical waste generation was negligible. In routine procedure the waste is handed over to authorized BMW

5.4 Current Eco-friendly solid waste management practices:

The universityis following eco friendly solid waste management practices.

5.4.1 Bio composter in Ladies hostel of University:

The ladies hostel in Shivaji University has three Messes in its premises with a capacity of more than 900 students. So, there is generation of food waste and vegetable waste which is organic in nature. The hostel premises also generate waste leaf litter and weeds. There is always a problem of disposal of such waste in the premises. Therefore, considering this difficulty a Rotary Drum Bio composter is installed near the Mess No.1. The composter is having 3 m length, 1 m diameter and 10mm thickness. The capacity of the drum is up to 100 kg. The composter has grinder at one end through which the waste input is chopped into small pieces and digested further in the digester. To remove the odour problem the aeration is provided through rotating the drum either by manually by mechanical handle or through motor.
In academic year 2020-21 hostel was closed so there is no generation of food waste.

Plate No. 5.1 Bio composter in Ladies hostel of University

5.4.2 Plastic to Fuel Equipment –

Plasto Green through pyrolysis process: Plastics make up many of the everyday products we use, as well as the packaging that encloses a vast variety of products. The collection and appropriate disposal of plastic waste is the greatest global challenge. Plastics can be converted into hydrocarbon fuels since it contains hydrogen and carbon. Pyrolysis is the thermo chemical decomposition of organic substances at elevated temperatures in absence of oxygen. Plastic waste is treated in a cylindrical reactor at temperature of 300 0C – 350 0C. The gases are condensed to give a Fuel oil. A solid carbon residue is generated at the bottom of the reactor. A pyrolysis model is prepared by YCSRD,Shivaji University, Kolhapur and installed in Technology building in SUK. The basic objective behind preparing this Pyrolysis plant is to design and develop economical and commercially feasible technology for converting Waste Plastic into Fuel and fabricate portable PTF convertor demo unit of plastic disposal capacity of 25 kg. Through this pyrolysis process the plastic waste is converted into fuel. This process is beneficial to reduce environmental pollution by eliminating need of open air burning of waste plastic or disposal of plastic by way of dumping on land or in water resources.

Plate No. 5.2 Pyrolysis fuel equipment – Plasto Green

5.4.3 Biogas Plant:

The extraction of energy from the biomass wastes by its anaerobic degradation with the help of various technologies is useful renewable energy. In this contest, one of the best methods to extract the energy from the biological wastes which includes, Kitchen wastes, Agricultural wastes; Animal wastes etc. are the installation and generation of biogas plant. The biogas

released acts as an environmentally sustainable energy source. In our Shivaji University campus there are two units of Biogas plants. One unit is installed near Earn and Learn Hostel and another unit is installed near Technology Hostel in the campus. The input given to these plants is in the form of Kitchen waste generated in hostel mess. These Biogas plants are organic processing facilities to generate biogas which will be more cost effective, ecofriendly, reduce landfill waste, generate a quality renewable fuel and reduce carbon dioxide and methane emissions. The reactor works as anaerobic digester system to produce biogas energy. Biogas is used as energy source for cooking.

Plate No. 5.3 Biogas plant near Technology hostel

5.4.4 Vermicomposting:

It is an ecological way of dealing with organic waste. The most important aspect of compost produced by earthworms is that it is 100% organic. There are no harmful chemicals and it does not need to be mixed with anything. Vermicomposting produces a product that is naturally designed to benefit plants in several different ways. The most significant benefit is that the nutrients in earthworm compost are very easily absorbed by the roots of plants. Unlike chemical fertilizers, vermicompost is not easily flushed from the soil because of the worm mucus that it contains. Plants have longer to obtain the nutrients and get the maximum benefit. As the compost is passing through the body of the worms it is enriched with bacteria and microbes. These help plants to become more disease resistant and also repel some plant pests. Vermicompost is a colloid and holds up to nine times its own weight in water. This can make a

huge difference when there is a dry spell. The water is held at an organic level so tends to evaporate slowly while still being available to the plants. Considering the advantages of Vermicomposting, Shivaji University has taken initiative in construction of Vermicomposting Plant near main Canteen. This plant was constructed in 2006 to convert the canteen food waste into good fertiliser.The waste is segregated to avoid the entry of nonbiodegradableitoms like plastic, metal,etc. and added into the vermicomposting pit. The waste is mixed with slurry of cowdung to increase the degradation rate.The Eiseniafoetida species is generally used for vermicompost production which gives better results.

Plate No. 5.4 Vermicomposting plant near main Canteen

5.6 Key Observations:

- The average waste generated in the university is app. 79,137kg during 2020-21.
- Highest quantity of solid waste is paper waste around 46,032 kg during 2020-21.
- Paper waste is generated by all department. Especially, administrative building is using more one side papers for printing and writing which is a good practice.
- Answer sheets, old bills and confidential report are sent for shredding, pulping and recycling after completion of their preservation period.
- University has banned single use plastic for any administrative as well as other purpose and therefore very less amount of plastic waste is generated in the University.
- Metal scrap is segregated separately by respective departments and sent for recycling.
- Biodegradable waste is utilized properly for composting.

- Waste segregation is done at the source.
- The E- waste, paper waste, plastic waste, metal waste and biomedical generated is given to the dealer for recycling.
- Cleanliness and hygienic conditions were maintained in the campus.

Chapter VI

Ambient Air and Noise Quality Status

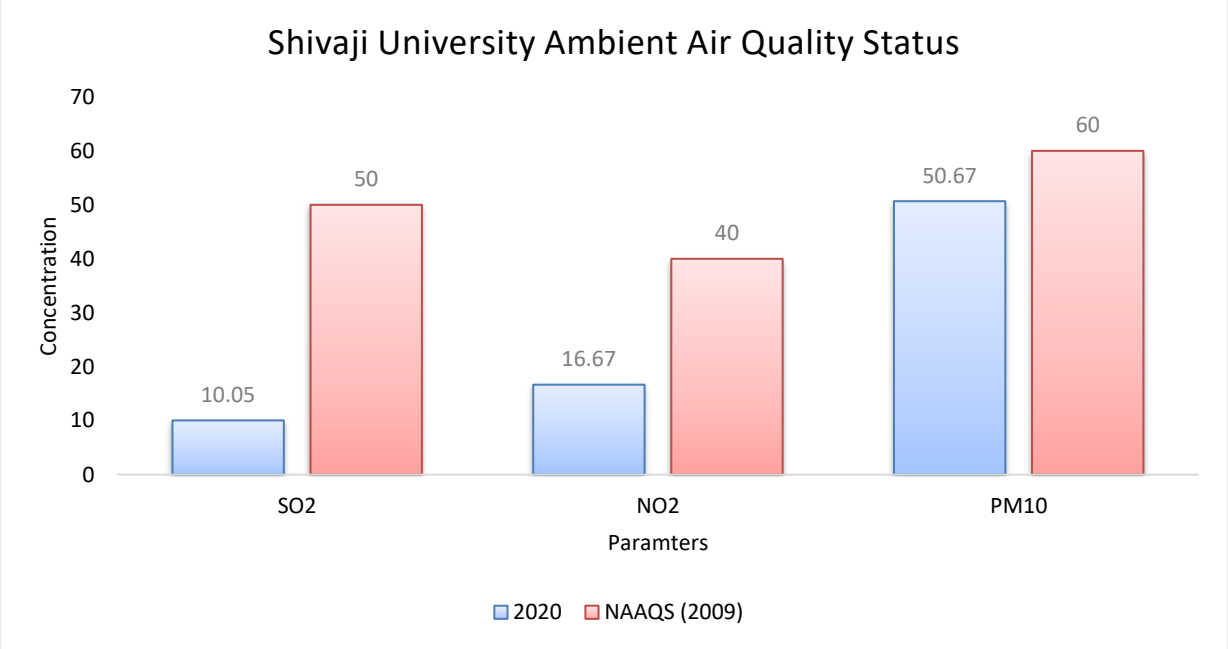
Department of Environmental Science, Shivaji University, Kolhapur is one of the air pollution monitoring stations for National Ambient Air Quality Monitoring Program Maharashtra Pollution Control Board, Mumbai. High Volume Sampler (HVS) machine installed at the Department of Environmental Science. This machine continuously runs two days in week and minimum 104 days over the year. Department of Environmental Science monitors the changes in ambient air quality throughout the year.

Ambient air quality in the Shivaji University is given in the Table no. 6.1 and Graph No. 6.1.

Table no. 6.1Ambient air quality status in Shivaji University, Kolhapur, Dist: Kolhapur.

Sr. No.	Parameters	Results (µg/m^3)	NAAQS (µg/m^3)
1	SO_2	10.05	50
2	NO_2	16.67	40
3	PM_{10}	50.67	60

Central Pollution Control Board, India set guidelines to monitoring and analyze the air pollution parameters. Shivaji University campus ambient air is very good.



Graph No. 6.1 Ambient air quality status in Shivaji University, Kolhapur.

6.2 Ambient noise monitoring status:

Ambient noise monitoring was carried out in different areas of Shivaji University campus like at University campus entry, Departments, Mechanical working places, Canteens, Boys and ladies hostel. The sampling was carried out using calibrated Sound Level Meter (AZ 8921) by logarithmic scale in Decibels (dB). The noise readings were collected in the University campus and calculated. The details of noise status in University campus are given below in the Table No. 6.2and Graph No.6.2

Table no. 6.2Ambient Noise levels in Shivaji University, Kolhapur,

Sr. No	Location Name	dB (A) Leq Day time	Noise Standard Day Time
1	Dept of Env. Science	**54.86**	50
2	Dept of Chemistry	**55.48**	50
3	Dept of Physics	47.04	50
4	Dept of Mathematics	**52.03**	50
5	Dept of Geography	**52.39**	50
6	Humanity Building	49.69	50

7	Dept of Technology	**51.48**	50
8	Dept of Nano Science	**55.60**	50
9	Dept of Education	**72.62**	50
10	Dept of Music	49.91	50
11	Dept of Law	48.71	50
12	Main Building	**58.97**	50
13	Library	44.73	50
14	MBA Canteen	48.42	50
15	Main Canteen	46.61	50
16	Exam Building No. 1	**60.27**	50
17	Press (Machine Dep.)	47.78	50
18	Press (Sieving Dep.)	47.56	50
19	Ladies Hostel	**52.95**	50
20	Boys Hostel	**58.38**	50
21	Main Gate	**72.03**	50
22	Gate No. 2	**68.05**	50
23	CSIBER Gate	**64.44**	50
24	Gate No. 8	**67.98**	50
25	Consumer Store	47.43	50
26	Health Center	45.86	50

Note: - 1. All parameters expressed in dB (A) Leq.

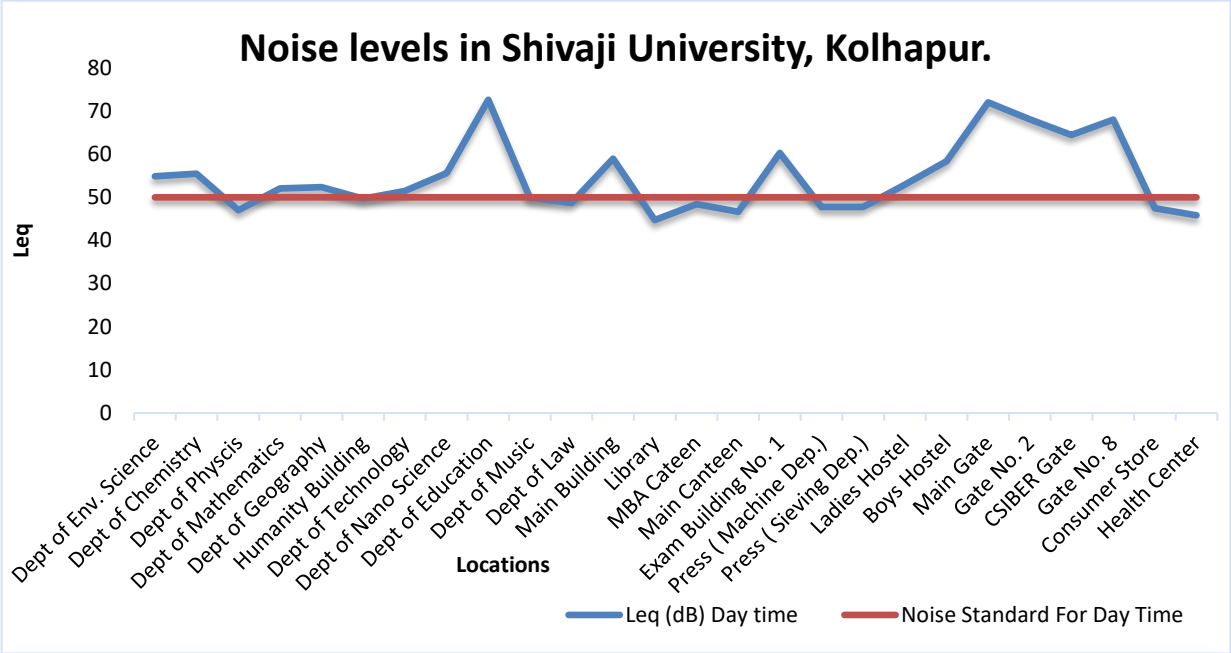
2. Monitoring is carried during day time.

