# **Integrated Audit Report**

## (2022-23)

(Green, Environment & Energy Audit)

## **Toshniwal Arts, Commerce & Science College**

## Sengaon Dist. Hingoli MS- 431542







## **CONDUCTED BY :**

## SHREYAS QUALITY MANAGEMENT SYSTEM,

11, Tulsivihar, Abhyankarnagar, Nagpur-440010 (MS)

M :9822469560, 0712-2240012, sqmslakhe@gmail.com, www.sqmsindia.com

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## **ACKNOWLEDGEMENT:**

Green Audit Assessment Team thanks **Toshniwal Arts, Commerce and Science College, Sengaon, Dist. Hingoli** for assigning this important work of Green Audit. We appreciate the cooperation extended to our team during the entire process.

Our special thanks are due to Principal – **Dr. Talnikar Shripad Gajananrao, Dr. R. A. Joshi, Coordinator - IQAC** & Team members for giving us necessary inputs to carry out this very vital exercise of Green Audit.

We are also thankful to Department Heads and other staff members who were actively involved while collecting the data and conducting field measurements.

Dr. R. R. Lakhe Director Shreyas Quality Management System, Nagpur.



### **DISCLAIMER:**

Green Audit Team has prepared this report for **Toshniwal Arts**, **Commerce and Science College, Sengaon, Dist. Hingoli** based on input data submitted by the representatives of College complemented with the best judgment capacity of the expert team. The audit was conducted on the sample basis by visiting the college and interacting with the various stakeholders. Audit was conducted by interviewing the concerned persons, observing on-site implementation and verifying the documents and records.

While all reasonable care has been taken in its preparation, details contained in this report have been compiled in good faith based on information gathered.

It is further informed that the recommendations are arrived following best judgments and no representation, warranty or undertaking, express or implied is made and no responsibility is accepted by Audit Team in this report or for any direct or consequential loss arising from any use of the information, statements or forecasts in the report.

#### **Prepared by:**

Mr. M. M.Naveed, Sr.Consultant Shreyas Quality Management System, Nagpur

#### **Technical Review by:**

Dr. R. R. Lakhe Director SQMS, Mr. Sayyad Nasir, Sr.Consultant





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## **EXECUTIVE SUMMARY:**

The rapid urbanization and economic development at local, regional and global level has led to several environmental and ecological crises. On this background it becomes essential to adopt the system of the Green and environmentally sustainable practices on the Campus of the institute which will lead for sustainable development.

Toshniwal Arts, Commerce and Science College, is deeply concerned and unconditionally believes that there is an urgent need to address these fundamental problems and reverse the trends of pollution. Being a premier institution of higher learning, the college has actively promoted the various projects for the environment protection and sustainability.

The purpose of the audit was to ensure that the practices followed in the campus are in accordance with the Green Environment Energy Policy adopted by the institution and also following the



practices of ISO 14001-2015 EMS/ ISO 50001:2018 EnMS. It works on the several facets of 'Green Campus' including Water Conservation, Tree Plantation, Waste Management, Paperless Work, Alternative Energy and Mapping of Biodiversity. With this in mind, the specific objectives of the audit are to evaluate the adequacy of the management control framework of environment sustainability as well as the degree to which the Departments are in compliance with the Green and Environment Policy. It can make a tremendous impact on student health, reducing college operational costs and improvement in the environment. The criteria, methods and recommendations used in the audit were based on the identified risks.

#### **BRIEF RECOMMENDATIONS**

#### **Green & Environment:**

1. Ensure Environment policy, Environment objectives, Environment conservation plan availability.

2. Disposal of waste to MPCB/Corporation approved agency. Maintain the record of waste disposal as per local authority norms.

3. Environment (Air, Water, Stack, Noise etc.) testing and monitoring with defined frequency to be ensured. (At least once in a year)

4. Facilitate & Ensure PUC for all the fuel vehicles arriving at college.

5. Plantation of traditional trees as CSR activity can be undertaken.

6. Green initiatives/practices, 3R (Reuse, Recycle, Reduce) to be adopted/researched upon.

7. Ban on single use plastic. Poster to be displayed related to it.

8. Store electrical and electronic waste and hand it over periodically to scrap dealers to ensure its proper recycling

9. Environment friendly poster displays.

10. Installation and maintenance of ETP/STP as per regulatory norms.

11. Rainwater harvesting system needs to be improved and horizontally deployed.

12. Awareness building related to Environmental acts and rules, Good practices amongst the staff and students.

#### **Energy:**

1. A well-prepared electrical wiring plan for the campus, which would help identify unused points of power and also in re-wiring the buildings.

2. Electric fans should be serviced and bearings replaced wherever necessary.

3. The scope for non-conventional energy should be utilized. Eg. Installation of roof top solar panels, Use of solar cells.

4. Installation of a suitable Bio-gas plant to save energy used for heating water in Science laboratories.

5. Rigorous training for both students and staff to inculcate awareness for the need of energy conservation. If everyone ensures switching off lights, fans and electrical gadgets that are not in use, roughly 10% to 15% of energy saving is possible.

6. A master switch located at a prominent place which can be directly supervised by the HoD/supervising staff would help avoid power wastage in closed rooms.

7. A healthy competition may be encouraged between departments by honoring those departments that produce higher savings by good practices. An element of weight-based on the above lines may be considered for allocation of funds.

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- 8. Conversion of ordinary tubes into LED tubes can save a major share of power consumption
- 9 Effective use of classrooms and laboratories by switching off electrical gadgets after use
- 10. Replacement of low power consuming equipments in laboratories instead of old ones
- 11. Encouraging the application of solar energy.
- 12. Study & research on use of renewable energy sources in campus like-
  - 1. On-Campus Solar Energy
  - 2. On-Campus Wind Energy
  - 3. Solar Heating and Hot Water
  - 4. Geothermal Energy
  - 5. Renewable Energy Purchasing
  - 6. Energy Efficiency in Campus Buildings
  - 7. Microgrids and Energy Storage
  - 8. Electric Transportation
  - 9. Sustainable Transportation
  - 10. Energy Conservation

## **COLLEGE VISION, MISSION, GOAL**

#### Vision:

• All Inclusive Educational Development Of The Region.

#### **Mission:**

- To Develop The Rural Students To Face Challenges Of Futures And Make Them Responsible Citizens Of India.
- To Provide Opportunity Of Higher Education With Economic And Social Relevance To The Region.

## **Goal:**

- ✓ To Encourage The Rural And Tribal Students For Higher Education.
- To Create Awareness Among Students, Teachers And People Regarding Emerging Social- Cultural And Environmental Issues.
- ✓ To Impart Enough Opportunities For Students, And Teachers For Their Career Development.
- ✓ To Encourage Students And Teachers To Contribute And Participate In Knowledge Based Activities.
- To Carry Forward Various Extension Activities Through Cultural Committee And NSS Department For Cultivation Of Core Values Like National Integration, Equality, Fraternity, Humanity, Secularity, Democracy, Social Ethics, Piece Etc.
- ✓ To Make Students Job Efficient And Create Job Skills Required For Employment And Make Them Self Reliable.
- ✓ To Cater The Needs Of Diversity Of Students From Traditional To Scientific Approach And Develop The Same Among Them.
- ✓ To Provide Scientific Knowledge And Technical Assistance, Guidance And Training To Need Based Individuals And Groups In This Area.



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## **INTRODUCTION:**

Green, Environment and Energy Audit is a process of systematic identification, quantification, recording, reporting and analysis of components of environmental diversity of various establishments. It aims to analyze environmental practices within and outside of the concerned sites, which will have an impact on the eco-friendly ambience. Green, Environmentand Energy audit can be a useful tool for a college to determine how and where they are using the most energy or water or resources; the college can then consider how to implement changes and make savings. It can also be used to determine the type and volume of waste, which can be used for a recycling project or to improve waste minimization plan. It can create health consciousness and promote environmental awareness, values and ethics. It provides staff and students better understanding of Green impact on campus. If self-enquiry is a natural and necessary outgrowth of a quality educational institution. Thus it is imperative that the college evaluate its own contributions toward a sustainable future. As environmental sustainability is becoming an increasingly important issue for the nation, the role of higher educational institutions in relation to environmental sustainability is more prevalent.



A Nation's growth starts from its educational institutions, where the ecology is thought as a prime factor of development associated with environment. Educational institutions now a daysare becoming more sensitive to environmental factors and more concepts are being introduced to make them eco-friendly. To preserve the environment within the campus, various viewpoints are applied by the several educational institutes to solve their environmental problems such as promotion of the

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energy savings, recycle of waste, water reduction, water harvesting etc.. The activities pursued by colleges can also create a variety of adverse environmental impacts. Environmental auditing is a process whereby an organization's environmental performance is tested against its environmental policies and objectives. Energy audit helps to improve energy performance there by reducing energy consumption, carbon foot print etc. Green, Environment & Energy audit is defined as an official examination of the effects a college has on the environment. As a part of such practice, internal audit is conducted to evaluate the actual scenario at the campus. This can be a useful tool for a college to determine how and where they are using the most energy or water or resources; the college can then consider how to implement changes and make savings.



It can also be used to determine the type and volume of waste, which can be used for a recycling project



or to improve waste minimization plan. Green, Environment and Energy auditing and the implementation of mitigation measures is a win-win situation for all the college, the learners and the planet. It can also create health consciousness and promote environmental awareness, values and ethics. It provides staff and students better understanding of Green impact on campus. Green, Environment and Energy auditing promote financial savings through reduction of resource use. It gives an opportunity for the development of ownership, personal and social responsibility for the students and teachers. Thus it is imperative that the college evaluate its own contributions toward a sustainable future. As environmental sustainability is becoming an increasingly important issue for the nation, the role of higher educational institutions in relation to environmental sustainability is more prevalent. A clean and healthy environment aids effective learning and provides a conducive learning environment. There are various efforts around the world to address environmental education issues. ISO 14001-2015 Environmental Management Systems (EMS) is very popular in the industrial sector, but the general belief is that EMS is something pertaining to industries only. Other

parts of the world have started adopting compatible environmental management systems either voluntarily or for promoting standards by external certification.

#### **Goals of Audit:**

College has conducted Green, Environment & Energy audit with specific goals as:

- 1. Identification and documentation of good practices followed by college.
- 2. Identify strength and weakness in systems/practices.
- 3. Conduct a survey to know the ground reality about practices.
- 4. Analyze and suggest solution for problems identified from audit.
- 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.

#### Objectives of the Audit:

The main objective of the Audit is to promote the Energy and Environment Management and Conservation in the College Campus. The purpose of the audit is to identify, quantify, describe and prioritize framework of Environment Sustainability in compliance with the applicable regulations, policies and standards. The main objectives of carrying out Green Audit are:

•To examine the current practices which can impact on environment such as of resource utilization, waste management etc.

