

**INTEGRATED GREEN AND ENERGY AUDIT
FOR THE ASSESSMENT YEAR 2019-20 AND 2020-21
IN LINE WITH NAAC REQUIREMENTS**



॥ नहि ज्ञानेन सदृश्य पवित्रमिह विद्यते ॥

**Shri Santaji Shikshan Vikas Santha's
Santaji Mahavidyalaya, Nagpur**



**27/02/2021
Version 01**

**By:
Energy and Green Audit Team,
Sustainability Solutions**

From the Principal's Desk



An Institution has responsibility to become role model of society. In addition to setting benchmarks for quality education, we feel that we have responsibility towards making this world a better place. We therefore took cognizance of the perilous topic of "Climate Change" and its impact on the human beings and the habitat. Global warming is fuelling the bulk mean temperature of our earth, causing rise in sea levels, catalyzing extreme weather conditions, acidic rains and an eminent catastrophe is in the making. The cascading effects of climate change are jeopardizing the livelihood of larger sections as food and water are becoming scarce. We therefore decided to take up directed action which are in-line with the United Nations Sustainability Development Goal, precisely UNSDG-13. We are aligning ourselves towards the UNFCCC's goal of limiting global temperature rise to well below 2°C and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels.

We sought the help of Green Audit Team (Mr. Swapnil Thanekar, Mrs. Bhakti Thanekar & Mr. Ashish Soni) who played key role in this achievement. We also want to set an example for our Peers so that they can also adopt sustainable practices.

Acknowledgement



Green Audit Assessment Team thanks the management of Shri Santaji Shikshan Vikas Santha's Santaji Mahavidyalaya, Nagpur for assigning this important work of Green Audit. We appreciate the cooperation of our Team for completion of study. Our special thanks to:

Chairman – Mr. Dinesh Govindrao Wanjari

Principal – Dr. Priya Dinesh Wanjari

IQAC Coordinator – Dr. Neehal R. Sheikh

NSS Program Officer – Mr. Vijay Kandalkar

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Laboratory Technician – Mr. Ashwin Gawate

Clerk – Mr. Vikrant Bhasme

All the members of College Development Committee, Shri Santaji Shikshan Vikas Santha's Santaji Mahavidyalaya, Nagpur. Team of students as stated under Annexure-I

For giving us necessary inputs to carry out this very vital exercise of Green Audit. We are also thankful to other staff members who were actively involved while collecting the data and conducting field measurements.

Profile of Audit Team Members and Independent Reviewers

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DISCLAIMER

Green Audit Team has prepared this report for Shri Santaji Shikshan Vikas Santha's Santaji Mahavidyalaya, Nagpur, based on input data submitted by the representatives of College and after having complemented with the best judgment capacity of the expert team.

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 calculations are arrived following best estimates 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 director consequential loss arising from any use of the information, statements or forecasts in the report.



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Scope of Work

Topics to be covered as part of the assessment are:

✓ Solar Passive Architecture

- How the buildings are constructed to utilize the solar energy efficiently. This includes use of day light as lighting source and avoidance of GHG intensive technology example AC as source of cooling due to solar heat gains.

✓ Implementation of measures to reduce wastage of energy

- This includes effective and objective evidences to create awareness towards wastage of electric energy. Hoardings, placards, messages, posters etc. planted at key locations in college, hostels and cafeterias. PCRA (Petroleum Conservation Research Association, Govt. of India) and BEE (Bureau of Energy Efficiency) posters are exhibited.
- It can also be extended to include papers presented by the students on avoidance of electricity at college or day to day life.
- Appointment of joint committees of teachers and students to save electricity
- Controlling of Power Factor by installation of APFC and getting rebate (up to 5% or MSEDCL norms) from MSEDCL for maintaining unity Power factor

✓ Energy Efficient Procurement

- This includes evaluation of energy efficient procurement practices. This does not exactly mean that you need to buy the most efficient, but you need to buy the most efficient which is financially viable. Example AC with efficiency star ratings, Transformer etc.
- Replacement of lighting sources to CFL or LED
- Replacement of Copper Ballast with Electronic Ballast
- Centralized controls of lighting, auditorium etc. to avoid any misuse of electricity
- Procurement of LED monitors to phase-out CRT Monitors
- Shift to paperless regime wherever not required, example attendance muster replaced by biometrics, DG logbook replaced by computerized logbook, daily reports converted from paper to paperless, HoD meetings converted to paperless formats, and all such examples.
- Installation of Solar panels, Power Purchase Agreements with Solar Power Plant owners to buy environmentally friendly energy Source etc.
- Documentary evidences as feasible to calculate the above impacts and finally into the value of avoidance of tCO₂ emitted to atmosphere.

✓ Rain Water Harvesting

- This includes Calculation of Catchment Area (Terrace and ground) and evaluating rough amount of water that is recharged into the water recharge pits if applicable.

✓ Hazardous Waste Management and E-Waste Management

- There are various wastes that are generated within the organization. The report will give the list of the procedures for waste handling.