3. Day time is from 6.00 a.m. to 10.00 p.m.

It is observed from the table that the Ambient Noise levels overall in Universityis on higher side except Consumer Store, Health center, Press section, Library, Dept of Law, Music, Physics, Humanity building, MBA and main canteen, as compared to the standards of Central Pollution Control Board for the day time.

Since the Shivaji University is located adjacent of old Pune - Bengalore National highway and therefore, the major source of noise is automobile. The human communication and transportation are producing high level sound.

Graph No. 6.2 Ambient Noise levels in Shivaji University, Kolhapur, Dist: Kolhapur.



Chapter VII

Green initiatives

The survey for the green cover inventory was conducted for compiling campus information. The Garden Department of Shivaji University, Kolhapur gave the information related to the entire campus. The Garden Department under the guidance of Hon. Vice Chancellor Dr. D.T. Shirke and Hon.Pro-Vice Chancellor Dr. P.S. Patil, Hon. Registrar Dr. Vilas Nandvadekar, and Dy. Registrar of Garden Department Dr. V. N. Shinde has taken many initiatives to make this campus more diverse and rich by planting more endemic trees.

7.1 The initiatives taken by the Garden Department are as follows:

7.1.1 Plantation under Social Forestry at Synthetic track SUK:

India was one of the first countries who have launched social forestry. In 1950, the festival of tree planting was initiated by the Central Government as an annual feature. Since then, rapid developments have taken in the field of social forestry. The National Forest Policy (1952) strengthened the social forestry programmes. Fast growing species were raised by the forest department in a number of rows, having a rotation of 7-10 years. Social forestry is involvement of people in tree plantation activities on barren and fallow lands as well as on farm bunds to achieve the dual goals of providing income to the persons and ensuring increase in forest cover which helps environment, social and rural development. Social forestry is an integral part of the Gandhian philosophy of economic growth and community development. The social benefits thus generated and the additional resources so created may serve as stepping toward self-sufficiency. The first social forestry programme in Maharashtra was established in year 1982. The Social forestry programme is a policy introduced by the Government of Maharashtra to increase green cover in the state.

Various activities were also done under social forestry in Shivaji University, campus. During 2020-2021 under this programme, a huge number of plantation was done near Synthetic track at Synthetic track SUK is the enormous plantation site on the campus. This initiative was taken under the Maharashtra Government’s 13 crore trees plantation drive. This event was organized in collaboration with Samajik Vanikaran Vibhag, Kolhapur. About 11,111saplings

were planted at Shivaji University on 1st July 2018by the District Guardian Minister Chandrakantdada Patil. Shivaji University has performed impressively under the tree planting campaign undertaken by the Government of Maharashtra for the last two years. The survival rate of the planted trees is 91% in the house. Therefore, Shivaji University is famous for planting trees as well as cultivating trees. In the year 2018, the university has decided to plant 11,111 trees in the area in collaboration with the Forest Department and Social Forestry Department. It was done by Mr. Chandrakantdada Patil in presence of Hon. Former Vice Chancellor Dr. Devanand Shinde, Hon. Pro-vice Chancellor Dr. D.T. Shirke, District Collector Mr. Avinash Subhedar, Chief Executive Officer of ZP Dr. Kunal Khemnar, Chief Conservator of Forests Mr. Arvind Patil, Deputy Conservator of Forests Mr. Prabhunath Shulk and Hon. Former Registrar Dr. Vilas Nandvadekar.

Photo plate: 7.1 Social Forestry Plantation at Synthetic track SUK

The Samajik Vanikaran covers 10 hectares area on the campus behind Synthetic track, Shivaji University, Kolhpur. The plant tree species has planted on site are *Casia fistula* (Bahava), *Syzygium cumini* (Jambhul), *Tamarindus indica* (Chinch), *Pithecellobium dulce* (Vilayati Chinch), *Bambuseae* (Bamboo), *Pongamia pinnata* (Karnj), *Azadirachta indica* (Neem), *Bauhinia variegata* (Kanchan) and *Mangifera Indica* (Deshi Amba) etc. The site has also includes the shrub species as *Hibiscus rosa-sinensis* (Jaswand), *Cestrum nocturnum* (Ratrani), *Justicia adhatoda* (Adulsa) and *Acalypha indica* (Acalypha) etc. The Garden Department has taken an initiative to plant more native trees on the Social forestry site to attract native biodiversity around the campus.

विद्यापीठाच्या २५ एकर जागेवर होणार वृक्षारोपण

सामाजिक वनीकरणची मोहीम : जलयुक्त विद्यापीठ उपक्रमाला गती, दहा हजार झाडे लावली जाणार

वृक्षारोपणातून जलसमृद्धीकडे

या झाडांची होणार लागवड

विद्यापीठाच नेटके नियोजन

Photo plate: 7.2 Social Forestry Plantation Site

7.1.2 Miyawaki Gardens:

In the 1980's the Japanese Professor Akira Miyawaki introduced the innovative and new technique of afforestation called "Miyawaki Forest". The innovative technique focuses on the plantation of indigenous or native plant trees which restores the native ecosystem and also maintain global environment including disaster prevention and carbon dioxide mitigation. The Miyawaki forestation method is a unique way to create an urban forest. The Miyawaki forest is the natural vegetation succession process which includes the conversion of bare soil to mature forest. The planted tree in the Miyawaki forest shows good growth in short period which can store the atmospheric carbon dioxide in the form of carbon stock. The Miyawaki Forest is the theoretical and practical method of restoration of natural and native ecosystem for the future as

well as for the mitigation of global problem like Climate change. With this plantation method, an urban forest can grow within a short span of 20-30 years while a conventional forest takes around 200-300 years to grow naturally. In Miyawaki technique, various native species of plants are planted close to each other so that the greens receive sunlight only from the top and grow upwards than sideways. As results, the plantation becomes approximately 30 times denser, grows 10 times faster and become maintenance-free after a span of 3 years. The Miyawaki method is also known as "the Potted Seeding Method".

On 19th June 2021, The Garden Department has established two Miyawaki Forest on the SUK campus. Both forests are established on the SUK Campus. According to data and information provided by the Garden department these Miyawaki forest posses 958 trees with native species of trees.

Photo plate: 7.3 Miyawaki forest plantations by Hon. VC Dr. D.T. Shirke and Hon.PVC Dr. P.S. Patil and Hon. Registrar Dr. Vilas Nandvadekar

The Miyawaki forests includes *Pongamia pinnata* (Karnj), *Azadirachta indica* (Neem), *Bauhinia variegata* (Kanchan) and *Mangifera Indica* (Deshi Amba) *Casia fistula* (Bahava), *Syzygium cumini* (Jambhul), *Tamarindus indica* (Chinch), *Pithecellobium dulce* (Vilayati Chinch), and *Bambuseae* (Bamboo), etc. The plantation is done for 2 plants per square meter to avoid competition between two trees as they required large area for their basal area such as *Pongamia pinnata* (Karnj), *Azadirachta indica* (Neem), *Syzygium cumini* (Jambhul), *Tamarindus indica* (Chinch), and *Pithecellobium dulce* (Vilayati Chinch), etc. This is a great initiative taken by the Garden Department under the guidance of Hon. Vice Chancellor Dr. D.T. Shirke and Hon.Pro-Vice Chancellor Dr. P.S. Patil and Hon. Registrar Dr. Vilas Nandvadekar, Registrar of Garden Department Dr. V. N. Shinde and Garden Superintendent Mr. Abhijit Jadhav. The

Garden Department has well maintained these Miyawaki gardens. The Gardner and other people take care of this Miyawaki forest.

Photo plate: 7.3.1Miyawaki forest plantation site

7.1.3 Chancellor's Coconut Garden:

Chancellor's Coconut garden was established in year 2018 by Garden Department SUK. The Chancellor's Coconut garden covers total area about 2.5 Acers on campus. The garden was established near Reverse Osmosis (RO) plant, Shivaji University, Kolhapur. The garden posses total 265 coconuts trees.

Photo plate: 7.4 Chancellor's Coconut Garden site

7.2 Initiatives taken for Green cover conservation:

7.2.1 Road construction on the Campus:

The roads were prepared in the wilderness area, by the SUK administration and Garden Department to mitigate fire events on the campus during summer season and for patrolling. The purpose of these roads are made in remote areas to access the area with vehicles and it will also helps fire extinguisher vehicles to reach fire incident site as soon as possible in case of any fire hazards. The employees, students and visitors on campus can also observe the beauty of campus in all season through these walkways. This will help nature lovers and environmentalists to interact with campus environment.

Photo plate: 7.5Road constructions on the Campus

7.2.2 Removal of weed from campus area:

As the university campus covers total 853 acres area, this huge area possesses 99 species of woody trees on the campus. Some native and non-native species of weeds are observed on the campus during all seasons. Weeds are those wild plants that prevent other plants from growing properly. Weeds are valueless plant growing wild, especially one that grows on cultivated grounds to the exclusion or injury of the desired crop or plant. These weeds are grown unintentionally, and afterwards it widely spread and has less ecological importance in nature. The Garden Department has taken an initiative to conserve the native biodiversity by removing these non-native weeds from the campus area. Currently it has been observed that three weed species named *Cosmos sulphureus* (Cosmos), *Tithonia diversifolia* (Mexican sunflower) and *Chromolaena odorata* (Raanmodi) are growing widely on the campus.

Cosmos sulphureus (Cosmos) is a prolific seed-producing annual herb considered native to Mexico and northern South America. It grows yellow to two meters tall, and sports very attractive heads of yellow flowers. *Cosmos sulphureus* (Cosmos) prefers meadows and open shrub land. The species*Cosmos sulphureus* (Cosmos) has been known to escape cultivation and to naturalize. It is recorded as an environmental weed and occasionally as an invasive plant in parts of America, Asia, North and Central America and Pacific Islands.

Photo plate: 7.6*Cosmos sulphureus* (Cosmos)

According to Plant Pono, 2014, *Cosmos sulphureus* (Cosmos) received a 'high risk' score of 9.0 from Hawaii risk assessment. Invasive traits include its widespread use as an ornamental plant and repeated intentional introduction by humans, its ability to seed freely, self-compatibility, tolerance of tropical climates and its ability to thrive in a variety of soil types. Based on these traits, it has been reported as weed in places beyond its native range, considering this other members of the *Cosmos* genus are also known to be weeds, the risk of introduction for this species is high, particularly in places where it continues to be popular in cultivation. Many environmentalist and nature lovers has written articles about uprooting of this *Cosmos sulphureus* (Cosmos) and organized movements for removal of *Cosmos sulphureus* (Cosmos) in many regions of Maharashtra state.

The second weed observed on campus is *Tithonia diversifolia* (Mexican sunflower) which is an aggressive weed that quickly invades disturbed sites, open grounds, forest edges, riverbanks and disturbed secondary forests native to Mexico. According to I3N-Brasil, 2018; PIER, 2018 and Queensland Government, 2018 Once *Tithonia diversifolia* (Mexican sunflower)

established, it forms dense stands that out compete and displace native vegetation and alter natural regeneration.

Photo plate: 7.7Image Source: Google; *Tithonia diversifolia* (Mexican sunflower)

Tithonia diversifolia (Mexican sunflower) is successful invader of new habitats through its tolerance to heat and drought, its rapid growth rates and its large production of lightweight seeds which are easily dispersed by wind, water and animals. A dormant seed also remains viable in the soil for up to four months. Once established, *Tithonia diversifolia* (Mexican sunflower) quickly forms dense stands with the potential to out compete native vegetation and thus prevent the recruitment and growth of native plant species. Allelopathic activity has also been reported for this species. According to Suzuki *et al.,* 2017, in areas invaded by *Tithonia diversifolia*, native plant species growing beneath and near this species are negatively impacted by allopathic substances. The Hon. Registrar of SUK Dr. V.N. Shinde has written awareness article for Lokmat newspaper to aware *Tithonia diversifolia* (Mexican sunflower).

लोकमत

विज्ञान

डॉ. व्ही. एन. शिंदे

आकर्षक पण घातक

तीसेक वर्षांपूर्वी महाराष्ट्रात सर्वत्र एका गवताने मोठे नुकसान करायला सुरुवात केली. पांढरी शुभ्र चांदण्यासारखी फुले येणारे झाड तण म्हणून शेतात वाढले की, पिकांचे उत्पादन घटायचे. हे गवताचे बी १९७२च्या दुष्काळात आयात धान्याबरोबर परदेशातून भारतात आले, असे म्हणतात. हे गवत त्यावेळी एका राजकीय पक्षाच्या नावाने लोकांना माहीत आहे. आता या गवताचे प्रमाण मोठ्या प्रमाणात दिसत नाही. त्याची दोन कारणे आहेत. एक म्हणजे लोकांनी गवत मोठ्या प्रमाणात नष्ट केले. दुसरे म्हणजे निसर्गातील काही घटक त्यावर प्रभुत्व गाजविण्यास सक्षम झाले असावेत. हे तण ॲस्टरच्या कुटुंबातील आहे. अशी अनेक झाडे आणि वनस्पती भारतात आल्या आणि त्या येथील वातावरणात सरावल्या आहेत. घाणेरी त्यापैकीच एक. अनेक वृक्षही असे परदेशातून या देशात आले आणि आता इथले झाले आहेत. त्यांच्यावर येथील लोक प्रेम करू लागले आहेत. मात्र, काही अशीही झाडे, वनस्पती आहेत की त्यांनी येथे येऊन येथील जैवविविधतेला धोका निर्माण केला आहे. आता एका नव्या गवताने भारतात चांगलेच डोके वर काढायला सुरुवात केली आहे.