- •To identify and analyze significant environmental issues.
- •Setup goal, vision and mission for practices in campus.
- •Establish and implement Energy and Environmental Management in various departments.
- •Continuous assessment for betterment in performance in green practices and its evaluation.

•To prepare an Energy & Environmental Statement Report on practices followed by different departments, support services and administration building.

In order to perform Green, Environment and Energy audit, the methodology included different tools such as preparation of questionnaire, physical inspection of the campus, observation and review of the documentation, interviewing key persons and data analysis, measurements and recommendations. The study covered the following areas to summarize the present status of environment management in the campus:

#### Water management

- ✓ Raw Water
- ✓ Drinking Water
- ✓ Laboratory Waste Water
- ✓ Sewage Water
- ✓ Rain Water Harvesting
- ✓ Washroom water
- ✓ Water used in Canteen/Mess
- ✓ ETP/STP
- $\checkmark$  Waste water
- Energy Conservation
  - ✓ Petrol
  - ✓ Diesel
  - ✓ LPG
  - ✓ Electricity
  - ✓ Batteries
  - ✓ Solar Energy
- Green area management
- Air & Noise Quality Monitoring
- Waste Management
  - ✓ Hazardous Waste
  - ✓ Non- Biodegradable Solid Waste
  - ✓ Biodegradable Municipal Solid waste Bio- Medical Waste
  - ✓ Kitchen Waste
  - ✓ E-waste management
- Environment Consciousness

## **Review of the Documentation:**

- Green and Environment Policy,
- ISO14001 Environment Management System requirements.
- ISO50001 Energy Management System requirements

## **Interviews:**

Interviews were conducted with the Principal, and also faculties and students.

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## **Physical Inspection:**

The audit team virtually inspects the college to inspect the campus and review Green and Environmental actions.

Sr.No.	Name of Auditor	Designation	
1	Dr D D Lakha	Lead Auditor for ISO 14001 EMS, ISO	
I	DI. K. K. Lakile	45001, ISO 9001 & ISO 50001	
		ISO 14001 EMS auditor, Sr. Consultant,	
2	Sayyad Nasir	SQMS, Certified Energy Auditor from Bureau	
		of Energy Efficiency (BEE)	
		ISO 14001 EMS auditor, ISO 14001 EMS	
3	Mr. M. M. Naveed	auditor Sr. Consultant, SQMS Nagpur,	
		Environment System Auditor	

## Auditors for Green, Environment and Energy audit:



## **ABOUT COLLEGE:**

Toshniwal College of Art's, Commerce and Science have directly or indirectly played a crucial role in craving a new niche for students. During the last two decades, the institute has taken a giant leap in introducing conventional, vocational, career and job-oriented Programmes at undergraduate levels benefiting thousands of students and empowering a large number of rural women.



## Name of the Institute:

Toshniwal Arts, Commerce and Science College Address: Hingoli Road, Sengaon Tq Sengaon Dist Hingoli 431542 Website/ Email/ Contact No. www.toshniwalcollege.ac.in **Contact Person:** Dr SG Talnikar Principal 8378888333/ Dr RA Joshi Coordinator IQAC 7775058884 **No. of Branches:** 03 UG (BA, BCom and BSc) 04 UG (BVoc) and 04 PG (MSc Botany, MA Marathi, MA Economics and MCom) 01 Research Centre Commerce **No. of Students** : 1169 **No. of Faculty Members** : 36 **No. of Non-Teaching Members** : 15 **No. of Buildings** : 04 **No. of Buildings** :04 No. of Hostel :01 No. of Boys hostel./ Total occupancy : Nil No. of Girls hostel./ Total occupancy : 60 : 10 Acre 29768 SM **Total campus area Total Garden Area/ Open Area** : 03 Acre **College building Spread Area** : 07 Acre

## **Academic Environment:**

Students have a wide choice of UG as well as PG programs in the Faculty of Science & Literature. It includes B.Sc., M.Sc. MA, MCom and skill based degree programmes. The College is recognised as Centre for Higher Learning and Research to SRTM University Nanded for Ph.D. Programme.

## Infrastructure;

College spread in lush green area of about 10 acres in which Over 3 acres are used for building campus and 7 acres remains for ground, garden, RO drinking water, Botanical Garden, green lush lawn, students' section, parking, solar lights etc

#### **Placement:**

Good number of student placemen in companies TCS, Wipro, Cognizant, Infosys, and others.

## **ENVIRONMENTAL POLICY**

Management faculty and staff of Toshniwal Arts, Commerce and Science College, is committed for carrying out its activity for sustainable development. This we will achieve through the following-

- To Use Solar Energy on College Campus by installing Solar Lamps.
- To sensitize the students and staff regarding the use of water properly.
- To bring in use the 'Rain Water Harvesting' on the campus.
- To minimize the use of paper. It will help to go towards 'Paperless Office'.
- To use the solid waste through vermin-compost on the campus and use it as a fertilizer.
- To protect and nurture the Flora and Fauna on the campus
- To maintain the green campus.

## **Good Points:**

1. College has formed the team of faculty and student to enhance the green environment, to maintain biodiversity on the campus and also participates in preventing pollution in society through various drives.

2. College has installed solar panels as an renewable energy source.

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- 3. Environmental subject is included in teaching plan of  $3^{rd}$  year.
- 4. College has a system of e- waste disposal through authorized agency.

5. Tree plantation at college premises and forest is taking place and encourages students to plant the tree.



- 6. College has developed Environmental Policy.
- 7. Arranged training program for the staff of the college on Green Environment.

As a part of the Green Initiatives the practices followed are:

- 1. Plantation at Campus and nearby area
- 2. Vermicomposting
- 3. Solar Panels as renewable energy source
- 4. Disposal of e-waste as per norms



## A. Water Management:



This indicator addresses water consumption, water sources, irrigation, storm water, appliances and fixtures. A water audit is an on-site survey and assessment to determine the water use and hence improving the efficiency of its use.

Water conservation is a key activity as water availability effects on the development of the campus as well as on all area of development such as farming, industries, etc. Keeping this in view water conservation activity is carried out by the college.

The college has 03 bore well as a source of water. The college does not have municipal source of water. The college stores the water in overhead tank (Capacity: 10000L\*3 Tanks). Every day about 25-30000 Litre water is used or pumped (for laboratory use, college use, irrigation etc). Wastage of water is prevented by closing the valves manually. No leakage of water is detected during the audit. The waste water mainly comes from labs, washrooms & kitchen & waste water is released to soap pit. At present waste water is not used for any other purposes. At present lab water is released in common drainage of qty. 1000 Ltr/week. Treatment of lab water is not carried out at present using neutralization.

The sources waste water are categorized in two types:

- I. Laboratory Waste Water which can be said as Effluent and
- II. Domestic Waste Water i.e. Sewage Water.

The effluent produced in this college is about 5000 liters per week per laboratory. The effluent produced in chemistry department will be released after treating and neutralization into the common drainage. Which presently is not carried out by the college.

The Sewage water mainly comes from washrooms of college, girls hostels etc.

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Location/ Area	Avg. total consumption of water per day
1.College	3000
2. Gardening	10000
3. Labs	5000
4. Hostel	5000
5. Utilities/uses	2000
6. Canteen	3000

#### **Recommendations:**

The team of Auditors appreciates the College administration for the good practices in conserving water such as regular plumbing services, regulating the water flow from top and some of the flushes are switched to water efficient flushes. There is willingness to explore the option of Waste Water Treatment thus the (plant based) recycled water can be utilized for the toilet flushing and gardening if it is implemented successfully. It is not possible to estimate the exact quantity of water used by different departments. However the highest consumption of water is most likely happening in toilets, hostels, canteen, girls hostel and in chemical lab in view of the escalation of water scarcity in the region team recommend basic steps be carried out to optimize the water utilization at the college level, which will also contribute to reducing the related expense: College has also work on project like rain water harvesting and widening of Kayadhu River.

- I. Putting up notices in all washrooms and near all water coolers about the need for saving water, and simple tips like ensuring all the taps are properly closed.
- II. Leakages are immediately brought to the notice of the management; respective floor cleaning staff could be given the responsibility to keep a check on every floor if any taps are open or leaking.
- III. To eliminate the spillage and over usage of water in washbasins, urinals and toiler push taps are highly recommended.
- IV. Training to the cleaners in economical use of water for cleaning purposes and a system in place for immediate response when issues of water leakage are observed so that water losses are prevented.

- V. Need of monitoring, controlling overflow is essential and periodically supervision drills should be arranged. In campus small scale/medium scale/ large scale reuse and recycle of water system is necessary.
- VI. Minimize wastage of water and use of electricity during water filtration process, if used, such as RO filtration (Drinking Water) process and ensure that the equipment's used for such usage are regularly serviced and the wastage of water is not below the industry average for such equipment's used in similar capacity.
- VII. Ensure that all cleaning products used by college staff have a minimal detrimental impact on the environment, i.e. are biodegradable and non-toxic, even where this exceeds the Control of Substances Hazardous to Health (COSHH) regulations.
- VIII. All water taps to be checked for its leakage particularly in toilet (Hostels).
- IX. Identification of areas to be carried out such as compost making area, water harvesting tank, bore well used for water harvesting purpose, bore well used for consumable purpose, parking area of staff, students, hazard area etc.
- X. Water meter to be installed on bore well as well as well which is used and daily monitoring and record of water used to be maintained.
- XI. Cleaning schedule of water purifier to be made and followed.
- XII. Water consumption of the college to be monitored and graphs/table to be prepared.
- XIII. Water to be tested from various sources including the potable water purifiers and in canteen.
- XIV. Maintenance of water purifier to be done including replacement of filters.
- XV. Special Internal Water Audit to be conducted quarterly and should be submitted to environment committee.







#### **B. ENERGY USE AND CONSERVATION:**

This indicator addresses energy consumption, energy sources, energy monitoring, lighting, appliance, natural gas and vehicles. Energy use is clearly an important aspect of campus sustainability and thus requires no explanation for its inclusion in the assessment. The college primarily uses energy in the form of electricity provided by MSEDCL. A proper analysis of energy consumption, we need to understand the electricity consumption over at least one academic year, and ideally three previous years. Major use of the energy is at office and laboratories of different departments for lighting, practical and laboratory work. The main electric appliances in the college are, air condition, fans, computers, LCD projectors, and computers , lab equipments, and accessories Major energy consumption equipments are the high wattage electrical appliances such as Air conditioners, water coolers, geyser installed girls hostels, deep freezers in canteen. etc.

#### **Good Practices:**

In all sections of campus lecture rooms, office rooms, laboratories etc are spacious voluminous and airy, having proper natural light and ventilation. Hence actual requirement energy consumption in Page 20 of 66

lightening is minimal. The air conditioners in the management chamber or in Principal Chamber are rarely used and avoiding unnecessary use of the same is a part of the green practice in the College. Besides this, solar system is also installed in the campus as an alternate renewable source of energy,. Installation of solar panels: with capacity-5kva



Equipments like Computers are used with power saving mode. Also, campus administration runs switch –off drill on regular basis.