✓ Duration of the Green Audit

- The Green audit field observations data collection was carried from 23rd February 2021 to 27th February 2021 for the session 2019-2021. The submitted data was monitored by the college throughout the year and assessed by Assessment Team during the visit.

Scorecard

NAAC Criteria	
Key Indicator - 7.1 Institutional Values and Social Responsibilities	
Environmental Consciousness and Sustainability	Audit Team Assessment
<i>The Institution has facilities for alternate sources of energy and energy conservation measures</i>	
1. Solar energy ✓	Evaluating Financial viability for the installation of solar systems
2. Biogas plant	
3. Wheeling to the Grid	
4. Sensor-based energy conservation	Annexure –V: Lighting Survey 2019 – 20
5. Use of LED bulbs/ power efficient equipment ✓	
Options: A. 4 or All of the above B. Any 3 of the above C. Any 2 of the above ✓ D. Any 1 of the above E. None of the above	Annexure –XI: Solar Passive Structure
<i>Describe the facilities in the institution for the management of the following types of degradable and non-degradable waste (within 500 words)</i>	
1. Solid waste management ✓	Refer chapter 12 and Annexure –XIII: Waste Management
2. Liquid waste management	
3. Biomedical waste management	
4. E-waste management ✓	
5. Waste recycling system	
6. Hazardous chemicals and radioactive waste management	
<i>Water conservation facilities available in the Institution:</i>	
1. Rain water harvesting ✓	Refer chapter 06 and Annexure –XII: Water Management
2. Bore well / Open well recharge ✓	
3. Construction of tanks and bunds ✓	
4. Waste water recycling NA	
5. Maintenance of water bodies and distribution system in the campus NA	
<i>Green campus initiatives include (4)</i>	
7.1.5.1. The institutional initiatives for greening the	

campus are as follows:		Annexure –XIII: Waste Management SoP : Green Initiatives by College
1. Restricted entry of automobiles		
2. Use of Bicycles/ Battery powered vehicles		
3. Pedestrian Friendly pathways	✓	
4. Ban on use of Plastic	✓	Chapter 13 and Annexure –XIII: Waste Management
5. Landscaping with trees and plants	✓	
Options: A. Any 4 or All of the above B. Any 3 of the above ✓ C. Any 2 of the above D. Any 1 of the above E. None of the above		
Quality audits on environment and energy are regularly undertaken by the institution		Covered as part of this report. Please refer the contents of this report
7.1.6.1.The institutional environment and energy initiatives are confirmed through the following		
1. Green audit	✓	
2. Energy audit	✓	Covered as part of this report under Chapter -11 and Annexure –XVI
3. Environment audit	✓	Covered as part of this report. Please refer the contents of this report
4. Clean and green campus recognitions/awards		
5. Beyond the campus environmental promotional activities	✓	
Options: A. Any 4 or all of the above ✓ B. Any 3 of the above C. Any 2 of the above D. Any 1 of the above E. None of the above		Please refer Annexure – XIV: List of Awareness Program Undertaken by College

Clean Campus¹

Sr. No.	Aspect	Reference
1.	Cleanliness in and around the campus and waste minimization	➤ Chapter No. 1 & Annexure No. IV ➤ Chapter No. 1 & Annexure No. XIV
2.	Water conservation and management including ➤ Waste water management and reuse ➤ Rain water harvesting, etc.	➤ Chapter No. 12 & Annexure No. XII ➤ Chapter No. 6 & Annexure No. XII
3.	Environment-friendly activities adopted and practiced by the campus	➤ Chapter No. 1 & Annexure No. IV ➤ Chapter No. 1 & Annexure No. XIV
4.	Greenery within the campus to provide pollution free air and carbon-sink	➤ Chapter No. 13 & Annexure No. XIV

¹ <http://www.aicte-india.org/csc2019>

Smart Campus²

Sr. No.	Aspect	Reference
1.	Impact of deployment of digital technology in order for the students, faculty and management in the campus to reduce consumption of natural resources (such as paper, gas, energy etc).	➤ Digital library ➤ Digital attendance ➤ Digital Meetings ➤ Digital notes ➤ Digital papers ➤ Online conference's and classes ➤ Double side printers ➤ Efficient electronic equipment's like LED screens, LED projectors. For details please refer annexure 08 ➤ Procurement of energy efficient equipment
2.	Alignment of the latest digital trends like IoT, Big Data and Cloud Networking to achieve various aspects of sustainability in the campus, specifically to contribute to United Nations SDGs	The college uses goggle forms goggle classroom and other technical tools for online classes. This helps us to share data / links with all students within fraction of a second and result is prepared in less time duration which saves our time, man power and paperwork. In this pandemic situation, we are conducting online classes. The college has purchased 5 licenses from Edfly.com portal . The college is conducting online classes through this platform which is available round the dock and 5 lectures can be conducted simultaneously. The videos of lecture are recorded and accessible anytime on Amazon Clouds.
3.	Create an ecosystem to 'smartly' connect and share the information with each other at campus, institute and national level. Any international level connect will provide a distinct advantage. The smart connect, though the cloud networking, so established should address concerns of environmental challenges including contribution to United Nations Sustainable Development Goals.	To share the data among all the Teachers and students, we are using Edfly.com portal . The videos of lecture are recorded and accessible anytime on Amazon Clouds to specific users. It helps to share academic material in soft copy by single click. We are sharing notes with students in Pdf & Doc format. The college has organized e-Essay competition, e-Poster competition, National Webinars during COVID lockdown. We had connected resource persons from across the nation on one platform. We also shared E-certificates to the participant's. This platform is helpful not only to connect the peoples but also useful in saving paper. The teachers have attended many Webinars and Faculty Development Programs.