हे गवत किंवा वनस्पती म्हणजे मेक्सिकन सनफ्लॉवर! हे गवत कधी आले माहीत नाही, पण त्याची आकर्षक फुले सर्वांना भुरळ घालतात. मूळची मेक्सिको आणि मध्य अमेरिकेतील ही फुलांची जात आहे. त्याचे प्रचलित नावही 'मेक्सिकन सनफ्लॉवर' असेच आहे. त्याला 'जपानी सनफ्लॉवर किंवा मितोथे ट्रिसँथेमम' या नावानेही ओळखले जाते. ही वनस्पतीही ॲस्टरेसी कुटुंबातील आहे. वनस्पती विषयाचे अभ्यासक या वनस्पतीला 'तिथोनिया किंवा टिथेनिया' नावाने ओळखतात. ही सिझनल वनस्पती आहे. पाऊस सुरू झाला की ही वनस्पती थी रुजून उगवायला सुरुवात होते. जमीन कसलीही असो ती उगवते. या वनस्पतीची झाडे चांगली सहा ते आठ फुटांपर्यंत वाढतात, असे मानले जाते. मात्र, कोल्हापुरात या गवताची रोपे पंधरा फुटांपर्यंत वाढल्याचे आढळले आहे. या रोपांना लाल, गडद केशरी, भगव्या आणि पिवळ्या रंगांची फुले येतात. या फुलांकडे फुलपाखरे तशी अपवादानेच आकर्षित झालेली दिसतात. नाही म्हणायला वी परिपक्व झाले की, एखादा पोपट येतो आणि बियांवर ताव मारत असतो, अन्यथा या झाडाच्या आजूबाजूला कोणी फिरकत नाही.

पावसाळ्य संपला की ही झाडे कोमेजू लागतात. फुले तोपर्यंत परिपक्व होत आलेली असतात. पाऊस आणि सूर्यप्रकाश जितका जास्त तितकी ही रोपे चांगली वाढतात. मात्र, पावसाळा संपला की संपले. मात्र, त्याच्या बिया सर्वत्र पडतात. पुढचा पावसाळा आला की, एका झाडाची असंख्य झाडे झालेली आपणास दिसतात. ही वनस्पती वाळली की तिचे पोकळ बांधूसारखे खोड राहते. ते तसेच उभे असते. अशा भागात आग लागली की ही खोडे वेगाने पेटतात. आगीच्या उंच ज्वाळा तयार होतात. त्यावेळी अन्य जीवांना धोका निर्माण होतो. मात्र, या वनस्पतीच्या बियांना कोणतीच हानी पोहोचत नाही. उलट अशा जमिनीत पाऊस पडला की ते पुन्हा जोमाने उगवते. त्याच्या आजूबाजूला अन्य कोणत्याही वनस्पतीला ते वाढू देत नाही. त्याची पाने पसरट असल्याने आणि अशी रोपे दाट उगवत असल्याने सूर्यप्रकाश जमिनीपर्यंत पोहोचत नाही. त्यामुळे या वनस्पतीची वाढ झालेल्या भागांत अन्य वनस्पती वाढत नाहीत. येथील मूळ वनस्पती त्या भागात नसल्याने त्या मूळ वनस्पतीवर अवलंबून असणाऱ्या जीवांना दुसरीकडे स्थलांतरित व्हावे लागते.

परदेशात या वनस्पतींचे संकरित वाण बनवून शोभीवंत झाडे बनवली आहेत. ती बागेची शोभा वाढवितात. आपल्यालाही ही फुले वेड लावतात. मात्र, त्यांना जंगलात आणि शेतात अमर्याद स्वरूपात वाढू दिल्यास येथील जैवविविधतेला धोका निर्माण होतो. मागील काही वर्षांपासून अनेक भागांत ही वनस्पती अमर्याद स्वरूपात वाढत आहे. तिच्यावर वेळीच नियंत्रण आणायला हवे!

(लेखक विज्ञान व तंत्रज्ञान विषयाचे अभ्यासक आणि शिवाजी विद्यापीठाचे उपकुलसचिव आहेत.)

Hello Kolhapur
Page No. 2 Sep 20, 2019
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Photo plate: 7.8 Hon. Registrar of SUK Dr. V.N. Shinde's article on *Tithonia diversifolia*

The third weed selected for removing from campus is *Chromolaena odorata* (Raanmodi). *Chromolaena odorata* is a very widely distributed tropical shrub that is still expanding its range, and is considered one of the world's worst weeds. It is continues to spread due to its effective short-and long distance dispersal. It can form pure stand where established, often in distributed areas, grasslands, fallow areas and forestry plantations and is highly competitive.

Photo plate: 7.9 Image Source: Google; *Chromolaena odorata*

Depending on the length and the intensity of the dry season, *Chromolaena odorata* represents a serious fire hazards because of the presence of volatile oils in stems and leaves. Uncontrolled fires cab destroy plantation, villages and infested natural vegetation. According to Macdonald, 1983; this problem is particularly acute in Natal, South Africa, where *Chromolaena odorata* is reported to burn even when green in the growing season. This weed also reported

impacts on biodiversity in South Africa like as per Macdonald, 1983; *Chromolaena odorata* invades natural vegetation such as forest margins and savannahs in Africa.

7.3 Composting units at SUK nursery:

The Garden Department, SUK has taken an initiative to produce organic compost from plant litter. The compost includes only plant litter collected during the campus cleaning. Two composting units are established at SUK Nursery site. Each of unit has size 12ft X 3ft X 2ft. The plant litter will naturally degraded by degradation method. According to the information provided by Garden Department SUK, the plant will produce sufficient amount of compost per year as the composting unit run efficiently. The main objective of composting is to convert leaf litters into organic compost. After the production of compost, it will be used for the nursery plants as well as plants on the campus.

Photo plate: 7.10 Composting units at SUK Nursery

7.3.1 Carbon Sequestration potential of SUK campus:

Climate issues are now a day's becoming one of the serious issues. All of these changes in global atmosphere are caused by human activity. Human enhanced greenhouse effect is caused by greenhouse gases which are equally important for maintaining life on Mother Earth. Greenhouse gases (GHGs) are the gaseous which absorb the long wave radiation emitted by Earth Although this mechanism is important to perform a self-regulator in maintaining the temperature of the Earth system and sustains the life on the planet, rising concentrations of the GHGs in the atmosphere, mostly driven by the anthropogenic or man-made activities is the

major driver of climate change. Carbon dioxide (CO_2), Methane (CH_4), nitrous oxide (N_2O), chlorofluorocarbon (CFC), water vapor (H_2O) and hydrochloroflurocarbons (HCFC) compounds are the most concentrated GHGs according to Intergovernmental Panel on Climate Change (IPCC).

All these GHGs are having the Global Warming Potential (GWP). GWP is the potential capacity of warming by any GHG. GWP which is a measure of cumulative warning by any GHG over the given time after it is released into the atmosphere. For this purpose, CO_2 is considered as the reference and the emission of any other GHG is converted to the amount of CO_2 with identical GWP, and thus expressed in terms of equivalent CO_2. Carbon dioxide is one of the most important GHGs containing carbon, one of most abundant material on Earth. Natural sources and sinks of carbon exist in the Earth system that had stabilized the atmospheric CO_2 concentration at approximately 280 ppm in the pre-industrial era. However, since the industrial revolution the atmospheric CO_2 concentration has been increased rapidly due to the increasing demand of fuel that has been extracted from the geological reservoir in the form of non-renewable energy resources. Added to this, rapid land cover and land use change to meet the increasing demand of food, feed, fiber and housing has added to the increase of CO_2 in the atmosphere.

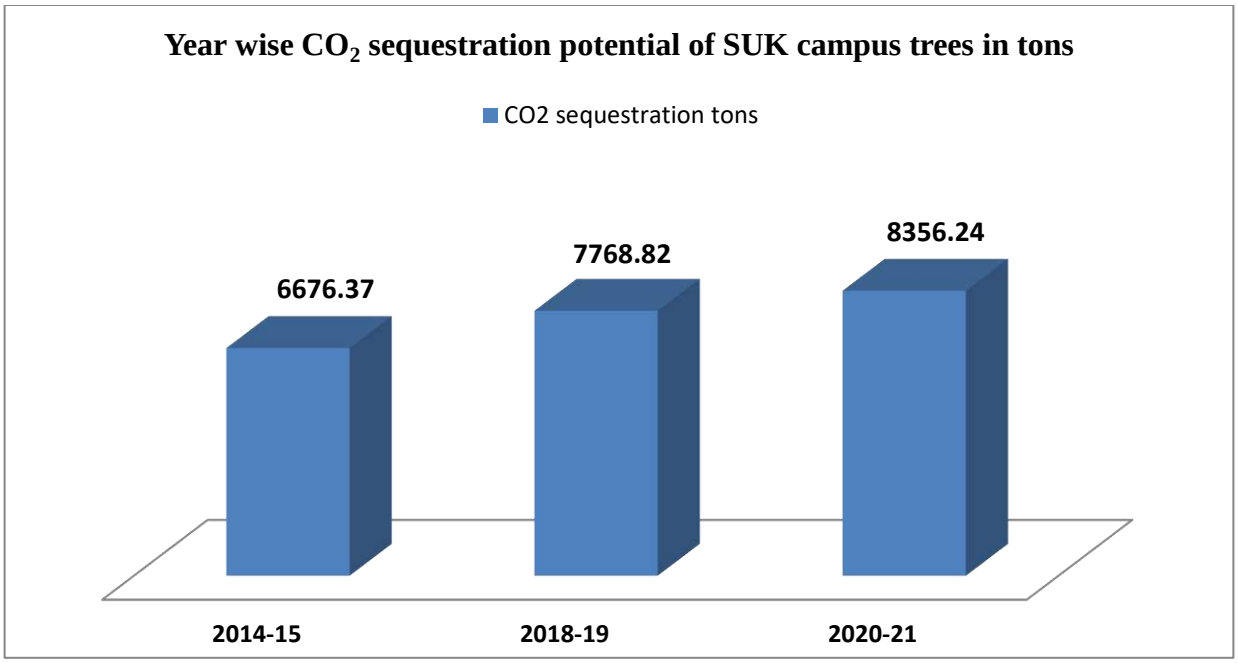
To deal with current scenario of climate change, the elimination of this excess carbon from atmosphere is an ideal mitigation plan. The safe storage of excessive carbon into the secured sink is easiest method for the carbon storage. The progression of transfer and secured storage of atmospheric CO_2 into other long-lived carbon pool that would otherwise be emitted or remain in the atmosphere is called 'carbon sequestration'. It is long-term storage of atmospheric CO_2 in soil, ocean, plants and geological formation. It is a natural as well as anthropogenic process. Among these natural and anthropogenic processes, anthropogenic process required expensive cost for machineries, process and equipments while the natural process is cost effective and inexpensive. But, the natural processes are time consuming as compared to anthropogenic. Pacala and Socolow (2014) have outlined fifteen options of stabilizing the atmospheric concentration of CO_2 by year 2050 at approximately 550 ppm. Among these fifteen options, three were based on carbon sequestration in terrestrial ecosystems. The terrestrial sequestration is one of best sinks for the long-term safe storage of atmospheric carbon. Terrestrial sequestration is defined as transfer of atmospheric CO_2 in biotic and pedologic carbon pool. The sequestration method involves plants, soil and micro-organisms to convert atmospheric

carbon into the global carbon pool for secure and permanent carbon storage. The terrestrial ecosystem comprises a major carbon sink owing to photosynthesis and secure storage of CO_2 in live or dead organic matter, therefore terrestrial sequestration is often called as win-win strategy or no-regrets strategy. Trees sequester the atmospheric CO_2 by photosynthesis process, which is vital for their vegetative and productive growth.

While featuring ourselves from regional university to global university it is a duty of such universities to face the global future challenges and try to find out possible solution for them. It is a social and environmental responsibility of Government institutes; Universities, National and International Organization to respond positively for various global issues at local level and should percolate the generated knowledge in to the society. Global warming and climate change are present environmental issues need to be addressed scientifically and efficiently. As Universities are provided with skillful human resources supported by analytical infrastructure, it is our sense of duty to bring such ideas in practice. While indulgent the call of time the Department of Environmental Science, Shivaji University, Kolhapur has decided to enumerate the green cover of SUK campus and quantify the carbon sequestration of existing tree population.