This indicator addresses energy consumption, energy sources, energy monitoring, lighting, appliance, natural gas and vehicles. Energy use is clearly an important aspect of campus sustainability and thus requires no explanation for its inclusion in the assessment.

## Aim and objective:

- To save conventionally produce electric energy
- Use of non- conventional source of energy
- Use carbon neutral electricity
- Minimization of electric expenses

#### **Observations:**

Following Energy Sources are used in the college:

- > Solar
- Electrical
- Diesel
- > LPG
- > Petrol

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Some of the "Green Practices" on the Campus may include; the display of the instruction boards/notices displayed on each classrooms/ lab for switching of the fans and lights when not required. College may switch to star rating electric appliances in phase wise manner,

- Electrical energy consumption per day for institute—30-40 units per day as per Avg. of Record 2021-22
- ➢ % of LED lamps of total lightning of the campus-50%
- Institute have policy to procure BEE approved, 5 star Rating energy devices/instruments/utilities.
- Total no. of ACs Spilt Ac:06
- Annual maintenance contract is given for ACs.

List of major consuming equipments/ devices lab instrument in institute to be provided with energy usage.

Electrical/Energy audit conducted on 13.08.2022

Electrical Bills for last 12 months

Month	Jan-	Feb-	March-	Aprl-	May-	June-	July-	Aug-	Sep-	Oct-	Nov-	Dec-
	22	22	22	22	22	22	22	22	21	21	21	21
Electrical	1408	981	1675	1680	1581	1434						
Bill												
(Units)												
Amount	9270	6510	11030	10550	10390	10430			14960	8460	7850	6830
(Rs)												

As per the electrical consumption report for the last 10 Months it is observed that

- 1. Less electrical consumption in Feb 22 (Rs. 6510/-) is due to Winter section
- More electrical Consumption in April 22 (Rs. 10550/-) and Sept 21 (Rs 14960) is due to Summer season and Utilization of AC and Cooler

#### ACs used are 06 Nos

Consumption of energy because of ACs is not estimated. No. of Electrical equipment used & electrical Energy Consumed Equipment wise is not estimated.

Sr.No	Utility	Quantity/Nos.
1.	Split AC	06
2.	Window AC	No
3.	LED Light	90

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4.	Tube light (other than LED)	
5.	Cooler	03
6.	Fan	50
7.	Laptop	10
8.	Desktop LED	90
9.	Desktop Tube type	
10.	Water cooler	5
11.	Street light (write type)	
12.	Printer	10
13.	Projector	10
14.	DG Set	01-capacity 32Kva



Fuel type	Four Wheeler	Two Wheeler
Petrol	07	50
Gas	-	-
Diesel	03	-
Battery operated	-	03

# Following simple ways to reduce electricity consumption can be followed:

1. Don't Leave Electronic Appliances On Standby Mode: It is a common tendency among the people to switch off their electrical appliances using the remote, leaving them on standby mode.

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They fail to realize that the device is still consuming 85% of electricity energy and wasting the valuable energy reserve. Instead, by switching off the main power button or by unplugging the socket, they can make a commendable contribution in saving electricity energy.

2. Lighting: The traditional bulbs and tube lights consume a large amount of electricity energy, making a contribution of almost 10 to 15 percent in the electricity bill. In lieu of these outdated bulbs, one must prefer purchasing an energy saving bulb and the fluorescent tubes that glows brightly without consuming more energy.

3. Bring Home Solar Garden Lights: To lighten your garden and add grace to its look, one can easily bring home the highly efficient solar garden lights as they do not entail you to dig trenches or set up wiring connections. Users can easily arrange these fitting anywhere they desire and highlight the dark areas of their gardens. These lights get charged up during the day and illuminate the garden at night.

4. Check out The Energy Star Label: While purchasing electronic appliances like air conditioner, fans refrigerator, microwave and other household appliances, one must make sure that the appliance has an energy star label on it that can help to cut almost 30 percent of the electricity bills.

#### **Recommendations:**

- 1. All electrical loose wire to be dressed up properly.
- 2. Electrical Earthing of the college to be checked regularly.
- 3. Awareness for the use of electricity and paper to be developed in the college.
- 4. Instruction such as all electrical appliances (fans/AC) shall be switched off when "not in use or at the end of the day" to be displayed.
- 5. College takes steps to purchase fans, refrigerators and air conditioners with low energy consumptions with maximum star ratings.
- 6. Use of Diesel generator to be avoided (to reduce the consumption of oil, record of consumption of diesel to be maintained.
- 7. Enhanced renewable energy source capacity.
- 8. The display of the instruction boards/to be displayed on each classrooms/ lab for "switching of the fans and lights when not required".
- 9. Switching to star rating electric appliances in phase wise manner.
- 10. Carbon Sequestration study shall be carried out before plantation of Green Belt.
- 11. Energy Consumption for each building should be estimated to design the energy conservation plan.
- 12. Instead of out-sourcing the Annual Maintenance of Electrical Equipment college concern department staff shall take that responsibility

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- 13. Energy saving awareness shall be done by displaying the boards at appropriate place.
- 14. List of electrical gadgets used in every section, departments, hostels, canteens to be prepared with electrical capacity required.
- 15. Encourage natural ventilation and illumination by alteration in the building structures whenever going for new constructions.
- 16. Air condition in offices needs to be set on  $26^{\circ}$ c.
- 17. Optimise temperature to 26 degree Centigrade in AC
- 18. Regular preventive maintenance of AC.
- 19. Installation of Capacitor Bank in Control Panel to improve power factor
- 20. Proper use of Day light in class room / faculty room.
- 21. Display Energy saving poster at prominent places
- 22. Extra protection MCCB to be installed in each control panel.
- 23. Proper Maintenance of Three Boring machines which are used for Drinking water
- 24. Installation of BEE Approved AC and BLDC Fan in future to reduce Energy consumption
- 25. Regular preventive maintenance of Solar Panel
- 26. Occupancy sensor to be installed in Wash room
- 27. Proper earthing of all equipment s to be checked regularly



## C. GREEN BELT AREA & BIO-DIVERSITY:

The Green Belt Area is meant for conservation of nature and esthetic value of the college premises, the total area of the plot is 10acre. As per the requirement of National Green Tribunal the green belt shall be developed as per the guide lines of Central Pollution Control Board. The area of Green Belt in this College is around 7 acres. The Green Area in the college includes the plants, greenery and sustainability of the campus to ensure that the buildings conform to green standards This also helps in ensuring that the Environmental Policy is enacted, enforced and reviewed using various environmental awareness programme.



The area is immensely diverse with a variety of tree species performing a variety of functions, Sprawling lawn/ garden. Most of these tree species are planted in different periods of time through various plantation Programmes organized by the authority and have become an integral part of the college. The trees of the college have increased the quality of life, not only the college fraternity but also the people around of the college in terms of contributing to our environment by providing oxygen, improving air quality, climate amelioration, conservation of water, preserving soil, and supporting wildlife, controlling climate by moderating the effects of the sun, rain and wind. Leaves absorb and filter the sun's radiant energy, keeping things cool in summer. Many spices of birds are dependent on these trees mainly for food and shelter. Nectar of flowers and plants is a favorite of birds and many insects. Leaf – covered branches keep many animals, such as birds and squirrels, out of reach of predators. Different species display a seemingly endless variety of shapes, forms, texture and vibrant colors. Even individual trees vary their appearance throughout the course of the year as the seasons change. The strength, long lifespan and regal stature of trees, enormous variety of flowering plant, give them a monument – like quality.



They also remind us the glorious history of our institution in particular. We often make an emotional connection with these trees and sometime become personally attached to the ones that we see every day. A thick belt of large shady trees in the periphery of the college have found to be bringing down noise and cut down dust and storms This includes the plants, greenery and sustainability of the campus to ensure that the buildings conform to green standards This also helps in ensuring that Environmental Policy is enacted, enforced and reviewed using various environmental awareness Programmes.



## **Observations:**



Campus is located in the vicinity of various types (species) trees. Various tree plantation programs are being organized during the month of July and August at college campus and surrounding villages through NSS unit. This program helps in encouraging eco-friendly environment which provides pure oxygen within the institute and awareness among villagers. The plantation program includes various types of indigenous species of ornamental and medicinal. Instead of maintaining biodiversity the similar species planted is observed for example "NEEM". The dominant species in green belt are Neem, Pongam Tree, Amaltash, Copepod and Sita Ashok. This Bio-diversity never fulfills the aim of green belt development.

> Total land area available for plantation. Approximately. 7 acre

➤ Total land area covered by plantation.7 acres





## ➤ No. of trees planted in campus.

Sr. No.	Botanical Name	Family	Common Name
1	Saraca asoca	Detarioideae	Ashoka
2	Alstonia	Apocynaceae	Satvin
3	Bougainvillea	Nyctaginaceae	Booganvel
4	Mangifera indica	Anacardiaceae	Mango, Amba
5	Tecoma stans	Bignoniaceae	Ghanti ful
6	Plumeria alba	Apocynaceae	Champa, Chapha
7	Pongamia pinnata	Fabaceae	Karang
8	Mimusops elengi	Sapotaceae	Bakul, Bakuli
9	Bauhinia purpurea	Caesalpiniaceae	Apta
10	Azadirachta indica	Meliaceae	Neem
11	Albizia lebbeck	Mimosaceae	Saras
12	Carissa carandas	Apocynaceae	Karvand
13	Roystonea regia	Arecaceae	Royal palm
14	Tabernaemontana divaricata	Apocynaceae	Crape Jasmine Flore Pleno
15	Tabernaemontana divaricata	Apocynaceae	Crape Jasmine
16	Dypsis lutescens	Arecaceae	Areca Palm
17	Hibiscus schizopetalus	Malvaceae	Japanese Hibiscus
18	Eucalyptus globulus	Myrtaceae	Eucalyptus, Nilgiri
19	Ficus benghalensis	Moraceae	Banyan

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20	Anthocephalus cadamba	Rubiaceae	Kadam
21	Cycas circinalis	Cycadaceae	Sago palm
22	Wodyetia bifurcata	Arecaceae	Foxtail palm
23	Nerium oleander	Apocynaceae	Kaner
24	Hibiscus rosa-sinensis	Malvaceae	Jaswand
25	Dypsis decaryi	Arecaceae	Triangle palm
26	Thuja occidentalis	Cupressaceae	Morpankhi
27	Phoenix dactylifera	Arecaceae	Date palm
28	Azadirachta indica	Meliaceae	Neem
29	Cycas revoluta	Cycadaceae	Sago palm
30	Caryota urens	Arecaceae	Fishtail Palm, Wine Palm
31	Spathodea campanulata	Bignoniaceae	Rugtoora
32	Alstonia Scholaris	Apocynaceae	Saptaparni
33	Tabebuja rosea	Bignoniaceae	Pink trumpet tree, Basant
55	55 Fabebula losea Bignonia		Rani
34	Mimusops elengi	Sapotaceae	Bakul
35	Ixora coccinea	Rubiaceae	Rugmini

## **Recommendations:**

The Management of College may consider on top priority that:-

- The Green Belt is to be developed as per the guidelines of NGT
- > The Biodiversity is to be maintained while considering the plantation in future.
- The selection of trees species to be based on environmental conservation and carbon sequestration value.
- Artificial nests and water ponds are recommended to attract different birds in their migrating and breeding season.
- Plant survival rate is to be maintained.
- Watering schedule to be planned according the season.
- > Drip irrigation is strongly recommended to conserve the water.
- Reuse of the water shall be done instead of use of fresh water.
- Special Tree Plantation shall be celebrated every year on environment day and also competitions for bird species identification and knowing the tree values in terms of medicinal and environment conservation.

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## D. AIR QUALITY& NOISE QUALITY MONITORING:

Since air quality plays a vital role for good health. Air Quality monitoring instrument is used to monitor quarterly the criteria pollutants. The most important air quality parameters, which are measured, are NO2, SO2& PM10. The other criteria pollutants such as Ozone, Carbon Monoxide and Lead are not measured because there are no nearby Industries located near the institute, which are emitting these pollutants. Noise equally plays a vital role in the environment, hence noise measurement are also done at the institute quarterly.



#### **Carbon Foot Print:**

A carbon footprint is a measure of how much someone is contributing to the gases that contribute to global climate change. More scientifically, it is the amount of anthropogenic carbon dioxide (CO2) emissions (those resulting from or produced by human beings) attributable to an individual or a household or an organisation, generally resulting from their direct or indirect use of energy. Although we talk about a 'carbon footprint', it would be more accurate to talk about a 'carbon dioxide footprint'. A carbon footprint is normally calculated in tonnes of carbon dioxide equivalent (tCO2e) but occasionally footprints are calculated in tonnes of carbon equivalent (tC). You will need to multiply by 44 and divide by 12 to convert from tonnes of carbon to tonnes of CO2 equivalent. In this unit we may talk interchangeably about carbon emissions, carbon dioxide emissions and CO2 emissions.

Carbon footprints may also include other gases that contribute to global climate change – the so called 'greenhouse gases' (GHGs). The most common of these is methane (CH4), but they also include nitrous oxide, hydro fluorocarbons, per fluorocarbons and sulphur hexafluoride (SF6). These other gases tend to be produced from agriculture or industrial processes. Most are much more powerful contributors to global warming than CO2. Water vapour (H2O) is also a significant contributor to global warming but, as its concentration varies little with time, it is not considered to be an anthropogenic greenhouse gas, except from aircraft vapour trail. However, the largest contributor to global warming is carbon dioxide itself, which is produced from burning fossil fuels such as coal, oil or gas. As well as the direct use of fossil fuels, people's carbon footprints normally Page **31** of **66** 

include the use of electricity (where CO2 is emitted at the power station) and as a result of collective travel, such as on trains, buses and aircraft.



#### **Recommendation:**

- 1. Calculate the carbon foot print.
- 2. Check PUC certificate for each vehicle.
- 3. Institute should carry out air monitoring.



## **E.WASTE MANAGEMENT:**

This indicator addresses waste production and disposal of different wastes like paper, food, plastic, biodegradable, construction, glass, dust etc. and recycling. Furthermore, solid waste often includes wasted material resources that could otherwise be channeled into better service through recycling, repair, and reuse. Solid waste generation and management is a burning issue. Unscientific handling of solid waste can create threats to everyone. The survey focused on volume, type and current management practice of solid waste generated in the campus. The different solid wastes collected as mentioned above.

For Plastic and waste generated in the college there is a provision to dispose the same with waste collection vehicle of corporation on daily basis under the swatch Bharat Abhyaan. The wastage from the canteen needs to be used in the composting purpose rather than disposing it through other sources.

Also college encourages their staff and students for using the plastic bags of more than 50 micron or use clothes bags or paper bags makes with the waste paper through awareness training.

#### Solid waste:

The collecting, treating, and disposing of solid material that is discarded because it has served its purpose or is no longer useful. Improper disposal of municipal solid waste can create unsanitary conditions, and these conditions in turn can lead to pollution of the environment and to outbreaks of vector-borne disease—that is, diseases spread by rodents and insects. The tasks of solid-waste management present complex technical challenges. They also pose a wide variety of administrative, economic, and social problems that must be managed and solved.



The sources of solid waste include residential, commercial, institutional, and industrial activities. Certain types of wastes that cause immediate danger to exposed individuals or environments are classified as hazardous; these are discussed in the article hazardous-waste management. All Page **33** of **66** 

nonhazardous solid waste from a community that requires collection and transport to a processing or disposal site is called refuse or municipal solid waste (MSW). Refuse includes garbage and rubbish. Garbage is mostly decomposable food waste; rubbish is mostly dry material such as glass, paper, cloth, or wood. Garbage is highly putrescible or decomposable, whereas rubbish is not. Trash is rubbish that includes bulky items such as old refrigerators, couches, or large tree stumps. Trash requires special collection and handling.

Construction and demolition (C&D) waste (or debris) is a significant component of total solid waste, although it is not considered to be part of the MSW stream. However, because C&D waste is inert and nonhazardous, it is usually disposed of in municipal sanitary landfills

Another type of solid waste, perhaps the fastest-growing component in many developed countries, is electronic waste, or e-waste, which includes discarded computer equipment, televisions, telephones, and a variety of other electronic devices. Concern over this type of waste is escalating. Lead, mercury, and cadmium are among the materials of concern in electronic devices, and governmental policies may be required to regulate their



recycling and disposal.

Once collected, municipal solid waste may be treated in order to reduce the total volume and weight of material that requires final disposal. Treatment changes the form of the waste and makes it easier to handle. It can also serve to recover certain materials, as well as heat energy, for recycling or reuse.

## Type of waste generated 1.Plastic Waste:

The plastic are strongly restricted to bring in the college or if brings the same, its thickness shall be more than 50 micron as per the government rules and regulations.

Otherwise in the State of Maharashtra 'Plastic is Ban".

#### 2. Hazardous Waste;

The chemical hazard which is being generated in the chemical lab is required to be collected in drum (identified), and neutralized the same before it is being drained to drained line. Therefore the amount of chemical waste generation is almost nil. The other hazardous waste is Florescent Tubes and CFL Bulbs, Electronic waste, Laboratory Waste, etc. The disposal plan needs to be prepared.

3. Wooden Waste:

Damaged Furniture, Wooden Packaging

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The wooden policy is being followed. The new purchases in the form of solid wood are not carried out, instead particles boards are used. College has appointed carpenter permanently for repair of old furniture. They used old chair and tables to build and repaired the new chair and tables instead buying any new wood from the market. All the chair and tables, cupboard is now from metal, PVC material with recyclable material.

**4. Metal Waste:**Scrap Metal, broken utensils, and damaged machinery from Laboratory. Metals if possible reused and scrape out to respective scarp dealer.

**5.** Non-Biodegradable Waste: - Papers, Plastic Coated Papers ect. The college has framed policies for handling and disposal for these wastes.

#### 6. Food Waste:

The only area from where the food waste is generated is canteen, and hostel mess. The canteens has well displayed importance of avoiding the food waste poster in the canteen. Also if it is noticed that the food is wasted by any person/girls, then the same may be brought to their notice. The food waste generated in the canteen is being transferred to Gaushaala or for decomposing site.

**7. Biodegradable Waste**: - Tree Leaves and biomass produced in garden, uncooked vegetable remaining from Kitchen of Mess and Canteen.

#### E-waste:

E-waste is required to be given to the authorized vendor approved from pollution control department.

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

E-waste generated in the campus is very less in quantity. The cartridges of laser printers are refilled outside the college campus. Administration conducts the awareness programme regarding E-waste Management with the help of various departments. The E- waste and defective item from computer laboratory is being stored properly. The institution has decided to contact approved E-waste management and disposal facility in order to dispose E-waste in scientific manner.

#### Aim and objective:

- E-waste is the future coming environmental problem will create hazards to our environment, it is non-degradable waste can pollute water, soil and air.
- With keeping this view we are aware students and all staff about hazards effect of the ewaste on the health of man and ecosystem destruction, Waste material mainly metal, insulating materials present in the e-waste like CD, scrap mobile like devices, computer Page **35** of **66**

waste like monitor, CPU, mouse, Key board, cable and unused pen drive etc. are coated and deposed in scientific method.

## Waste disposal Activity:

- With keeping view to minimize the pollution created through the e-waste, we have carried out the scientific disposal of e-waste by two ways
- Collection of e- wastes in e- waste box and sale it to concerned firm for its disposal.
- Reuse of the component of unused electronic devices in laboratory viz. Physics.
- Recycle or safely dispose of white goods, computers and electrical appliances.
- Use reusable resources and containers and avoid unnecessary packaging where possible.
- Disposal machines/incinerator for sanitary napkins for Girls.

## **Observation:**

- 1) Types of waste-paper, plastic, waste books, e-waste etc.
- 2) Data for each type for last 3 years is required to be documented.
- 3) Paper consumption to be reduced.
- 4) Re use of paper system is evident. Paper recycling is done by both side usages.
- 5) Garbage segregated into wet and dry, monitored by security.
- 6) Garbage plastic black bags are sent to external agency named 'Email Scrap Centre'.
- 7) Canteen wet garbage is given to external vendor.
- 8) Book recycling is evident by library.
- 9) Waste segregation in various dustbins at place
- 10) College have vermiculture composting capacity but not in use

#### **Recommendations:**

- 1. The management of college can consider the following recommendations on top priority:-
- 2. The solid waste generated in the collage premises to be collected in scrap Yard or any identified place or in computer room (Notified Area) and segregated as per the category of solid waste management with proper well labeled.
- Plastic waste to be given to either recycler vender registered with Maharashtra State Pollution Control Board as per "The Plastics Manufacture, sale and Usage Rules, 1999 and all its Amendments.
- 4. Hazardous Waste to be disposed by identified disposal pathway within 90 days from its generation as per the guidelines of "Hazardous Waste (Management, Handling and Transboundary Movement) Rules 2008 with all the Amendments.