7.3.2 Carbon sequestration potential of Shivaji University campus:

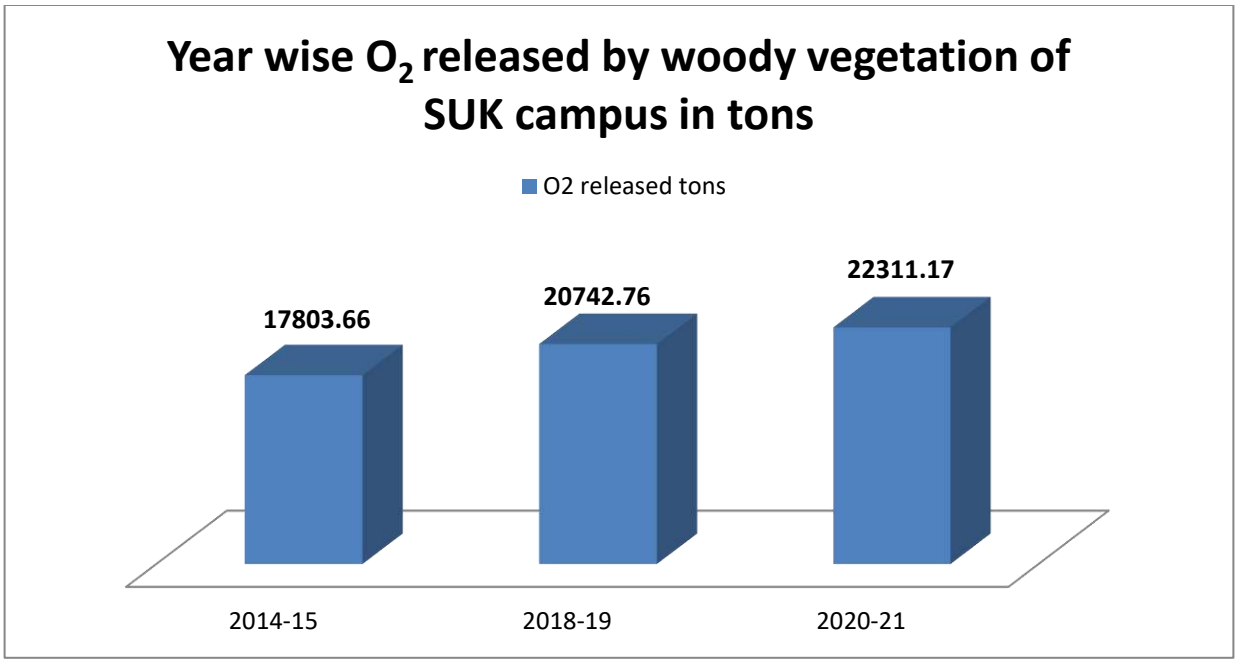
Carbon sequestration is long-term storage of carbon dioxide or other forms of carbon to avoid climate change. Vegetation carbon pool having the potential of 560 Pg (Pg: Pentagram= billion ton) of carbon storage globally. In the current study is the assessment of existing carbon stock stored in Shivaji University campus in the form of woody vegetation by enumerating every tree species. Overall 8,356.24 tons of CO_2 has been captured and stored by the woody plants present on the University campus during 2020-21.



Graph No: 7.1 Year wise CO_2 sequestration potential of SUK campus trees in tons

7.3.2 Oxygen released by SUK campus:

Woody vegetation in Shivaji University campus has released 22,311.17 tons of oxygen in their lifetime till date. Released oxygen is directly proportional to CO_2 in the ratio of 32/12. The oxygen released by woody trees present on campus is working as support system to people living in campus and surrounding. The university campus works as Oxygen Park in Kolhapur city.



Graph No: 7.2 Year wise O_2 released by woody vegetation of SUK campus in tons

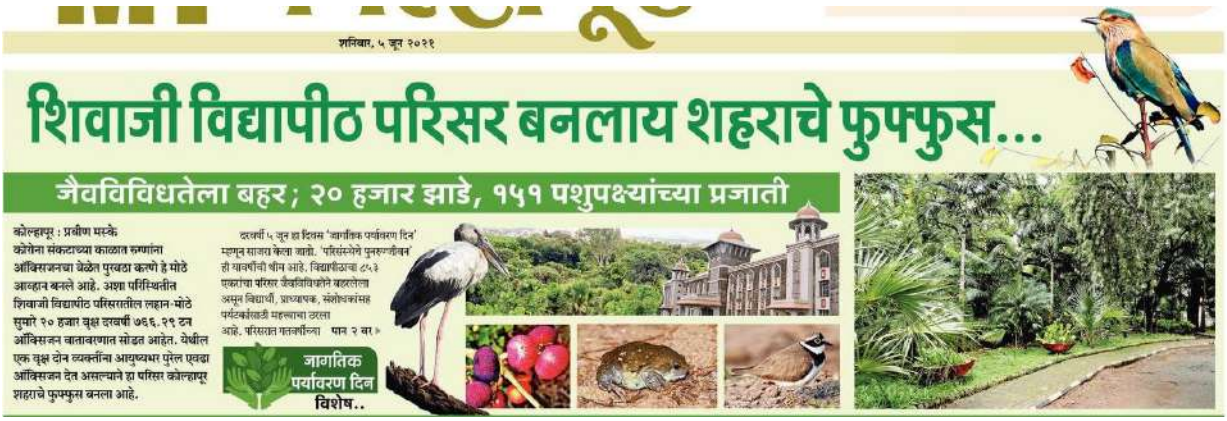


Photo plate: 7.11 News article in Pudhari on SUK Carbon Sequstration

7.3.3 Carbon sequestration potential of campus woody tree vegetation in future:

Plants sequester atmospheric carbon dioxide with natural process called photosynthesis. They absorb atmospheric CO_2 for their vegetative growth. Carbon sequestration by woody trees is the effective carbon offset methods recommended by many researchers for the minimization of carbon footprint and carbon emission. The Carbon offset by trees is the most widely used methodology used by institutions as well as many industries. Institutes and universities are usually having large campus which can be used for current as well as future carbon emission by planting more and more trees in their campus areas. Forests and woody trees are the biggest

carbon pool on Earth, act as a major sources and sinks of carbon in nature. The woody vegetation of 13,473 trees is sequestering approximately 294 tons of CO_2 with the liberation of 783 tons of oxygen annually. The trees planted at Social forestry site will sequester 242 tons of CO_2 /annually while; Miyawaki forests and Chancellor's Coconut garden will sequester 21 tons of CO_2 and 5 tons of CO_2 /annually respectively. Overall, 269 tons of CO_2 will annually sequester by total 12,334 woody trees in future. The oxygen released by newly planted trees at Social forestry will be 647 tons of O_2 /annually, Miyawaki forests 55 tons of O_2 /annually and Coconut garden 15 tons of O_2 /annually respectively.

7.4 Fire mitigation plan for SUK campus:

Forest fire or wild fires are most hazardous disaster that mother Earth currently facing now rapidly. Some wild fires have occurred by natural events while some have occurred by extreme human negligence. As an example, The Brazil, the Great Amazon forest, North America, Siberia, North Africa and Mediterranean and India also experienced this deadest event in last two years. The loss of native and important biodiversity is another huge impact caused by these wild fires.

In the year 2021, some of the coldest regions of the world have experienced this wildfire, some even through the winter months, indicating an influence of a changing climate. According to European Union's Copernicus Atmosphere Monitoring Service, wildfires around the world emitted 1.76 billion tons of carbon in 2021. This is equivalent of 6.45 billion tons of carbon dioxide and was 148 percent more than the total fossil fuel emission of the European Union, according to the Copernicus. According to Bhupender Yadav, Union Minister for Environment, Forest and Climate Change, Odisha state had reported 51,968 forest fires from November 2020 to June 2021. A total of 345,989 forest fires were recorded across our country. If we talk about India, the other states Madhya Pradesh, Chhatisgarh, Maharashtra, Jharkhand, Uttarakhand, Andhra Pradesh, Telangana, Mizoram, Assam and Manipur faced huge losses due to forest fires. Forest fires had ravaged Uttarakhand in the early part of this year and the fire had been going on continuously for six months. The important thing to note here is that Uttarakhad is a mountain state and the fires were burning through the entire winter season. These kinds of serious and deadly disaster are happening in our country continuously. So, it is necessary to prepare a mitigation plan for wild fires in the forests as well as for the woodland vegetation also.

"Precaution is always better than cure" by taking these words in consideration, we need to prepare mitigation plan for wild fire near by our areas.

According to UN-SPIDER knowledge portal, Wildfire, also known as forest fire, bush fire, or vegetation fire is any uncontrolled, unwanted and un-prescribed combustion or burning of plants in a natural context such as a forest, grassland, brush land, or tundra that uses natural fuels and spreads due to environmental circumstances (e.g., wind, topography). The wild fires burn the vegetation in and above land surface. According to some researchers, these wildfires are might be helpful at some context as they kill unwanted insects, weeds and diseased plant. On contrary, they are also responsible for vanishing of native biodiversity and natural forest. Wildfire can be incited by human actions, such as land clearing. There are three conditions that are required to present for wildfire to burn i.e. fuel, oxygen and a heat source. Fuel is any flammable material surrounding a fire, including trees, grasses, brush, even homes. The fire is more intense as it get huge fuel load. Winds or air supplies oxygen that fire needs to burn. Heat sources help spark the wildfire and bring fuel to temperature hot enough to ignite e.g. lightning, burning campfires or cigarettes, hot winds, and even sun can all provide sufficient heat to spark a wildfire. There are three basic types of wildfires Crown fires, Surface fires and Ground fires correspondingly. Crown fires burn trees up their entire length to the top which are most intense and dangerous wild land fires. Surface fires burns only surface litter and duff. These fires are easiest fires to put out and cause the least damage to the area. Ground fires, are sometime also called as underground or subsurface fires. These are occurring in deep accumulation of humus, peat and similar dead vegetation that become dry enough to burn. The ground fires move very slowly, but become difficult to suppress or mitigate.

The SUK campus covers very large area of 853 acres contains various woody trees, shrubs and herbs. As the SUK campus contains woodland as well as grassland, there will be a chance of wild fires in dense vegetation on the campus. The grassland present on the campus will become very dry in summer season which can acts fuel in the surface fires. The lack of fire alarming system, fire mitigation balls or any easily available extinguishing system in remote as well as built up areas can be helpful for surface fire incidents. In previous years, university campus has already experienced such kind of small fire incidents; therefore it is necessary to prepare a mitigation plan or system to avoid surface fire or any kind of fire incidents on campus.

Photo plate: 7.12 Fire incidents happened on SUK campus

As the University campus sequesters 294 tons CO_2 and liberates 783 tons O_2 annually through woody vegetation, there is chance of emission of this CO_2 by burning the carbon stock due to fire incident on campus. By taking this into account, university should take some precautionary measures to avoid fire incidents. The lack of proper wall around campus can be a threat for fire in some regions of campus e.g., Rajendranagar area, area behind Technology Department, Rajaram lake area. These areas are easily accessible to local people because lack of campus wall. Therefore there will be chance of anthropogenic causes of wildfire on campus. The fire incidents can cause several tangible and intangible losses on the campus. Currently, university has taken some initiative to avoid these fire incident on campus such as trenches are made in remote areas to avoid running of surface fire on campus and roads are constructed to reach fire extinguishers at incidents site. University is covering large and lust green vegetation area which made university campus as carbon sink on the other hand these kinds of rapid incidents can made carbon emission source also. Hence, the precaution and preparedness plan for surface fire is essential for the campus.

- Suggestions to prevent and control fire on the university campus:
  - Identification of fire-prone areas and its GIS mapping by Geography department.
  - Development and installation of fire forecasting systems or tools.
  - Prevention measures to be ensured well before fire season on the campus i.e. summer.
  - Communication network should be in place for ensuring timely flow of information, manpower and materials to fire prone and incident site on campus.

- Public awareness should be done on campus to protect grassland and woodland from fire incidents.
- Installation of sign boards, prevention methods of Do's and Don'ts for mitigation of fire on campus is needed.
- Proper training of fire mitigation should be given to employees from Garden department SUK and Security guards.
- Periodical cleaning of trenches should be done to avoid fire incidents on campus.

7.5 Botanical Garden of Shivaji University, Kolhapur:

Shivaji University is located on the Western Ghats' shoulders. 850 acres of land are the area of campus. The environment is undulating, providing excellent opportunity to develop and conserve a variety of Western Ghats species. The Botany Department was founded in 1964. Initially, the department was given 6 acres of land on which to plant trees. In 1985, the department requested an extra 6 acres of property for a botanical garden, and University officials agreed to donate the space, which began the building of the garden around the department. In couple of years, the garden became visible with introduction of various plant species and continuous enrichment of the garden. However, it took almost 4-5 years to give sure shape to the garden. Developing garden is not overnight job but requires continuous activity for its growth.

7.6 Achievements:

- Conservation of majority of bulbous and endemic plant species (ca 40) in Botanical garden.

- Establishment of Field Gene Banks for Indian Barleria, Flemingia, Crinum, Pancratium, Drimia, Dipcadi, Aponogeton, Chlorophytum species in LBS.

- Making Leaf Botanical Garden self-reliable in its water requirement through wells, and water conservation by developing water bodies.

- Establishment of an Arboretum of 80 (100) endemic and threatened trees species of Western Ghats.

- Bio-prospecting of Mucunasanjappae and Crinum malabaricum for active biomolecules

- Utilization of Wild species viz. Barleria species, Salacia chinensis, Crinums as an Ornamentals.

Establishment of Victoria Amazonicain LBG- A centre of attraction for school students.

7.7 Objectives of Lead Botanical Garden:

- Ex- situ conservation and multiplication of Threatened and Endemic plants species of Western Ghats.
- Establishment of seedbanks.
- Reintroduction and rehabilitation of plants in its natural habitats.
- Create awareness in people about biodiversity conservationandSustainable utilization.

Plate No. 7.13 MAP and Gate of Botonical Garden of Shivaji Uiversity, Kolhapur

7.8 Functions of Lead Botanical Garden:

- Help to conserve natural vegetation specially Threatened and Endemic species through multiplying and rehabilitating them in natural habitats.
- Undertake botanic research resulting in excellent referral system for plants as authentically identified, classified and labeled live collection in gardens and as dry collections (pressed, processed and mounted specimens) in herbaria both for monitoring and documentation of threatened and endemic plant resources of the country.
- Study of phenology and response of the plants to climate variability/change.
- Carry out conservation biological studies with a view to find out ecological, biological and genetic bottlenecks or barriers in the reproduction and survival of species.
- Carry out rehabilitation/recovery programmes for threatened and endemic species.
- Serve as center of training with expertise in a focused area of subject specialization including horticulture.

- Building up of information on in-situ as well as ex-situ conservation of the threatened and endemic species and their habitats.
- Compile information on the area of occurrence, area of occupancy, number and size of populations, spatial distribution of populations, identification of important associates such as pollinators and dispersers, reproductive and breeding systems, population trends in relation to habitat changes and pattern of disturbance etc. Prepare Red Data Sheets for the selected species as per IUCN format.
- Promote environmental awareness of nature conservation through well designed education programmes and educational materials.
- Develop relevant research and development (R&D) expertise and capabilities in undertaking modem conservation and gene banking techniques including in-vitro tissue banks, DNA and Cryo-Bank.

VIII Summary and Conclusion

Summary :

Green Audit is one of the important tool to check the balance of natural resources and its judicial use. Green auditing is the process of identifying and determining whether institutional practices which are eco-friendly and sustainable. It is a process of regular identification, quantification, documenting, reporting and monitoring of environmentally important components in a specified area.

The Department of Environmental Science, Shivaji University, Kolhapur has conducted a "Green Audit" of Shivaji University, Kolhapur in the academic year 2020-21. The main objective to carry out green audit is to check the green practices followed by university and to conduct a well defined audit report to understand whether the university is on the track of sustainable development. The previous green audit of the university was conducted during the year 2013-14 and 2018-19. This is the third time to conduct green audit of university campus. This time the covid pandemic situation affected the use of all resources.

After completing the audit procedure of university for green practices, there are following conclusions, recommendations and Environmental Management Plan (EMP) which can be followed by university in future for keeping campus environment friendly.

Conclusion:

From the green audit, following are some of the conclusions which can be taken for improvement in the campus.

1. University takes efforts to dispose majority waste by proper methods. The Green computing i.e.online lectures , practices, meeting through Webex or Google platform, online admission system, Online payment system, online circulars and examination procedures became helpful for reducing the use of papers and ultimately reducing carbon footprint.
2. Reducing the use of one time use plastic bottles, cups, folders, pens, bouquets, decorative items will be useful to solve the problem of plastic pollution to some extent.
3. Biodegradable waste is used efficiently for composting and vermicomposting. There is a scope to utilize the organic matter for biogas generation or manure production.
4. Installation of solar panels provides ample amount of electricity. Such solar modules should be installed wherever possible in the campus.

5. Use of LED lamps and Tube Lights is minimum and is to be encouraged.
6. Shiv Jalashay in the campus proved to be one of the best watershed management program for making the university self reliant in water.
7. A continuous counter trench (CCT) has given good results on percolation of water and for filling up of lakes on campus. Roof top rain water harvesting has proved beneficial.
8. Toilets and bathrooms are consuming more water in the departments. The replacement of old taps can be beneficial for solving this issue
9. Shivjal Yojana of RO drinking water has solved the major problem of safe drinking water in all departments, Hostels, Guest house, Quarters, etc.
10. 'No Vehicle Day' proves to be one of the good practice to save the fuel and help for green and clean environment on the campus. The use of electrical cars are good initiatives to save fuel.
11. The overall ambient air quality on the campus is good while some air quality issues may arise due to developmental activities on the campus should be addressed.
12. The sound levels on the campus is good except due to some transportation and construction activities.
13. E-waste and biomedical waste segregation, handling and disposal are properly done as per rules.
14. Science departments are following the principles of Green Chemistry to reduce chemical wastes.

Recommendations:

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

1. An environmental policy document has to be prepared with all the recommendations and current practice carried by university.
2. A frequent visit should be conducted to ensure that the generated waste is measured, monitored and recorded regularly and information should be made available to administration.
3. The university should develop internal procedures to ensure its compliances with environmental legislation and responsibility should be fixed to carry out it in practice.
4. The solid waste should be reused or recycled at maximum possible places.

5. Reuse of glass bottles for storage of chemicals should be encouraged or the bottles should be sent to again suppliers for reuse.
6. Electrification of street lights by solar power should be encouraged.
7. Installation of sensor based electrification items like fans, lights, etc. can save electricity.
8. Installation of solar panels and rain water harvesting system to every terrace of building will be useful in conserving the natural resources.
9. Regular checkups and maintenance of pipes, overhead tanks and plumbing system should be done by engineering section to reduce overflow, leakages and corrosions.
10. Science laboratories large amount of water goes waste during the process of making distilled water; the system should developed to reuse this water for other purposes.The solar distillation unit be installed at the earliest.

Chapter IX

Environment Management Plan (EMP):

By understanding the dynamics of present situation of resource utilization and current practices of waste disposal, the Department of Environmental Science has prepared an 'Environment Management Plan' for the University. This plan will reveal the strengths and weaknesses and suggests remedies to develop green and clean campus. The EMP also gives suggestion for the priority of work to carry out.

Environment Management Plan 2018-19 to 2023-24

Solid Waste				
Sector	**Strengths**	**Weakness**	**Suggestions**	**Priority**
1. Paper	• Use of green computing practices • Pulping of major portion of papers i.e. answer sheets, bills and other administrative papers. • Use of one sided papers in main building and many departments. • The examination department use SRPD system for paper distribution. • The convocation process also involves online system. • The administration use emails and online payment.	• Multiple number of copies required for office work. • More number of departments and affiliated colleges where circulars to be sent.	• Towards paperless office: more use of e-mails, e-money transfer and advance IT technology for communication.	Medium

2. Plastic	• Total Plastic ban on campus. • Recycling and reuse of plastic at some departments. • In all functions the plastic mineral water bottles, tea cups, straws, bouquets and gifts with plastic covering, decorations, etc. unnecessary plastic use is avoided.	• Sometimes plastic items are thrown with general waste. • The plastic covering of dispatched laboratory equipment boxes and other items are unavoidable. • Sometimes plastic bottles and bags are required for water and soil sampling which is unavoidable as per the protocol. • Distribution of RO water through plastic cans.	• Segregation of waste at the source and sending plastic waste for recycling.	Medium
3. Biodegradable waste	• Composting of bio-degradable waste at canteen and at Vidyarthi Bhavan Mess	• Burning of dry bio-degradable waste at some places.	• Composting of all bio-degradable waste at various places by Garden section and using it for nursery, plantation and gardening. • The kitchen waste generated in hostel kitchens should	Medium

			be utilized for compost production or biogas generation**.**	
4. Glass waste	• Reuse of bottles at some departments for storage of chemicals.	• Throwing of glass waste with regular waste though it is recyclable. • Sometimes the glasses of windows and doors crack suddenly which produce glass waste.	• Maximum reuse of bottles. • Sending the broken glass for recycling.	High
5. Biomedical waste	• Biomedical waste sent to KMC incineration plant for disposal.	• separate containers for storage of biomedical waste are present.	• Separate containers for glass, Liquid and body waste should be maintained	High

Energy				
Sector	**Strengths**	**Weakness**	**Suggestions**	**Priority**
6. Electricity	• Installation of solar panels and production of 180 KW of electricity and fed to the grid. • Use of solar water heaters at Ladies and Boyz hostels. • Use of LED lamps in front of	• Insufficient use of solar energy for electricity generation. • Unnecessary use of lights, fans and computers at some places when no one is using.	• Electrification of street lights by solar power. • Installation of sensor based electrification for fans, lights, etc. • Use of solar pumps for water tanks.	Medium

	university main building. • Use of CFLs at some places • Most of the buildings are well constructed considering the need of illumination and ventilation which reduces the use of electricity. • The air conditioners are used only in essential conditions in the laboratories. • Energy Conservation programmes are conducted in some departments	• Sometimes ignorance by the staff and students wastes electricity in class rooms.	• Use of electricity efficient equipments for laboratory and office use. • Installation of solar panels on the top of every building can reduce the use of conventional energy. • General awareness about electricity saving among all the staff and students should be enhanced.	
7. Fuel	• 'No Vehicle Day' on first Saturday of every month which saves fuel. • Use of Electrical vehicles on university campus is use for internal transportation.	• Hostels using high quantity of LPG fuel for their kitchens.	• 'Cycle on rent' service for students will be beneficial. • The biogas generation plant can be helpful to the hostel kitchens. • General awareness about efficient use of fuel.	Medium

Water				
Sector	**Strengths**	**Weakness**	**Suggestions**	**Priority**
8. Water utilization	• WTP on campus to filter water. • Maximum water self-sufficiency by watershed management through Shiv Jalashay Yojana on the campus • Roof top rain water harvesting at some departments • Shivjal i.e. RO water system provides pure water to all university departments, administrative buildings, hostels, guest house, etc.	• Overflowing of tanks at some places • Excess use of water at bathrooms and toilets. • Fitting of old taps in bathrooms and toilets wastes water. • Leakages not repaired on time.	• Installation of water guards or sensors at overhead water tanks to avoid overflowing losses. • Proper and timely maintenance of plumbing. • Installation of rain water harvesting assembly at every department.	Medium
9. Wastewater	• Sewage Treatment Plant on campus • Phytorid installation at Department of Technology	• Laboratory effluent and other wastewater drain off untreated and it percolates into soil. • Wastage of large amount of good quality water by distilled water plants at various science departments.	• Installation of CETP to treat laboratory waste from all departments • Use of phytorid technology to be encouraged at every department. • Reuse of wastewater from the process of	High

			water distillation should be done. • Common distillation plant should be installed.	

Hazardous Waste				
Sector	**Strengths**	**Weakness**	**Suggestions**	**Priority**
10. Chemical waste	• The practical protocols are set to use minimum quantity of chemicals for the routine practicals. • Microbial waste thrown out after proper disinfection measures at every departments dealing with microorganisms.	• No proper disposal method for hazardous chemicals wastes.	• Hazardous chemical waste should be transferred to disposal facility centre.	High
11. E-waste	• Regular disposal of e-waste through certified e-waste collection agency.	• E-waste is thrown along with regular waste, some material in e-waste can be hazardous and most of it can be recycled.	• There must be segregation of e-waste from regular waste at source. • Precious metal recovery can be possible by university laboratories.	High

Air				
Sector	**Strengths**	**Weakness**	**Suggestions**	**Priority**
12. Air	• University has ample amount of green cover for maintaining fresh atmosphere.	• The construction activities and burning of waste on the University campus are adding contamination of ambient air quality.	• The precautions like water sprinkling or use of enclosures should be made to reduce the particulate matter in air during construction activity.	Low

Noise				
Sector	**Strengths**	**Weakness**	**Suggestions**	**Priority**
13. Noise	• University is located away from noisy area of city. • The tree cover absorbs the noise of highway traffic.	• The construction activities like excavation, digging, hammering, welding, transportation, loading and unloading operations. are responsible for ambient noise which disturbs the routine classes and research activities.	• Silent zone rules be followed. • The noise producing activities should be done during the holidays or after the office hours. • The contractor should be advised to use less noisy machines.	Low

Tree Census				
Sector	**Strengths**	**Weakness**	**Suggestions**	**Priority**
14. Tree Vegetation	• There is lots of space for plantation. • 99 tree species on campus. • 13,473 total full grown trees on campus. • Lead Botanical garden with endemic species of Western Ghats. • Plantation activity by university and all departments. • University tree authority to look after campus garden and plantation.	• Less plantation on campus. • Plantation on campus of some exotic plants. • More growth of trees like Gliricidia and subabhool.	• Avoid monoculture, variety of species should be planted in campus area. • Plantation only on slope areas of campus. • No permission to other organization for plantation. • Campus plantation plan be prepared. • Guidance of Botany department for plantation activity.	Medium

Environmental Initiatives

By

Shivaji University, Kolhapur

Media Coverage and Photo Gallery

2020-21

पुढारी

वातावरणातील कमी दाबाच्या पट्ट्यामुळे कोल्हापुरात मुसळधार पाऊस

शिवाजी विद्यापीठ पर्यावरणशास्त्र विभाग व क्लायमेट चेंज सेंटर विभागप्रमुखांचे मत

कोल्हापूर : पुढारी वृत्तसेवा

गेल्या काही वर्षांत अरबी समुद्र व बंगालच्या उपसागरावर वादळांचे प्रमाण वाढले आहे. त्यामुळे कमी दाबाचा पट्टा निर्माण होऊन कोल्हापूरसह राज्याच्या विविध भागांत डिसेंबरमध्ये मुसळधार पाऊस पडत आहे, असे मत शिवाजी विद्यापीठ पर्यावरणशास्त्र विभागप्रमुख डॉ. आसावरी जाधव, सेंटर फॉर क्लायमेट चेंजचे समन्वयक डॉ. सचिन पन्हाळकर यांनी व्यक्त केले.