- 5. Metal Waste to be reused in the college and workshop department shall be engaged for it, if they prove that the waste cannot be reused will be sale out to the venders who will recycle and reuse the same.
- 6. Unused food waste to be used as cattle feed or for vermicomposting.
- 7. Non- Biodegradable waste shall be disposed to the registered vender with Maharashtra State Pollution Control Board
- 8. Biodegradable waste to be compost in the college premises in technical manner, it is observed that the vermin culture pans are present in the college but in technical institute it is expected that the composting shall be done in perfect technical manner.
- 9. Municipal Solid Waste to be disposed as per the guidelines "The Municipal Solid Wastes (Management and Handling) Rules, 2000 with its all Amendments.
- 10. The replaced or used batteries which could not be recharged as the life get exhausted shall be disposed as per the guidelines of "The Batteries (Management and Handling) Rules, 2001 and all its Amendments. It is also good to replace the old battery with new one.
- 11. The E-Waste Produced in the collage to be disposed off as per the guidelines in "E-Waste Management and Handling Rules, 2011 and all its Amendments.
- 12. The records of proper disposal of all solid wastes to be maintained with its manifests at one central place.

#### F. ENVIRONMENT CONSCIOUSNESS:

Awareness building amongst staff, student and society Plantation drive







## **OVERALL RECOMMENDATIONS:**

- Putting up notices in all washrooms and near all water coolers about the need for saving water, and simple tips like ensuring all the taps are properly closed.
- To eliminate the spillage and over usage of water in washbasins, urinals and toiler push taps are highly recommended.
- Training to the cleaners in economical use of water for cleaning purposes and a system in place for immediate response when issues of water leakage are observed so that water losses are prevented.
- Need of monitoring, controlling overflow is essential and periodically supervision drills should be arranged.

- Minimize wastage of water and use of electricity during water filtration process, if used, such as RO filtration (Drinking Water) process and ensure that the equipment's used for such usage are regularly serviced and the waste water from RO to be used for some useable purpose.
- Ensure that all cleaning products used by college staff have a minimal detrimental impact on the environment, i.e. are biodegradable and non-toxic, even where this exceeds the Control of Substances Hazardous to Health (COSHH) regulations.
- > All water taps to be checked for its leakage particularly in toilet (Hostels).
- Identification of areas to be carried out such as compost making area, water harvesting tank, bore well used for water harvesting purpose, bore well used for consumable purpose, parking area of staff, students, hazard area etc.
- Water meter to be installed on bore well as well as usage and daily monitoring record of water to be maintained.
- > Water to be tested from various sources including the potable water purifiers and in canteen.
- Special Internal Water Audit to be conducted quarterly and should be submitted to environment committee.
- Environmental policy to be displayed at prominent locations.
- Environmental objectives to be set in measurable form and to be displayed at prominent location.
- > All electrical loose wire to be dressed up properly.
- Electrical Earthing of the college to be checked regularly.
- Awareness for the use of electricity and paper to be developed in the college.
- Instruction such as all electrical appliances (fans/AC) shall be switched off when "not in use or at the end of the day" to be displayed.
- College takes steps to purchase fans, refrigerators and air conditioners with low energy consumptions with maximum star ratings.
- College has to replace resistance regulators with electronic regulators, CRT monitors with LED monitors and DOT matrix printers with Deskjet printer.
- Use of Diesel generator to be avoided (to reduce the consumption of oil, record of consumption of diesel to be maintained.
- Enhanced renewable energy source capacity.
- The display of the instruction boards/to be displayed on each classrooms/ lab for "switching of the fans and lights when not required".
- Switching to star rating electric appliances in phase wise manner.

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- > Carbon Sequestration study shall be carried out before plantation of Green Belt.
- Energy Consumption for each building should be estimated to design the energy conservation plan.
- All ELCBs to be periodically checked for current leakages & ensure tripping in case of electric short circuits thus will save energy & hazard.
- Earth pit resistance of transformer DG set to be taken in every six or yearly basis.
- Instead of out-sourcing the Annual Maintenance of Electrical Equipment college concern department staff shall take that responsibility
- Energy saving awareness shall be done by displaying the boards at appropriate place.
- List of electrical gadgets used in every section, departments, hostels, canteens to be prepared with electrical capacity required.
- > Energy used by each appliance is to be estimated department wise.
- Encourage natural ventilation and illumination by alteration in the building structures whenever going for new constructions.
- $\blacktriangleright$  Air condition in offices needs to be set on 26°c.
- D. G. stack monitoring/Exhaust gas analysis shall be done.
- In HT transformer, there are three earth pits which are covered arrangement of water drop by drop is to be provided at each pits
- ➤ Transformer area must be cleaned.
- > Earthing of building to be checked on yearly basis.
- > Environmental data to be displayed at prominent place. These are
  - No of plantation done last year.
  - Electricity produced through renewable energy source (Solar).
  - Save electricity bill last year etc.
- Process of E waste to be defined and displayed (for all the E-Waste generated in the college).
- Room used for storing E-waste to be identified.
- E-waste generated at different departments other than the computer and its accessories needs to define the sections where these can be stored.
- Separate identified bins for E-Waste to be placed in hostels and other identified places.
- Waste collected bins for wet and dry waste to be made available and place in college to be defined.
- Cleanliness in college to be improved.
- Chemistry lab and other lab waste (chemical) to be neutralized before drained in to a waste pit.

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- Composting area to be properly identified.
- Plan for green belt development to be prepared. (Including college and other area of town as CSIR activity)
- > Drinking water analysis shall be done as per IS 10500.
- Air quality to be checked for SOx, NOx, PM2.5, PM10 etc.
- Monitoring of noise level to be done.
- > Ensure that all the vehicles entering into the college has Valid PUC.
- > Department wise electrical load consumption is to be done.
- Installation of Effluent treatment plant (ETP) or other method of effluent treatment method to be explored.
- Disposal of sanitary napkins / incinerator as per the latest guidelines under solid waste disposal. (As Sanitary pad disposal bags mandatory from January 2021) to be provided
- Tree plantation shall be done to maintain biodiversity as well as artificial nesting shall be installed. Area for plantation.
- Plantation to be done with proper plan and by identifying the locations.
- Proper parking place with identification to be provided.
- Environment day to be celebrated on 5thJune.

#### **General Energy Conservation Tips**

#### Electricity

- □ Schedule your operations to maintain a high load factor
- □ Minimize maximum demand by tripping loads through a demand controller
- □ Use standby electric generation equipment for on-peak high load periods.
- $\Box$  Correct power factor to at least 0.99 under rated load conditions.
- $\Box$  Set transformer taps to optimum settings.
- □ Shut off unnecessary computers, printers, and copiers at night.

#### Motors

- $\Box$  Properly size to the load for optimum efficiency.
- $\Box$  (High efficiency motors offer of 4 5% higher efficiency than standard motors)
- $\Box$  Check alignment.
- $\Box$  Provide proper ventilation

 $\Box$  (For every 10°C increase in motor operating temperature over recommended peak, the motor life

#### is estimated to be halved)

 $\Box$  Check for under-voltage and over-voltage conditions.

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- $\Box$  Balance the three-phase power supply.
- $\Box$  (An Imbalanced voltage can reduce 3 5% in motor input power)
- □ Demand efficiency restoration after motor rewinding.

#### Fans

- $\Box$  Use smooth, well-rounded air inlet cones for fan air intakes.
- $\Box$  Avoid poor flow distribution at the fan inlet.
- $\Box$  Minimize fan inlet and outlet obstructions.
- $\Box$  Clean screens, filters, and fan blades regularly.
- $\Box$  Use aerofoil-shaped fan blades.
- $\Box$  Minimize fan speed.
- $\Box$  Use low-slip or flat belts.
- Check belt tension regularly.
- □ Eliminate variable pitch pulleys.
- $\Box$  Use variable speed drives for large variable fan loads.
- □ Use energy-efficient motors for continuous or near-continuous operation
- $\Box$  Eliminate leaks in ductwork.
- $\Box$  Minimize bends in ductwork
- $\Box$  Turn fans off when not needed.

#### Blowers

- $\Box$  Use smooth, well-rounded air inlet ducts or cones for air intakes.
- □ Minimize blower inlet and outlet obstructions.
- $\Box$  Clean screens and filters regularly.
- $\Box$  Minimize blower speed.
- $\Box$  Use low-slip or no-slip belts.
- $\Box$  Check belt tension regularly.
- $\Box$  Eliminate variable pitch pulleys.
- $\Box$  Use variable speed drives for large variable blower loads.
- $\Box$  Use energy-efficient motors for continuous or near-continuous operation.
- $\Box$  Eliminate ductwork leaks.
- $\Box$  Turn blowers off when they are not needed.

#### Pumps

- □ Operate pumping near best efficiency point.
- □ Modify pumping to minimize throttling.
- $\Box$  Adapt to wide load variation with variable speed drives or sequenced control of smaller offices.

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□ Stop running both pumps -- add an auto-start for an on-line spare or add a booster pump in the problem area.

- □ Use booster pumps for small loads requiring higher pressures.
- □ Increase fluid temperature differentials to reduce pumping rates.
- $\Box$  Repair seals and packing to minimize water waste.
- $\Box$  Balance the system to minimize flows and reduce pump power requirements.
- □ Use siphon effect to advantage: don't waste pumping head with a free-fall

(gravity) return.

#### Chillers

□ Increase the chilled water temperature set point if possible.

 $\Box$  Use the lowest temperature condenser water available that the chiller can handle.

 $\Box$  (Reducing condensing temperature by 5.5°C, results in a 20 - 25% decrease in compressor power consumption)

 $\Box$  Increase the evaporator temperature

- $\Box$  (5.5°C increase in evaporator temperature reduces compressor power consumption by 20 25%)
- $\Box$  Clean heat exchangers when fouled.
- (1 mm scale build-up on condenser tubes can increase energy consumption by

40%)

- □ Optimize condenser water flow rate and refrigerated water flow rate.
- $\hfill \Box$  Use water-cooled rather than air-cooled chiller condensers.
- □ Use energy-efficient motors for continuous or near-continuous operation.
- □ Specify appropriate fouling factors for condensers.
- $\Box$  Do not overcharge oil.
- □ Install a control system to coordinate multiple chillers.

□ Study part-load characteristics and cycling costs to determine the most-efficient mode for operating multiple chillers.

- $\Box$  Run the chillers with the lowest operating costs to serve base load.
- $\Box$  Avoid over sizing match the connected load.
- $\hfill \Box$  Isolate off-line chillers and cooling towers.

□ Establish a chillers efficiency-maintenance program. Start with an energy audit and follow-up, then make a chillers efficiency-maintenance program a part of your continuous energy management program.

#### HVAC (Heating / Ventilation / Air Conditioning)

 $\Box$  Tune up the HVAC control system.

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□ Consider installing a building automation system (BAS) or energy management system (EMS) or restoring an out-of-service one.

□ Balance the system to minimize flows and reduce blower/fan/pump power requirements.

□ Eliminate or reduce reheat whenever possible.

□ Use appropriate HVAC thermostat setback.

□ Use building thermal lag to minimize HVAC equipment operating time.

□ In winter during unoccupied periods, allow temperatures to fall as low as possible without freezing water lines or damaging stored materials.

□ In summer during unoccupied periods, allow temperatures to rise as high as possible without damaging stored materials.

 $\Box$  Improve control and utilization of outside air.