साधारणपणे जून महिन्यात महाराष्ट्रात पावसाळा सुरू होतो. ऑक्टोबर महिन्यानंतर परतीचा पाऊस सुरू होतो. तामिळनाडू व आंध्र प्रदेश राज्यात परतीचा पाऊस मोठ्या प्रमाणात पडतो. महाराष्ट्रात हलक्या स्वरूपाचा पाऊस पडतो. परंतु, गेल्या दोन वर्षांत हवामानात बदल झाला आहे. लॉकडाऊन काळात पोषक वातावरण निर्माण झाले होते. मात्र, अनलॉक केल्यानंतर सर्व उद्योग, व्यवसाय पूर्ण क्षमतेने सुरू झाले आहेत. याचा परिणामही जाणवू लागला आहे. समुद्रावर वारंवार कमी दाबाचा पट्टा निर्माण होत आहे. पाण्याचे बाष्पीभवन वाढले आहे. हिवाळ्यातील सरासरी तापमानात वाढ झाली आहे. परिणामी, कोल्हापूरसह राज्यात विविध ठिकाणी मुसळधार पाऊस पडत असल्याचे डॉ. जाधव यांनी सांगितले.

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लोकमत

वाहनांच्या गर्दीमुळे प्रदूषणाचा कहर; दिवाळीनेही घातली भर

कोल्हापूरची दिल्ली व्हायला नको : प्रदूषणावर मर्यादा आणणे गरजेचे

लोकमत न्यूज नेटवर्क

यंदाचा फटाक्यांचा आवाज (डेसिबलमध्ये)

शहरातील परिसर	२०२१	२०२०
सीपीआर	५२.६१	५४.००
जिल्हाधिकारी कार्यालय	५६.२६	५६.३७
शिवाजी विद्यापीठ	४९.७२	५१.२२
राजारामपुरी (शांतता क्षेत्र)	६५.७८	५५.०१
उत्तरेश्वर पेठ	६०.७८	५८.५७
शिवाजी पेठ	६६.०१	५८.६८
मंगळवार पेठ	६२.५८	५६.७२
ताराबाई पार्क	६१.०५	५२.६३
(व्यावसायिक क्षेत्र)		
राजारामपुरी	६६.३८	६०.६३
शाहूपुरी	६४.८६	६३.५३
लक्ष्मीपुरी	६३.०५	५९.१०
महाद्वार रोड	७२.४७	६३.१७
गुजरी कॉर्नर	६५.१५	६४.४८
पापाची तिकटी	७२.७८	६८.७८
बिनखांबी गणेश मंदिर	६८.१२	६३.४०
मिरजकर तिकटी	६८.१३	५९.३१
गंगावेश	६३.७१	६०.३८
बिंदू चौक	६५.४३	६२.८८
शिवाजी उद्यमनगर	५९.१९	५९.०४

एप्रिल २०२० ते डिसेंबरपर्यंत शहरातील ध्वनी तसेच वायू प्रदूषणात प्रचंड घट झाली.

ध्वनी मर्यादा किती असावी (डेसिबलमध्ये)

७०	५५	४५	४०
औद्योगिक	व्यावसायिक	रहिवासी	शांतता

ध्वनी प्रदूषणाचे टप्पे (डेसिबलमध्ये)

- ० ते ७० हलका आवाज
- ७० ते ८० त्रासदायक आवाज
- ८० ते ९० त्रास देणारा आवाज
- ९० ते १२० अतिशय त्रासिक आवाज

ध्वनी प्रदूषणाचे परिणाम

ध्वनी प्रदूषणामुळे माणसांच्या मनावरील ताण वाढून हृदयाची धडधड वाढते, रक्तदाब वाढतो, हृदयाचे विकार जडू शकतात, लक्ष विचलित होते, चिडचिड होते, कार्यक्षमता घटते, पचनक्रिया बिघडते, बहिरेपणा येण्याची शक्यता.

औद्योगिक, व्यावसायिक, रहिवासी आणि शांतता क्षेत्रनिहाय शहरातील २२ ठिकाणी विद्यापीठाच्या पर्यावरणशास्त्र विभागाने लक्ष्मीपूजन, पाडवा, भाऊबीज यादिवशी पाहणी केली. सायंकाळी सहा ते रात्री दहा या वेळेत ध्वनी प्रदूषणाच्या नोंदी घेतल्या. त्यामध्ये गेल्या वर्षीच्या तुलनेत ध्वनी प्रदूषणात वाढ झाली. आवाजाची पातळी प्रदूषण नियंत्रण मंडळाच्या मानांकनापेक्षा जास्त होती.

- डॉ. आसावरी जाधव, पर्यावरणशास्त्र विभाग, प्रभारी प्रमुख

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लोकमत

कोल्हापूर, सांगली, साताऱ्यातील हवा स्वच्छतेचा कृती आराखडा

कुलगुरू डी. टी. शिर्के : शिवाजी विद्यापीठातील कार्यशाळेतून पाऊल

लोकमत न्यूज नेटवर्क

कोल्हापूर : कोल्हापूरसह सांगली, सातारा जिल्ह्यांतील हवा स्वच्छ ठेवण्यासाठी आराखडा तयार करण्या. विद्यार्थी, शिक्षकांच्या मदतीने पर्यावरण क्षेत्रातील व्यक्ती, कार्यकर्ते, संघटना, प्रदूषण नियंत्रण मंडळ, महानगरपालिका यांच्या माध्यमातून हा आराखडा राबवूया. फटाकेमुक्त दिवाळी साजरी करून, कोल्हापूरची हवा स्वच्छ ठेवूया, असे आवाहन शिवाजी विद्यापीठाचे कुलगुरू प्रा. डी. टी. शिर्के यांनी बुधवारी येथे केले.

कोल्हापूर शहरातील हवा प्रदूषण नियंत्रण आणि जनजागृतीसाठी महानगरपालिका, प्रदूषण नियंत्रण मंडळ, शिवाजी विद्यापीठातील पर्यावरणशास्त्र विभाग यांच्यातर्फे आयोजित 'राष्ट्रीय स्वच्छ हवा कार्यक्रमा'अंतर्गत ऑनलाईन कार्यशाळेच्या उद्घाटनप्रसंगी ते बोलत होते. पर्यावरणतज्ज्ञ डॉ. पी. डी. राऊत यांनी कोल्हापुरातील हवा प्रदूषण आणि सद्यस्थितीची माहिती दिली. प्रदूषण नियंत्रण मंडळाचे उपप्रादेशिक अधिकारी प्रशांत गायकवाड यांनी हवा प्रदूषणविषयक कायदेशीर बाबींची माहिती दिली. पर्यावरण अधिकारी समीर व्याघ्रांबरे यांनी शहराच्या हवा प्रदूषण नियंत्रण आराखड्याबाबतची माहिती दिली. याची अंमलबजावणी कशा प्रकारे करता येईल, याबाबत पर्यावरणतज्ज्ञ उदय गायकवाड यांनी मार्गदर्शन केले. पर्यावरण विभागप्रमुख डॉ. आसावरी जाधव यांनी स्वागत केले. डॉ. पल्लवी भोसले यांनी आभार मानले.

कोल्हापुरात बुधवारी शिवाजी विद्यापीठामधील राष्ट्रीय स्वच्छ हवा कार्यक्रमाअंतर्गत ऑनलाईन कार्यशाळेत पर्यावरणतज्ज्ञ उदय गायकवाड यांनी मार्गदर्शन केले. यावेळी शेजारी आसावरी जाधव, पी. डी. राऊत, उपस्थित होते.

हवा प्रदूषणाबाबत जनजागृती

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लोकमत

अनंत चतुर्दशीदिवशी आवाजाची पातळी वाढली

शहरातील स्थिती : जास्त लोक रस्त्यावर; ध्वनिक्षेपक यंत्र वापराचा परिणाम

कोल्हापूर : कोरोना महामारीमुळे गर्दी नियंत्रणात असतानाही गेल्या वर्षाच्या तुलनेत यंदा अनंत चतुर्दशीदिवशी रविवारी (दि. १९) आवाजाच्या पातळीत वाढ झाली. गतवर्षीपेक्षा जास्त लोक रस्त्यावर आल्याने आणि ध्वनिक्षेपक यंत्राचा वापर केल्याने ध्वनी पातळीत वाढ झाल्याचे अभ्यासकांचे म्हणणे आहे. यासंबंधीचे सर्वेक्षणही शिवाजी विद्यापीठाच्या पर्यावरणशास्त्र विभागाने केले आहे.

पर्यावरणशास्त्र विभागाने रविवारी शहरातील चार विभागांतील २२ ठिकाणी आवाजाची पातळी यंत्राव्दारे मोजली. संध्याकाळी ६ ते १२ या वेळेत ही मोजणी केली. यातून गत वर्षाच्या तुलनेत यावर्षी ध्वनी पातळीत वाढ झाल्याचे दिसून आले.

अनंत चतुर्दशीच्या दिवशी शहरातील ध्वनी पातळी

(आकडे डेसिबल)

क्षेत्र परिसराचे नाव	२०२०	२०२१
सीपीआर	५५.१७	५६.०६
न्यायालय	४६.५१	५१.०३
जिल्हाधिकारी कार्यालय	४५.६२	५५.०४
शिवाजी विद्यापीठ	४१.७३	३९.९०
रहिवासी भाग		
राजारामपुरी	३९.४७	४०.०१
उत्तरेश्वर पेठ	४६.५२	५१.०२
शिवाजी पेठ	४६.६५	४४.०१
मंगळवार पेठ	३८.१७	४६.२०
नागाळा पार्क	४०.२१	४४.२३
ताराबाई पार्क	४६.८७	४७.३०
व्यावसायिक		
मिरजकर तिकटी	५१.७६	५४.०१
बिनखांबी गणेश मंदिर	४४.१३	५७.०६
महाद्वार रोड	५४.०५	५२.३०
गुजरी कॉर्नर	४३.७१	५२.०१
पापाची तिकटी	५१.६४	६०.०२
राजारामपुरी	५१.०२	५२.०३
लक्ष्मीपुरी	४२.१३	५४.०८
शाहूपुरी	४२.०५	५३.०२
गंगावेश	६०.६१	६३.०८
बिंदू चौक	५२.४०	५५.१०
औद्योगिक		
उद्यमनगर	४५.१२	५६.५०
वाय. पी. पोवारनगर	४३.४५	५४.६०

कोरोनामुळे गतवर्षी अनंत चतुर्दशीदिवशी रस्त्यावर भाविक कमी होते. त्या तुलनेत यंदा भाविकांची गर्दी जास्त राहिली. फटाके, ध्वनिक्षेपकाचाही वापर गतवर्षीपेक्षा अधिक राहिला. त्यामुळे ध्वनी पातळी वाढलेली दिसते.

- प्रा. डॉ. असावरी जाधव, प्रभारी विभागप्रमुख, पर्यावरणशास्त्र विभाग

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सकाळ

जैवविविधतेचे जतन करणे काळाची गरज : डॉ. बाचूळकर

कोल्हापूर, ता. २६ : "पृथ्वीवर असलेल्या फक्त १८ ते २० टक्के जैवविविधतेचा शास्त्रीय दृष्टिकोनातून अभ्यास झाला आहे. पृथ्वीच्या आणि पर्यायाने सर्व सजीवांच्या अस्तित्वासाठी आवश्यक असणारी जैवविविधता समजून घेण्यापूर्वीच नष्ट होत आहे," असे प्रतिपादन डॉ. मधुकर बाचूळकर यांनी केले. शिवाजी विद्यापीठाच्या पर्यावरणशास्त्र विभागातर्फे झालेल्या प्रा. नरहर विष्णू कारेकर विज्ञानविषयक व्याख्यानमालेत 'जैवविविधतेचे मानवी जीवनावरील परिणाम' यावर व्याख्यान झाले.

डॉ. बाचूळकर म्हणाले, "जगभरात केवळ १७ देश जैवविविधतेने नटले आहेत. त्यात भारताचा समावेश असणे जरी आनंद, अभिमान वाटणारी गोष्ट असली तरी जैविविधता नष्ट करत चाललेल्या देशांच्या यादीत देखील भारताचा समावेश आहे हा खेद आहे. सध्या विकासाच्या नावाखाली जंगले जाळून टाकली जात आहेत; पण त्यातून होणारी हानी ही कधीही न भरून काढता येणारी, मोजदाद न करता येणारी आहे. आपण ज्या पश्चिम घाटात राहतो, तो भूभाग निसर्गाची मुक्त उधळण केलेला आहे. तेथील निसर्गसंपत्ती पुढच्या पिढीसाठी जपून ठेवणे हे आपले कर्तव्य आहे."

पर्यावरणशास्त्र विभागप्रमुख डॉ. पी. डी. राऊत म्हणाले, "जैवविविधतेचं संवर्धन करणे हि प्रत्येकाची नैतिक जबाबदारी आहे. ती प्रत्येकाने वयक्तिक पातळीवर पार पडणे महत्वाचे आहे; अन्यथा भविष्यात आपणास नैसर्गिक आपत्तींना तोंड द्यावे लागेल." डॉ. आसावरी जाधव यांनी प्रास्ताविक केले. निर्मला पोखर्णीकर यांनी आभार मानले.

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Lecture by Dr. MadhukarBachulkar under Karekar lecture series
Sakal Page 3 ,27 Feb 2020

चांदोली : येथे वणवा जनजागृतीसाठी पथनाट्य सादर करताना शिवाजी विद्यापीठाचे विद्यार्थी.

पथनाट्यातून वणवा जनजागृती

आंबा : मानवाच्या चुकीतून पर्यावरणाची होणारी हानी, पर्यावरण संवर्धनाची गरज आणि वणव्याचे दुष्परिणाम यावर भाष्य करणारे पथनाट्य सादर करून विद्यार्थ्यांनी लोकांत जनजागृती केली. शिवाजी विद्यापीठाच्या पर्यावरणशास्त्र विभागाचे पंचवीस विद्यार्थी पथनाट्यात सहभागी झाले होते. या विद्यार्थ्यांनी बांबवडे येथील मध्यवर्ती ठिकाण, राजा शिवाजी महाविद्यालय करंजोशी, अंबेश्वर हायस्कूल आंबा व चांदोली येथील गावाच्या मध्यभागी पथनाट्याचे सादरीकरण केले. पर्यावरणशास्त्र विभागाचे प्रमुख प्रा. डॉ. पी. डी. राऊत, डॉ. आसावरी जाधव, निर्मला पोखर्णीकर, डॉ. पल्लवी भोसले, आरती परीट यांच्या मार्गदर्शनाखाली संशोधक विद्यार्थी संजीवनी चौगुले, चेतन भोसले, प्रिया वसगडेकर यांनी परिश्रम घेतले. संयोजन डॉ. योजना पाटील यांनी केले. यावेळी मोनेरा फाउंडेशनचे संस्थापक अध्यक्ष अजिंक्य बेर्डे, रोहित पाटील, रेश्मा पाटील, राहुल घट्टे उपस्थित होते.

Street play for Forest fire abatement

लोकमत

शिवाजी विद्यापीठाकडून मोजमाप

गतवर्षीपेक्षा यंदा दिवाळीत ध्वनिप्रदूषणात किंचित वाढ

■ लोकमत न्यूज नेटवर्क

कोल्हापूर : यंदाच्या दिवाळीमध्ये लक्ष्मीपूजन दिवशी सायंकाळी सहा ते रात्री साडेदहा वाजेपर्यंत गेल्यावर्षीच्या तुलनेत विविध भागांमध्ये फटाक्यांचा आवाजासह ध्वनिप्रदूषण किंचित प्रमाणात वाढले. औद्योगिक क्षेत्र वगळता इतर सर्व क्षेत्रांमध्ये केंद्रीय प्रदूषण नियंत्रण बोर्ड (सीपीसीबी) च्या मानांकनापेक्षा आवाजाची पातळी जादा राहिली.

शिवाजी विद्यापीठाच्या पर्यावरणशास्त्र विभागाने यावर्षी औद्योगिक, व्यावसायिक, रहिवासी आणि शांतता क्षेत्रनिहाय शहरातील १२ ठिकाणी शनिवार ते सोमवार दरम्यान पाहणी केली. सायंकाळी सहा ते रात्री दहा या वेळेत ध्वनिप्रदूषणाच्या नोंदी घेतल्या. त्याची माहिती पर्यावरणशास्त्र विभागाच्या प्रभारी प्रमुख डॉ. आसावरी जाधव यांनी बुधवारी दिली.

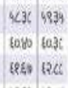
औद्योगिक क्षेत्रातील शिवाजी उद्यमनगर, वाय. पी. पोवारनगर परिसर वगळता व्यावसायिक, रहिवासी, शांतता क्षेत्रात आवाजाने मर्यादा ओलांडली असल्याचे दिसून आले. दिवाळीतील इतर दिवसांपेक्षा लक्ष्मीपूजनाच्या दिवशी आवाजाच्या पातळीत वाढ झाली. माजी विभागप्रमुख डॉ. पी. डी. राऊत यांच्या मार्गदर्शनाखाली संशोधक विद्यार्थी चेतन भोसले, अजय गौड, योगेश गळगले, अनिकेत भोसले, सौरभ पोवार यांनी ध्वनीपातळी मोजण्याचे काम केले.

गेल्या वर्षीच्या तुलनेत यावर्षी फटाक्यांचा आवाज (डेसिबलमध्ये)

शहरातील ठिकाणे	२०१९	२०२०
सीपीआर	५२.७६	५४.००
न्यायालय	५०.६३	५४.०७
जिल्हाधिकारी कार्यालय	५५.३५	५६.२०
शिवाजी विद्यापीठ	५०.५४	५१.१२
राजारामपुरी (रहिवासी)	५३.३२	५५.०९
शिवाजी पेठ	५५.५६	५८.६८
नागाळा पार्क	५२.९६	५३.९२
मंगळवार पेठ	५३.८५	५६.७२
राजारामपुरी (व्यावसायिक)	५८.५२	६०.६३
शाहूपुरी	५९.०३	६३.५३
लक्ष्मीपुरी	५८.३२	५९.७०
महाद्वार रोड	६०.३३	६३.६७
मिरजकर तिकटी	५८.३८	५९.३५
गंगावेश	६०.४०	६०.३८
बिंदू चौक	६१.६७	६२.८८
शिवाजी उद्यमनगर	५९.६२	५९.०४

मर्यादा अशा

क्षेत्र	रात्री
औद्योगिक	७०
व्यावसायिक	५५
रहिवासी	४५
शांतता	४०



गणेशोत्सवापेक्षा अधिक आवाज

गेल्यावर्षीपेक्षा यंदा ध्वनिप्रदूषण वाढले, पण त्याचे प्रमाण फार नाही. फटाक्यांसह गजबजलेल्या बाजारपेठा, वर्दळ, वाहनांच्या आवाजाचा ध्वनिप्रदूषणामध्ये समावेश आहे. यंदाच्या गणेशोत्सवातील आवाजापेक्षा दिवाळीत अधिक आवाज राहिला. अशी प्रतिक्रिया शिवाजी विद्यापीठाचे डॉ. आसावरी जाधव यांनी सांगितले.

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Sound level monitoring during Diwali Festival
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पर्यावरणाचा समतोल राखण्याचे आव्हान

अमोल सावंत : सकाळ वृत्तसेवा

कोल्हापूर, ता. १५ : कोरोनाच्या लॉकडाउननंतर कोल्हापूर जिल्हा अधिक समृद्ध अन् शांततेचं लेणं अनुभवत आहे. निळेभोर आकाश अन् स्वच्छ हवेचे प्रवाह सर्वत्र वाहत आहेत. पक्षी-प्राण्यांना निवांतपणा मिळाला आहे. मानवी हस्तक्षेप तर अजिबात जाणवत नाही. कितीतरी वर्षांनंतर हा अनुभव चराचर सृष्टीत उतरलेला दिसत आहे; पण कोरोनाच्या संकटाची तीव्रता कमी झाल्यानंतर तो अनुभवायला मिळणार का? असा प्रश्नही उपस्थित होतो. यामुळे पर्यावरणाचा समतोल राखण्याचे आव्हान आपल्यासमोर असेल.

कोरोना इम्पॅक्ट (पर्यावरण)

शिवाजी विद्यापीठाच्या पर्यावरणशास्त्र विभागाने केलेल्या पाहणीत शहरात हवेचे प्रदूषण ५० टक्क्यांनी घटलेले आढळले. शिरोली एमआयडीसी, गोकुळ शिरगाव एमआयडीसीतील घरघर थांबली आहे. हवा, पाणी, जमिनीच्या प्रदूषणात कमालीची घट जाणवत आहे. कचऱ्याचे प्रमाण घटले आहे. गतवर्षीच्या तुलनेत यंदा उन्हाळ्याला लवकर सुरवात झाली. दुपारच्या वेळेत तापमानाचा पारा ३७ ते ४० अंशांपर्यंत गेल्याची नोंद दिसते. असे असूनही उकाड्याची तीव्रता कमी आहे; कारण वाहने रस्त्यावर नसल्याने हवेतील कार्बनचे प्रमाण कमी झाले. औद्योगिक वसाहतीमध्ये येणारे सांडपाणी, रसायनमिश्रित पाणी सध्या बंद आहे. परिणामी, तुलनेत पंचगंगा नदीचे पात्र स्वच्छ दिसत आहे. सेंद्रिय पदार्थ, प्लास्टिक कचरा वाहून नेणारी गटारे तुंबत नाहीत.

मानवी हस्तक्षेप कमी झाल्याचा परिणाम निसर्गातील सर्व घटकांवर जाणवत आहे. पेट्रोल-डिझेलचा वापर तुलनेने कमी झाला. आवाजाची तीव्रता सर्वत्र कमी झाल्याने पक्ष्यांचे मुक्त आकाशात उडणारे थवे, निसर्गातील प्राणी-पक्ष्यांनी मोकळा श्वास घेतला आहे.

"लॉकडाउनमुळे पर्यावरणावर सकारात्मक परिणाम जाणवत आहे. हवा स्वच्छ झाली. प्रदूषके कमी झाली. आवाज कमी झाला. पाण्याची नितळता जाणवत आहे. आम्ही शिवाजी विद्यापीठातील प्रयोगशाळेत पाण्याचे पृथक्करण करत आहोत. जंगलात, गावात, शहरात शांतता अनुभवायला येत आहे. हीच शांतता निसर्गामध्येही दिसत आहे."
- डॉ. पी. डी. राऊत, पर्यावरणशास्त्र विभागप्रमुख, शिवाजी विद्यापीठ

Environmental Conservation during COVID pandemic -News bite by Prof.(Dr.)P.D.Raut

सकाळ TODAY कोल्हापूर परिसर

अॅकॅडेमिक कामास प्राधान्य

डॉ. पी. डी. राऊत यांचा पुस्तके, शोधप्रबंध वाचनावरही भर

Daily SakalNews paper, 15 Apr 2020

मटा राउंड टेबल महापालिका अर्थसंकल्प

दुसरा विकास आराखडा राबवा

प्रशासनाला दिली उत्पन्नवाढीची गुरुकिल्ली

उत्पन्नवाढीसाठी हद्दवाढ अनिवार्य

ओपन स्पेस विकासासाठी धोरण ठरवावे

वर्षभर वसुलीसाठी स्वतंत्र पथक असावे

उद्यमनगरासाठी स्वतंत्र निधी असावा

वाहतूक व्यवस्थेला प्राधान्य द्यावे

अधिकाऱ्यांना वेळ नाही

पर्यावरणासाठी वेगळा विभाग व निधी असावा

तिसऱ्या आराखड्यासाठी तरतूद करावी

Maharashtra Times News related to developmental plan round table

कर्फ्यूकाळात ध्वनिपातळी निम्म्यावर

म. टा. प्रतिनिधी, कोल्हापूर

आवाज कमी होण्याची कारणे

Sound level monitoring during Curfew Maharashtra Times News

दत्तक योजनेतून ग्रीन कॅम्पसला बळ

पर्यावरणशास्त्र अधिविभागाचा पुढाकार; विद्यार्थ्यांवर संगोपनाची जबाबदारी

DailySakalnews related to Green campus


पुढारी

आम्ही स्वच्छतेचे शिलेदार...

Cleanliness drive at Udyamnagar, KolhapurPudhari News


मटा अँकर

धूळ, कचऱ्यामुळेच शहराची हवा बिघडली

अतिप्रदूषित २० शहरांत कोल्हापूर

म.टा. प्रतिनिधी, कोल्हापूर

प्रदूषणाची काही महत्त्वाची कारणे

- कचरा उठावात सातत्य नाही
- कचरा विभाजनाबाबत लोकांमध्ये जागृती नाही
- बायोमायनिंग प्रकल्पाला मुहूर्त नाही
- वाहनांची वाढती संख्या
- १५ वर्षांपूर्वीच्या वाहनांची धूर तपासणी होत नाही
- भेसळयुक्त इंधन विक्रीवर अंकुश नाही

कोल्हापूरच्या विकासाच्या दृष्टीने प्रदूषण ही घातक बाब आहे. पर्यटनाच्या नकाशावर कोल्हापूरचे ब्रँडिंग होत असताना दूषित हवेचा टक्का वाढत राहणे योग्य नाही.