Use air-to-air heat exchangers to reduce energy requirements for heating and cooling of outside air.

□ Reduce HVAC system operating hours (e.g. -- night, weekend).

 $\Box$  Optimize ventilation.

□ Ventilate only when necessary. To allow some areas to be shut down when unoccupied, install dedicated HVAC systems on continuous loads (e.g. computer rooms).

□ Provide dedicated outside air supply to kitchens, cleaning rooms, combustion equipment, etc. to avoid excessive exhausting of conditioned air.

 $\Box$  Use evaporative cooling in dry climates.

□ Clean HVAC office coils periodically and comb mashed fins.

□ Upgrade filter banks to reduce pressure drop and thus lower fan power requirements.

□ Check HVAC filters on a schedule (at least monthly) and clean/change if appropriate.

□ Check pneumatic controls air compressors for proper operation, cycling, and maintenance.

□ Isolate air-conditioned loading dock areas and cool storage areas using high speed doors or clear PVC strip curtains.

□ Install ceiling fans to minimize thermal stratification in high-bay areas.

 $\Box$  Relocate air diffusers to optimum heights in areas with high ceilings.

- □ Consider reducing ceiling heights.
- □ Eliminate obstructions in front of radiators, baseboard heaters, etc.
- □ Check reflectors on infrared heaters for cleanliness and proper beam direction.

 $\Box$  Use professionally-designed industrial ventilation hoods for dust and vapor control.

 $\Box$  Use local infrared heat for personnel rather than heating the entire area.

□ Use spot cooling and heating (e.g. -- use ceiling fans for personnel rather than cooling the entire

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area).

- □ Purchase only high-efficiency models for HVAC offices.
- □ Put HVAC window offices on timer control.
- □ Don't oversize cooling offices. (Oversized offices will "short cycle" which results

in poor humidity control.)

□ Install multi-fueling capability and run with the cheapest fuel available at the time.

□ Consider dedicated make-up air for exhaust hoods. (Why exhaust the air conditioning or heat if you don't need to?)

 $\Box$  Minimize HVAC fan speeds.

- □ Consider desiccant drying of outside air to reduce cooling requirements in humid climates.
- $\Box$  Seal leaky HVAC ductwork.
- $\Box$  Seal all leaks around coils.

□ Repair loose or damaged flexible connections (including those under air handling offices).

□ Eliminate simultaneous heating and cooling during seasonal transition periods.

□ Zone HVAC air and water systems to minimize energy use.

□ Inspect, clean, lubricate, and adjust damper blades and linkages.

□ Establish an HVAC efficiency-maintenance program. Start with an energy audit and follow-up, then make an HVAC efficiency-maintenance program a part of your continuous energy management program.

#### Lighting

□ Reduce excessive illumination levels to standard levels using switching; delamping, etc. (Know the electrical effects before doing de-lamping.)

□ Aggressively control lighting with clock timers, delay timers, photocells, and/or occupancy sensors.

□ Install efficient alternatives to incandescent lighting, mercury vapour lighting, etc. Efficiency (lumens/watt) of various technologies range from best to worst approximately as follows: low pressure sodium, high-pressure sodium, metal halide, fluorescent, mercury vapour, incandescent.

□ Select ballasts and lamps carefully with high power factor and long-term efficiency in mind.

- □ Upgrade obsolete fluorescent systems to Compact fluorescents and electronic Ballasts
- $\Box$  Consider lowering the fixtures to enable using less of them.
- □ Consider day lighting, sky lights, etc.
- □ Consider painting the walls a lighter colour and using less lighting fixtures or lower wattages.
- □ Use task lighting and reduce background illumination.
- □ Re-evaluate exterior lighting strategy, type, and control. Control it aggressively.

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 $\Box$  Change exit signs from incandescent to LED.

#### DG sets

□ Optimize loading

Use waste heat to generate steam/hot water /power an absorption chiller or preheat process or utility feeds.

- □ Use jacket and head cooling water for process needs
- $\Box$  Clean air filters regularly
- □ Insulate exhaust pipes to reduce DG set room temperatures

□ Use cheaper heavy fuel oil for capacities more than 1MW

#### **Buildings**

□ Seal exterior cracks / openings / gaps with caulk, gasketing, weather stripping, etc.

 $\Box$  Consider new thermal doors, thermal windows, roofing insulation, etc.

- $\Box$  Install windbreaks near exterior doors.
- $\Box$  Replace single-pane glass with insulating glass.
- □ Consider covering some window and skylight areas with insulated wall panels inside the building.

□ If visibility is not required but light is required, consider replacing exterior windows with insulated glass block.

□ Consider tinted glass, reflective glass, coatings, awnings, overhangs, draperies, blinds, and shades for sunlit exterior windows.

 $\Box$  Use landscaping to advantage.

□ Add vestibules or revolving doors to primary exterior personnel doors.

□ Consider automatic doors, air curtains, strip doors, etc. at high-traffic passages between conditioned and non-conditioned spaces. Use self-closing doors if possible.

- □ Use intermediate doors in stairways and vertical passages to minimize building stack effect.
- $\Box$  Use dock seals at shipping and receiving doors.

□ Bring cleaning personnel in during the working day or as soon after as possible to minimize lighting and HVAC costs.

#### Water & Wastewater

- □ Recycle water, particularly for uses with less-critical quality requirements.
- □ Recycle water, especially if sewer costs are based on water consumption.
- □ Balance closed systems to minimize flows and reduce pump power requirements.
- □ Eliminate once-through cooling with water.
- □ Use the least expensive type of water that will satisfy the requirement.
- $\Box$  Fix water leaks.

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- □ Test for underground water leaks. (It's easy to do over a holiday shutdown.)
- □ Check water overflow pipes for proper operating level.
- $\Box$  Automate blow down to minimize it.
- □ Provide proper tools for wash down -- especially self-closing nozzles.
- $\Box$  Install efficient irrigation.
- $\Box$  Reduce flows at water sampling stations.
- □ Eliminate continuous overflow at water tanks.
- □ Promptly repair leaking toilets and faucets.
- $\Box$  Use water restrictors on faucets, showers, etc.
- $\Box$  Use self-closing type faucets in restrooms.
- $\Box$  Use the lowest possible hot water temperature.

□ Do not use a heating system hot water boiler to provide service hot water during the cooling season -- install a smaller, more-efficient system for the cooling season service hot water.

□ If water must be heated electrically, consider accumulation in a large insulated storage tank to minimize heating at on-peak electric rates.

- □ Use multiple, distributed, small water heaters to minimize thermal losses in large piping systems.
- $\Box$  Use freeze protection valves rather than manual bleeding of lines.
- □ Consider leased and mobile water treatment systems, especially for deionized water.
- $\Box$  Seal sumps to prevent seepage inward from necessitating extra sump pump operation.
- □ Install pre-treatment to reduce TOC and BOD surcharges.
- □ Verify the water meter readings. (You'd be amazed how long a meter reading can be estimated after the meter breaks or the meter pit fills with water!)

 $\Box$  Verify the sewer flows if the sewer bills are based on them



**ANNEXURES** 

**ANNEXURES-I** 



# **Quantitative Assessment of Rainwater**

# Harvesting



Prepared for

# **Toshniwal Arts, Commerce and Science College Campus**

Institutional Area: Sengaon, District Hingoli, Maharashtra, 431513

Prepared by

Department of Geology,

# **Toshniwal Arts, Commerce and Science College**

Sengaon-431513 Maharashtra (India)

May 2022

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#### 1: Introduction

The present study was carried out to identify various litho-sections for Toshniwal **College, Sengaon, Hingoli district, Maharashtra 431513.** The purpose of study is to find out various subsurface strata such as soil layer, weathered basalt layer, fractured layer and starting depth of hard rock strata.

For this, electrical resistivity method was adopted as groundwater wells survey to identify the various subsurface layers.

- Entire stretch of the proposed area and small sections exposed were observed to understand geological conditions.
- Observations were made in the entire campus area to infer the role of local geological, geomorphological and climatological factors leading to weathering of the rock.
- Wells observation Surveys were conducted to infer subsurface geological conditions in general and thickness / depth of different layers in particular estimating the extent and thickness of different layers.
- 2: Project site

The present site located at **Toshniwal College, Sengaon, Hingoli district, Maharashtra**. The site is situated at Kayadhu river right and on the road Hingoli to Risod. The college campus area covered by 07 acres and built-up area  $2600 \text{ m}^2$ . The campus area bounded by  $76^\circ 53'$  and  $76^\circ 54'$  E and  $19^\circ 46'$  and  $19^\circ 47'$  N and elevation of the area 5' to 6' msl (Fig no 1). The selected location for implemented the water harvesting structures (Pit) based on the different controlling factors were used such as topography, geology, thickness of weathered zone/soil, depth to water level and availability of source water for recharge.



Fig. 1 RWH site of Toshniwal College

#### 3: Climate and Rainfall

The semi-arid climate of the district is on the whole is agreeable. The winter season is from December to about the middle of February followed by summer season which last up to May. June to September is the south-west monsoon season, whereas October and November constitute the post-monsoon season. The mean minimum temperature is about 12°C and mean maximum temperature is about 39°C. Sengaon tehsil falls in the rain shadow region, with normal annual rainfall of about 800 mm to1200 mm.



Fig. 2 Rainfall Trends in Sengaon tehsil.

#### 4: Regional Geology

The entire area of the Hingoli district is underlain by the basaltic lava flows of upper Cretaceous to lower Eocene age. The shallow alluvial formation of recent age also occurs as narrow stretch along the major rivers flowing in the area.

Basaltic lava flows occupy more than 95% of the area of the district. These flows are normally horizontally disposed over a wide stretch and give rise to table land type of topography also known a plateau. These flows occur in layered sequences ranging in thickness from 7 to 45 m and represented by massive unit at the bottom and vesicular unit at the top of the flow. These flows are separated from each other by marker bed known as 'bole bed'.

The ground water in the district occurs under phreatic, semi – confined and confined conditions. Generally, the shallower zones down to the depth of 20 to 22 m bgl form the phreatic aquifer. The water bearing zones occurring between the depth 20 and 40 m bgl when weathered or having shear zones yield water under semi-confined condition. The deep confined aquifers generally occur below the depth of 40 m bgl. The vesicular unit of lava flow when exposed or lying just few meters below the surface forms a potential aquifer in the district. However, the vesicular portion of different lava flows varies in thickness from few m to 10 m and nature and density of vesicles, their distribution, interconnection, and weathering are the decisive factors for occurrence and movement of water in these units. The massive portions of basaltic flows are normally devoid of water, but when it is weathered, fractured and jointed forms potential aquifer. The water bearing properties of these flows depend upon the intensity of weathering, fracturing and jointing which provides availability of open space within the rock for storage and movement of ground water. The thickness of weathering in the district various widely up to 20 m bgl. However, the weathered and fractured trap occurring in topographic lows forms the potential aquifer in the district.

Alluvium occurs in small areas along banks and flood plains of major rivers like Purna, Kayadhu, Asna, Karpara and their tributaries. In alluvium the granular detrital material like sand and gravel usually

occurring as thin layer in the district yields water. But due to its limited extent the ground water potential in this formation is negligible.

Based upon the geological data available in the literature and that collected during projects carried out in the area, the regional geology is known to comprise of black cotton soil followed by Deccan Flood Basalt. The black cotton soil originated mainly due to in situ decomposition of the basalts. The thickness of soil-cap is highly variable, from 30 cm to 1.5 m. The soil is highly argillaceous, calcareous and very fine grained. Calcium and magnesium carbonate disseminates are present as kankar among its accessory constituents. The base-exchange capacity of this soil is fairly high. The Deccan Flood Basalts are dark grayish green to black coloured, homogeneous and cryptocrystalline vesicular rock of Cretaceous to Paleogene age. The bulk of the basalt is composed of plagioclase and augite. The amygdaloidal cavities are generally filled up by secondary minerals like calcite, quartz and zeolite. The continuity of basalt stratigraphy is generally intervened by sedimentary beds of small vertical as well as horizontal extent, known as inter-trappean beds. The basalt is highly fractured and jointed; however, it has been extremely weathered to a residual soil of grey to brown low plasticity gravelly clay. The occurrence and availability of groundwater in this region is controlled mainly by the shrinkage jointing, presence of vesicle and fracture interconnection between fracture, joints and vesicles and presences of inter trappean beds within the Deccan Floods basalt, which forms the aquifer. The aquifer is generally unconfined and receives across the site.

#### **5: Landscape**

The Hingoli Plateau covers a major portion of the district. It includes major parts of Sengaon, Hingoli, Aundh-Nagnath and Kalamnuri tahsils. The plateau is badly dissected with and uneven surface and hence the land available of agriculture is limited. Toshniwal College is located on a Plateau moderately dissected by the adjacent to Sengaon Hingoli State Highway road within Sengaon town administraion. The area shows mixed land use and flat physigraphy, with gentle towards north to Sengaon town and east towards a Kayadhu river valley and flat land with soyabean and wheat fields. So the college is on a medium top of moderate plateau. The Kayadhu River is flowing towards east south from this site.

#### 6: Hydrogeology Condition

The area is underlain by hard rock's comprising mostly basalt and associated alluvium sand along the river and streams. Ground water occurs under phreatic conditions in the weathered zones formation, which is restricted to about 10 - 12 mts bgl. It occurs under semi-confined conditions in the fracture zones at deeper levels. Groundwater extraction for domestic and agricultural use is mostly through bore wells. Analyses of long-term pre-monsoon water levels exhibit a significant declining trend in Sengaon tehsil.

Sr. No.	Litho Unit	Depth (mtr)
1	Black cotton soil	10 m
2	Weathered basalt saturated with water	22 m
3	Moderately weathered/fractured basalt saturated with water	44 m
4	Hard and massive basalt	> 44 m

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#### Table no. 1 Litho Succession of College Campus

Conceptual RWH Rooftop Unit Plan



#### 6: Results

The water quantity play important role in planning and management of water resources for urban and rural societies. Rainwater harvesting in the term of artificial recharge process that control and arrest the surface run-off water penetration into earth surface.

The following process to computational the rainwater quantity from catchment area to water harvesting stage. In this methods required three parameters value like Annual rainfall (mm), catchment Area  $(m^2)$  and rainfall run-off coefficient.

Catchment	Coefficients						
Roof Catchments							
Tiles	0.8-0.9						
Corrugated metal sheets	0.7- 0.9						
Ground surface covering							
Concrete	0.6-0.8						
Brick pavement	0.5-0.6						
Untreated ground catchment							
Soil on slopes less than 10%	0.0-0.3						
Rocky natural catchment	0.2-0.5						

#### Table.2 shows default values for the run-off coefficient

#### **Rainwater Harvest Calculation:**

Example: The calculation of rainwater harvested/recharged through the system has been computed as given below:

i) Annual normal rainfall (mm): x mm

ii) Area Catchment: 2600 m<sup>2</sup>

iii) Runoff Coefficient: 0.7

iv) Annual water Harvesting Potential 2600x2.6x0.7=4732 cub.mX885.1=32,65,080 liter Total water harvested/recharge is 32, 65,080 liter

Sr.No	Catchment Area (m <sup>2</sup> )	Year	Rainfall (mm)	Runoff Coefficient	Annual Harvest Potential Value (Cu.m)	Water Harvested/ Recharge Yearly (liters)
1	$2600 \text{ m}^2$	2016	850 mm	0.7	4732	40,22,200 liters
2	$2600 \text{ m}^2$	2017	652 mm	0.7	4732	30,85,264 liters
3	$2600 \text{ m}^2$	2018	690 mm	0.7	4732	32,65,080 liters
4	$2600 \text{ m}^2$	2019	885.1 mm	0.7	4732	41,88,293.2 liter
5	$2600 \text{ m}^2$	2020	974.5 mm	0.7	4732	95,58,640 liters
6	$2600 \text{ m}^2$	2021	1093.6	0.7	4732	1,00,36,572 liter

Table.3 Shows Year Wise Rainfall Water Harvested / Recharge Quantity in Campus Area

WH structure (Pit) Sub-Surface Section



Dimension of Water Harvesting Structure:

Length -25 ft Width -20 ft Depth -8 ft

Quantitative assessment of recharge is not an easy job, especially in the area covered by Basaltic rock formation. This is due to heterogeneous physical characters of Basalt. However, since the aquifer is dynamic in nature, the water conservation measures ensure downward percolation and thereby always leaving a space to accommodate additional quantity of recharge.

#### ANNEXURE-II

A report on

## **Installation & Performance Assessment**

of

5 kW Scale Grid Interactive Solar Photovoltaic Power Plant

at

Shri Gajanan Shikshan Prasarak Mandal's (Linguistic Minority)

**Toshniwal Arts, Commerce and Science College, Sengaon** 

Dist. Hingoli 431542 MS India



affiliated to

**Swami Ramanand Teerth** 

Marathwada University,

**Nanded MS India** 

funded by

**University Grant Commission, New Delhi** 

and

Shri Gajanan Shikshan Prasarak Mandal, Yeldari (Camp)

Dist. Parbhani MS India

#### **1.** Introduction

Shri Gajanan Shikshan Prasarak Mandal (Linguistic Minority), Yeldari Camp, Dist. Parbhani (MS) India has established Toshniwal Arts, Commerce and Science College at Sengaon Dist. Hingoli (MS) during the academic year 1993-94 with the motive to provide an education to budding citizens of these hilly, remote and an educationally diverse area (*educationally backward district*) of Maharashtra State. The Toshniwal Arts, Commerce and Science College is generously funded by University Grant Commission, New Delhi, Maharashtra State Government and Shri Gajanan Shikshan Prasarak Mandal, Yeldari Camp for carrying various academic as well as non academic, extra-curricular and activities of social interest.

The primary goal of this institution is to educate the students and make them eligible for the award of UG Arts, Commerce & Science and PG Marathi, Economics and Commerce degree of Swami Ramanand Teerth Marathwada University, Nanded (MS) as a regular student and for distance education Toshniwal College is approved study center of Yashwantrao Chavan Maharashtra Open University, Nashik (MS) and is recognized Local Chapter for National Program Technology Enhanced Learning (NPTEL), IIT Madras.

On the other hand College is also engaged in organizing and executing various Social activities particularly corporate social responsibility (CSR) like Water Conservation and Management (*Jalswaraj*), River Chanel Widening, *Beti Bachao Beti Padhao*, Cycle distribution to Woman students, Eye Check Up camp, Blood donation and Health Awareness etc.

The ultimate goal of the College is to make today's students tomorrows responsible most eligible and good citizens of this country. Every year number of students are enrolled and admitted to different courses on regular, distance and MOOC education basis. The current era of digitization and electrifications needs the students to be well qualified in handling and using of electronic instruments including computer and allied machinery which makes the institution to pay a lot on electricity and maintenance, hence for reducing and ceasing the expenditure on electricity bill College administration and management has decided to apply at University Grant Commission, New Delhi for the grant to install rooftop on grid solar photovoltaic systems, the other crucial part for empanelment of these solar panels are institutions location in remote and hilly area where the density of populations and houses are low hence abundant amount of solar radiations (light) can be harnessed without any difficulty and hurdles.

#### **2.** Institutional Electricity Need

The institutional functioning and working requires at most approximately 25 units of electricity a day that sums about to be nearly 750 units a months hence considering the needs and necessities of electricity college has considered to install solar photovoltaics of 5 kW.

#### **3.** Financial Assistance

The financial assistance of Rs 4,00,000/- (Rs. Four Lakh) for installation of rooftop on grid solar photovoltaic systems are provided by University Grant Commission (UGC), New Delhi and Shri Gajanan Shikshan Prasarak Mandal, Yeldari camp.

#### **4.** Geographical and Technical Specification

The geographical location of the institution is at latitude of  $19^0$  78' and at longitude of  $76^0$  91'. The overall area occupied by photovoltaic modules is approximately 125 sq ft/kW hence the net area covered for panel installation is ~625 sq.ft. There are 20 photovoltaic modules installed having a capacity of 250 W each made of poly crystalline Silicon solar cells. The solar photovoltaic modules are connected in series to each other so that the net output of these interconnections should be feeded to inverter. This is stepped upto 11 kV by a step-up transformer and connected to the existing 11 kV grid.

#### **5.** Grid Interactive Solar Panels

The grid interactive solar photovoltaic system is used without battery backup, these system works only when the grid power is available since the grid power outage are very rare this system will normally provide the greatest amount of bill savings to the customer against investments. However in the event of an outage the system is designed to shut down until the utility power is restored, the inverter switches to sleep mode and awaits restoring of grid power. Once the grid power is restored the inverter synchronizes itself to grid and starts feeding power.

- 1. The Solar Photovoltaic panels generate DC current in the presence of sun light.
- 2. DC Current is fed into inverter and converted into AC form.
- 3. The system works in synchronization with grid electricity and hence the load is powered using combination of solar and grid electricity.
- 4. In case of load shading (absence of electricity) solar system gets synchronized with diesel generators and generates exactly same sine waves.
- 5. The preferential circuit is present so that the electricity generated by the solar system is utilized first and remaining demands are fulfilled using grid electricity.
- 6. Solar system generates exactly same, in phase electricity using free raw materials i.e. Sun light.

#### 6. Typical system components

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#### Photovoltaic array

Photovoltaic array is made up of photovoltaic panels which in turn have several photovoltaic modules, these modules are made of polycrystalline silicon these environmentally sealed collections of cells convert's sun light into an electricity of DC form.