– डॉ. पी. डी. राऊत, विभागप्रमुख, पर्यावरण विभाग, शिवाजी विद्यापीठ

Opinion by Prof. Dr. P.D.Raut, Maharashtra Times News


पुढारी

वायू प्रदूषणामुळे आयुर्मानात घट

एनर्जी पॉलिसी इन्स्टिट्यूटच्या अहवालातील माहिती

Air quality analysis News Pudhari Page 1, 3 Apr 2021


सकाळ

विसर्जनादिवशी वाढले ध्वनिप्रदूषण

यंदा गणेशोत्सवात गर्दी अधिक; गतवर्षापेक्षा आवाज मोठा

Sound level monitoring during Ganesh festival , Daily Sakal, 21 Sep 2021

Plantation activity on campus, 5th June 2020

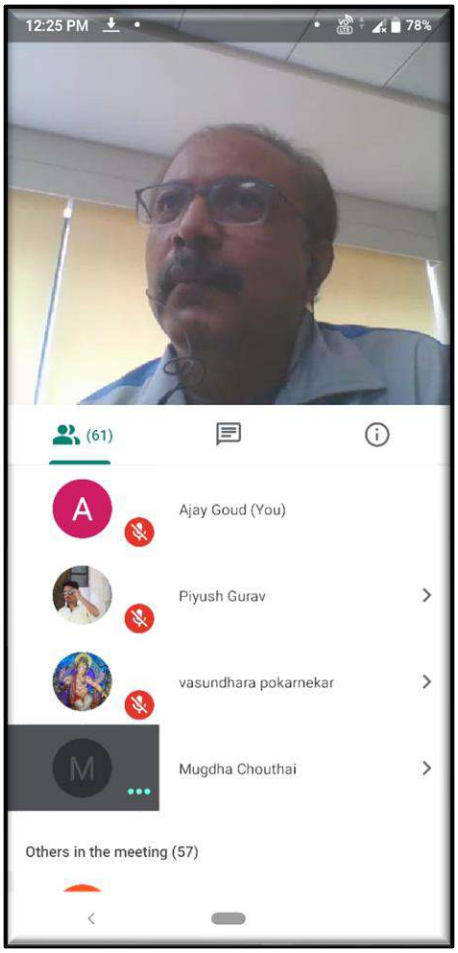
Plantation Activity on campus, 5th June 2020

Ecofriendly Ganesh Idol Making "Ecofriendly Ganesha Workshop"
10th August, 2020

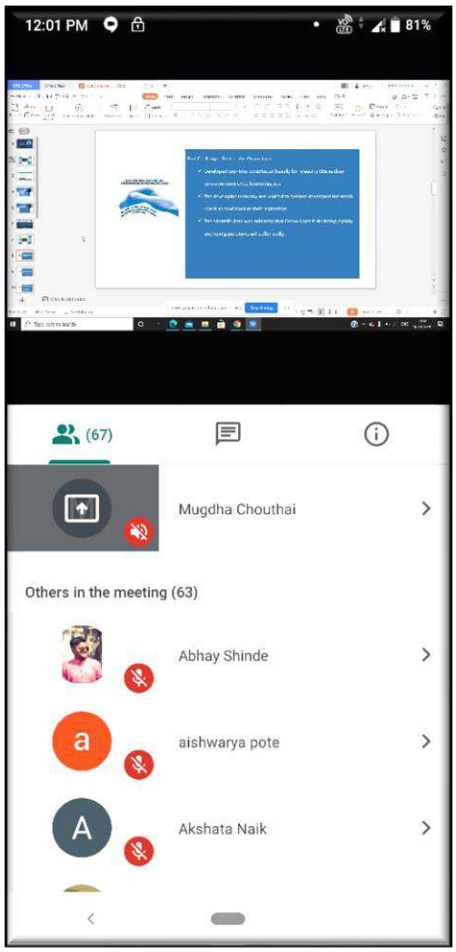
Ecofriendly Ganesh Idol Making "Ecofriendly Ganesha Workshop"
10th August, 2020

Donation of Ganesh Idol Program at SYBER Chouk, Kolhapur: 27th August 2020

Donation of Ganesh Idol Program at SYBER Chouk, Kolhapur: 27th August 2020



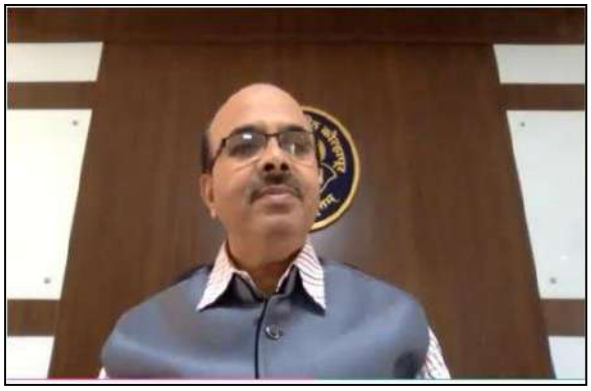
World Ozone Day Celebration
16th September 2020



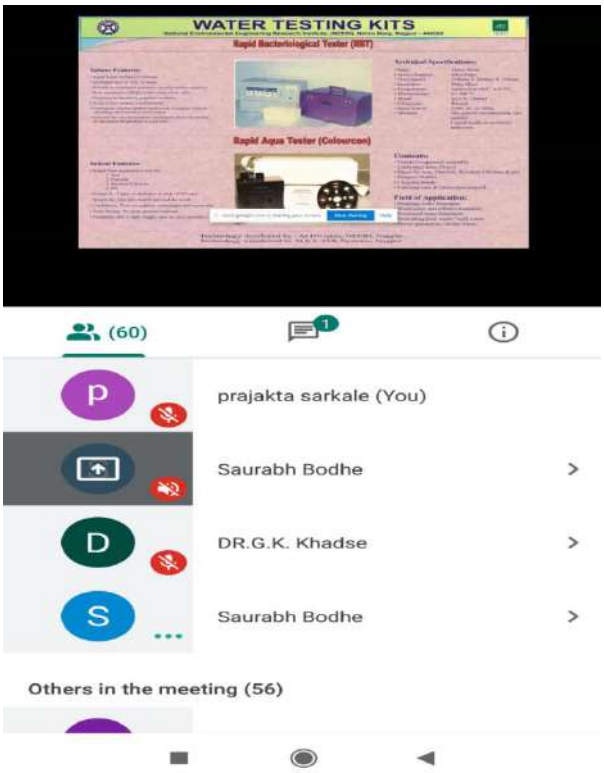
World Ozone Day Celebration
16th September 2020

Wild life week celebration of Department of Zoology in collaboration with Department of Environmental Science 5th to 8th October 2020

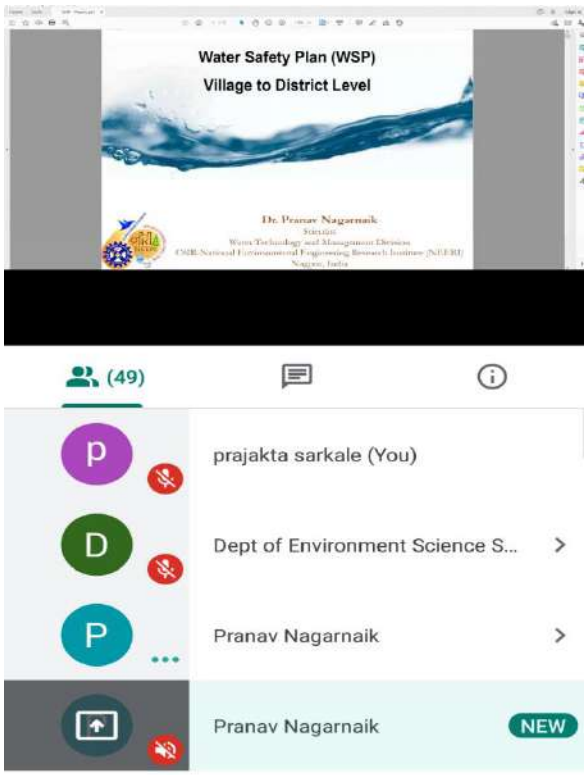
Online workshop under the National Clean Air Program



Hon. VC delivering a talk in National Clean Air Program



Online lecture series with NEERI under UGC's STRIDE program on "Water: Quality, Treatment and Management" 2nd Feb to 6th Feb, 2021.



Online lecture series with NEERI under UGC's STRIDE program on "Water: Quality, Treatment and Management" 2nd Feb to 6th Feb, 2021.

World Environment day plantation activity 5th June 2021

Lecture on the occasion of National Science Day celebration at Shahaji College, Kolhapur on COVID and Science on 27th Feb 2021.

Lecture delivered by Dr. Manoj Borkar, Goa world Environment Day 5th June 2021.


Nail free tree Abhiyan in Kolhapur
3rd January 2021
Surrounding of Shivaji University, Campus

लोकमत

'मी गाडगेबाबा' अभियानांतर्गत पाच टन प्लास्टिक संकलित

लोकमत न्यूज नेटवर्क

कोल्हापूर : मी गाडगेबाबा या अभियानांतर्गत शहरात विविध ठिकाणी स्वच्छता अभियान राबवले गेले. यामध्ये १६०० नागरिकांनी सहभाग घेतला, तर २० स्वयंसेवी संस्था यामध्ये सक्रिय होत्या. एका तासात सुमारे ५ टन प्लास्टिक संकलित करण्यात आले.

संत गाडगेबाबा जयंतीनिमित्त अर्थ वॉरियर्स संस्थेकडून हे अभियान राबवले. अर्थ वॉरियर्सचे निमंत्रक सुबोध भिंगार्डे, डॉ. सूर्यकिरण वाघ, पर्यावरणतज्ज्ञ उदय गायकवाड, ॲड. केदार मुनिश्वर, तृप्ती देशपांडे, आदिती गर्गे, प्र. द. गणपुले, महापालिका आरोग्य निरीक्षक जयवंत पवार, पर्यावरण अधिकारी समीर व्याघ्रांबरे, राहुल राजगोळकर हे सहभागी झाले होते. महापालिका उद्यान विभागाच्या १२६ कर्मचाऱ्यांनी शहरातील ५४ उद्यानांतून ७० पोती प्लास्टिक कचरा संकलित केला. जिल्हा परिषदेचे मुख्य कार्यकारी अधिकारी संजयसिंह चव्हाण, उपमुख्य कार्यकारी अधिकारी प्रियदर्शनी मोरे यांच्या मार्गदर्शनाखाली सुमारे २३ ग्रामपंचायतींमधील कर्मचारी यामध्ये सहभागी झाले होते. शिवाजी विद्यापीठाचे कुलगुरू डॉ. डी. टी. शिर्के यांच्या हस्ते विद्यापीठ परिसरात अभियानाची सुरुवात झाली.

मी गाडगेबाबा या अभियानांतर्गत शहरात विविध ठिकाणी स्वच्छता अभियान राबवले. यामध्ये मोठ्या प्रमाणात प्लास्टिक गोळा केले.

उपक्रमात सहभागी संस्था

किर्लोस्कर उद्योग समूह, क्रीडाई, वृक्षप्रेमी, निसर्ग मित्र, गार्डन क्लब, स्वरा फाउंडेशन, रोटरी क्लब, समृद्धी विकास मंच, आरग फाउंडेशन, वांगुळपणाची चळवळ, सात्विक समाज, फेरीवाला संघटना, पुई केअर सोशल फाउंडेशन, प्लास्टिक रिसायकल प्रोजेक्ट, करवीर नगर वाचन मंदिर, के.डी.एम.जी., स्वयंप्रभा मंच.

Kolhapur Main
Page No. 2 Feb 24, 2021
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Me GadgebabaAbhiyan:
Plastic Collection Drive by technology department
23rd January 2021

Cleaning Campaign
17January 2021
7.00-9.00am
Near Playground Department of Technology Premises

Radhanagari Wildlife Sanctuary Logo Competition
25 January 2021
ShahuSmarak, Kolhapur

Cleaning Campaign RCC Naka-SUK Campus
12 February 2021

World Sparrow Day

International Day of Forest

World Water Day22nd March, 2021

World Meteorological Day23rd March, 2021

International Vulture Awareness Day
Sep. 21
Rest House Forest Department Kolhapur

VanmohotsavSaptah
1 July 2021

Plantation Activity with Income Tax Department
Under AzadikaAmritMahotsav
15 Sept. 21 at Gadmudshingi

Plantation Near playground, Department of Technology, SUK

Nirmalya Collection Activity
AnantChaturdashi
Irani Khan, Rankala, Daulatnagar
19 Sept. 21

Nirmalya Collection Activity
AnantChaturdashi
Irani Khan, Rankala Kolhapur/Daulatnagar
19 Sept. 21