Photovoltaic module roof top of Toshniwal

## Figure 1: installed at the ACS College,

Sengaon Dist. Hingoli Balance of System Equipment (BOS)



Figure 2: Balance of system to AC converter and

equipment which includes DC transformer installed at

Toshniwal ACS College, Sengaon

BOS includes module mounting structure and electrical harness system used to integrate the solar module into structural and electrical system. The electrical wiring system includes junction boxes for paralleling, fuses/ switches, surge suppressers for DC current. The major components of the BOS are inverters and the collectors, these forms the brain of solar on grid system which does multi operations. Some of the major operations are conversion of direct current (DC) into alternating current (AC) and grid synchronizations.

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#### Module Mounting System

The module mounting structure is designed for holding suitable number of modules in series. The frame and leg assemblies of the array structure is made of Mild Steel Hot Dip Galvanized suitable solution of Channels, tubes which are in conforming to IS: 2062 for steel structure. Good quality nut and bolts are used for structural empanelments and installations. The array structure is designed in such a way that it occupies minimum space without sacrificing the output from solar photovoltaic panels.

Components	Particulars							
	MNRE Approved ETDC Certified							
Solar Photovoltaics	250 W silicon polycrystalline PV panels of 20 numbers which							
	sums about 5 kW							
Grid Tie Inverter	5 kW Delta single phase inverter							
	IS 694:1990							
Cable	Insulation class: XLPE							
Cable	High voltage breakdown: 1.1 kV							
	2 core armored copper							
Mounting structure	Aluminum and high quality steel structure suitable for holding							
wounting structure	20 number of panels							

#### **Components Installed**

#### 7. Conclusions

The performance of 5 kW grid interactive solar power plants has been analyzed and it is observed that the average basis of output power generation is 25 watt/day during summer season. This is lower than the expected power output on account of teething trouble associated with inverter and the grid encounter in the operation of plant. It was found due to regular and frequent failure of constant electrical supply by grid to solar plant and also lack of experience in handling the instruments. Some unexplained inverter failures might be caused by disturbance from the grid and other interconnected issues.



Figure 3: an eagle eye view of solar photovoltaic panels captured through Google map of Toshniwal ACS College, Sengaon

#### **ANNEXURE-III**



On

An approach to implemented (widening and deepening) Groundwater Recharge Potential Sites in Kayadhu River Bed, Sengaon Town

#### Executed

by

# Shri Gajanan Shikshan Prasarak Mandal, Yeldari Camp Toshniwal Arts, Commerce and Science College, Sengaon Dist. Hingoli Maharashtra

Technical Contribution

by

Department of Geology

21<sup>st</sup> May to 02 June 2017

#### Introduction:

Sengaon village fall in drought prawn belt of Maharashtra state, it faces water scarity during summer season, considering this facts Shri Gajanan Shikshan Prasarak Mandal, Yeldari Camp, District Parbhani has taken an initiative for organizing an event of River widening and digging so as to increase the recharge capacity and thereby problem. People generally feel that water is a free society and it is the responsibility of government as well as NGO's to solve these types of problems. At present groundwater recharge (widening and deepening) project are designed and executed by the management of Toshniwal Arts, Commerce and Science, Sengaon on the occasion of Page (0 of 6).

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establishment 25 years completed. The work has been started in summer, year of 2017 on dated 21<sup>st</sup> May to 02 June 2017 for within the 13 days short span for successfully finished.

Present Status and Situation analysis of the Area:



The Sengaon town is located along the bank of Kayadhu River in the Hingoli district of Maharashtra State. The total geographical area of the town is 21.51Sq.Km. Determinations of rainfall, run-off, and water loss, comprising largely evaporation from water bodies and transpiration by vegetation, are essential in indicating the hydrologic characteristics of river basins. The main factors are responsible for decline of groundwater table in the catchments of Kayadhu River System at Sengaon to clarify the feasible cause's high exploitation of groundwater, extensive demographic, climate changes predictable and lack1 of water management. If we prolong next to our present trajectory, "what time the groundwater resources (Dug well and Bore well) runs dry, society know the significance of water". Kayadhu River is the main tributary of the Penganga, which flowing direction W-E trending (Sengaon to Hingoli). The upstream part of river catchment area extended in North West direction 222. 04sq.km.The recommendation of widening and deepening in the study area has been carried by technical surveyed and collection of well observatory data from Kayadhu river channel and adjacent part of Sengaon town. The Project is located at the latitude of 76° 52' to  $76^{\circ}55'$  E latitude and  $19^{\circ}49'$  to  $19^{\circ}46'$  N latitude. The highest and lowest elevation of the Kayadhu river catchment area is 444m (bmsl) and 527m (bsml) respectively and average relief of the area 83m (bmsl). The drainage system of the catchment area is characterized as dendritic to parallel pattern. Catchment area of Kayadhu River from Sengaon town aerially extended 222.04 km<sup>2</sup> North West direction of the upstream. The geomorphically the catchment area classified in to various units plateau highly dissected, (PLH), Plateau moderately dissected (PLM), Valley (V) and Plateau Slightly dissected (PLS) and etc.

The powerful geospatial data such as rainfall, drainage, contour and slope map. After that implementation experience shows that are ubiquitous recharge sites (widening and deepening) impact for long term sustainability of groundwater intensity conditions are maintain.

#### 1) Population of Town: 8455 (As per 2011 census)

Sengaon town has total families residing 1708 families along with 4409 are males and female are 4046 as per the population of census 2011, the children as the age 0-6 years 1130.

#### 2) Soil Type:

These are major portion of the Sengaon town with shallow clay soil and black soil, which is thickness from 0.5m to 4m thickness, as well alluvium soil. The southern side of the covered the alluvial soil deposited at river bank and black soil covered the gravel clay loam with sandy with thin veneer of soil.

#### 3) Geology

The surface geology in the study area is characterized by (Deccan trap) basalt and recent alluvial deposits of the Kayadhu River. Alluvial deposits are underlain by bedrock of the (Deccan trap) Basalt of Ajanta group formation. The alluvial deposits strata's occur as gravels, sand, silts and clays along river banks as well as bed. The depth of the alluvium (between 1 and 4ft) is generally controlled by the topography of the underlying basalt hard bedrock. It comprises beds and lenses of sands, gravels and boulders in a matrix of clays.

#### 4) Land Use:

The land use pattern recommended by the Revenue department of Govt. Maharashtra and interpretation with remote sensing data IRS P6 LISS III has been analyzed to understand the nature and extent of land use under various types in the Sengaon town.

- 1. Total geographical Area 21.51 sq.km
- 2. Cultivate area 16.35 sq.km
- 3. Buildup area -2.45 sq.km
- 4. Waste land area -2.51 sq.km

#### 5) Climate and Rainfall Pattern:

The Sengaon taluka has been experiences four seasons in a year. The rainy season (monsoon season) starts from June and lasts up to the end of September, while October and November are the post monsoon season. This is followed by the cold season from December to February and the hot season from March to the end of May. In summer the maximum temperature reaches as high as 42 degrees centigrade while in winter the minimum

temperature is about 12 degrees centigrade. Sometimes due to cold waves over northern India, temperatures may drop to about 6 degrees centigrade. May and December are the hottest and coldest months of the year respectively.

The average annual rainfall in the district is below 900 cm. Rainfall is not uniform in all parts of the district. The southern portion receives more rain. The district gets about 75 per cent of the annual rainfall during the southwest monsoon season. August is the rainiest month of the year. The variation in the rainfall from year to year is fairly large.

Table. 1 Rainfall Data (Source GSDA)

<b>T</b> 1 1		Rainfall Years wise												
Taluk	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Sengaon	601	1155	888	705	322	407	1078	712.6	636	1170	521.68	677.33	774.66	652.00

#### 6) Catchment and Drainage System:



The catchment area is representation to covering the area to the catchment outlet where of the streams flow is measured. Slope and aspects data are also useful for linear parameters and runoff parameters in catchment. The catchment boundaries are extracting from Survey of India (SOI) topographical map or ASTER satellite data generating the catchment of DEM. The Kayadhu River originated from Risoda taluk 576m and 482m (amsl)) at Sengaon town. Its flowing pathway is west to south and main channel length is 28.80 km traveled up to the study area fig . In this catchment area 31 villages are fall under and well drainage network system occurred. The relief of the

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catchment area is 90m (amsl). Catchment length is 24.26m and width of the 18.70m. Drainage network system is dendritic to sub dendritic pattern (fig.2)

#### 7) Recharge Structures

On the basis of surveyed carried out and data collected from town Sengaon, the output of the final conclusion is the water scarcity is facing the local communities of the area. However, there are many Ways Rivers can be revived and rejuvenated, which will also lead to increased water availability. Some of the steps to rejuvenate parched and polluted rivers in Maharashtra include (We are not including governance steps like equitable water distribution etc. To harvest water where it falls, slow down the surface flow and increase recharge in aquifers in aquifer recharge zone. The catchment area to protect aquifers, improve water availability for all and improve base flows in the river. It is the base flows that contribute significant part of surface or sub surface river flows in drought. In this study area of Sengaon town 03-streures has to be implemented, which has been on deepening and widening of river bed for well groundwater recharge in around areas. The length of the deepening and widening should be decided based on surface run off calculations and technical measurement of size of the structures are 100 fit in length and wide size in 3 meters away from both banks. As per the guidelines of GSDA natural depth of river or nallas are more than 3 meters and deepening is not proposed in alluvium. The work of Kayadhu River Deepening, Widening and Straightening are being undertaken by Shri Gajanan Shikshan Prasarak Mandal, Yeldari Camp, and District Parbhani mostly using heavy machines like JCBs.



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#### **ANNEXURE-IV**

#### Report of hazardous waste management



Hazardous waste management has become strictly needed for the college after findence. Science faculty, since those chemicals and biological waste generated must be processed and it should not create a threat to envircement, living and non-living organisms. The college has established hazardous waste management committee with the view and motivation to store, treat and dispose the waste. Toxic materials including many organic materials metals such as Zn. Cd, Na etc acids, alkali, non-metallic elements are generally resistant to biological process unless very dilute metals car, often be precipitated out by changing the pH or by treatment with other chemicals, considering these facts we are treating the chemical waste into few steps as follows:

Treatment: using various processes such as oxidation, to alter the property or composition of hazardous waste some treatment processes unable waste to be recovered and reused in manufacturing setting etc, hence we are providing the treatment of dilution of the composition and concentrations so that it would not harm the environment.

Dilution by adding water into chemical waste at the time of chemical dissolution and addition of neutralizing agents, so as the nature of chemical ingredients would become nonhazardous.

Biological waste management: The biological waste generated in biological laboratories i.e. Zoology, Microbiology etc are dumped into a separate pit.

For the management and disposal of hazardous chemicals and waste, a pit of size 4ft s 4ft and depth of 5ft dig. Outlets of various laboratories are managed to be well connected to this pit. Chemicals disposed into pit get evaporated during the summer or summy time which prevents the land from erosion and converting itself into non-fertile.

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