² <http://www.aicte-india.org/csc2019>

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Abbreviations

AHU	Air Handling Unit
CFL	Compact Fluorescent Lamp
COP	Coefficient Of Performance
DG	Diesel Generator
ECRM	Energy Consumption Reduction Method
HVAC	Heating, Ventilation, And Air Conditioning
ISO	International Standardization Organization
ITHD	Current Voltage Total Harmonic Distortion
km	Kilometer
kV	Kilo Volt
kW	Kilo Watts
Lab	Laboratory
LED	Light-Emitting Diode
MNRE	Ministry of New and Renewable Energy
MSEDCL	Maharashtra State Electricity Distribution Co. Ltd.
MEDA	Maharashtra Energy Development Agency (MEDA)
TR	Tons of Refrigeration
VTHD	Voltage Total Harmonic Distortion
MSRTC	Maharashtra State Road Transport Corporation

Reference list of Websites

Sr. No.	Websites
1	IEEE 519 - http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=2227
2	http://mnre.gov.in/solar-energy/ch2.pdf
3	BEE - http://www.beeindia.in/
4	ECBC - http://beeindia.in/content.php?page=schemes/schemes.php?id=3
5	http://www.energymanagertraining.com/new_index.php
6	http://www.usalighting.com/stuff/contentmgr/files/1/92ffeb328de0f4878257999e7d46d6e4/misc/lighting_comparison_chart.pdf
7	https://www.bijlibachao.com/lights/use-energy-efficient-lights.html
8	http://www.imd.gov.in/section/climate/climateimp.pdf
9	http://www.bijlibachao.com/air-conditioners/air-conditioner-selection-understand-tonnage-eer-cop-and-star-rating.html
10	http://www.thehindubusinessline.com/opinion/time-to-focus-on-more-crop-per-drop/article9778971.ece
11	http://www.agri.mah.nic.in
12	http://www.indiawaterportal.org/sites/indiawaterportal.org/files/Roof%20Top%20Rain%20Harvesting_Presentation_2006.pdf
13	http://www.imd.gov.in/section/climate/climateimp.pdf
14	http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver14.pdf
15	http://cdm.unfccc.int/
16	http://database.v-c-s.org/
17	http://www.santajicollege.ac.in/
18	https://www.mahadiscom.in/
19	https://www.mahaurja.com/meda/
20	https://offset.climateutralnow.org/vchistory/details?orderId=15798
21	https://www.aicte-india.org/Initiatives/clean-green-campus

Introduction of the College

Santaji Mahavidyalaya, Nagpur, run by Shri Santaji Shikshan Vikas Sanstha, was founded in 1971 and has been included in the list of University Grants Commission under 2F and I2B. Since establishment the college has put forth a courageous attitude and achieved many notable milestones. The college has been accredited thrice by NAAC. The college has been awarded 'A' grade by NAAC in the third Cycle of Assessment and Accreditation. The college has scaled new heights in different fields. The college runs 6 UG and 4 PG courses which consist of professional courses as well.

At Junior College level there are Arts, Commerce, MCVC and Science streams and at Senior College level there are Arts, Commerce, Science, Computer Application and Management Streams. There are courses like B.A., B. Com, (Eng. & Mar. Medium), B. Sc., BCA, B. Com (Computer Application) and BBA at UG level. There are PG Departments like- M. A (English), M. Com, M. Sc. (Microbiology) and M. Sc. (Chemistry).

The progress of the institution has been due to the untiring efforts and guidance of the Ex-President Late Shri Govindraoji Wanjari. Shri Dinesh Govindraoji Wanjari assumed the charge of President of Shri Santaji Shikshan Vikas Sanstha and under his effective leadership the college is spearheading towards new goals by bringing into practice use of latest technological equipment's and providing satisfactory services to the stakeholders.

The primary aim of the college is to strive for the academic development of the rural strata, deprived, weaker section and women. The college aims to have an all-round development of the students who become responsible citizens and eligible for employment. The college is committed to devote its efforts in imparting education through integrity and accountability on the part of its Management and Employees. The College promotes research and creativity to pave ways for new vistas of knowledge. The College has been holding conferences, seminars and webinars at National and International level. The college has well equipped laboratories, Library with spacious Reading Room and Auditorium. In order to achieve all round development of the students, various academic and extra-curricular activities are run. The college has been awarded Best NSS Unit Award at the state level for remarkable work in the field of NSS by the Higher and Technical Education Ministry, Govt. Of Maharashtra. In 1995 and 1998 the 'Best NSS Volunteer Award' at State level was conferred upon the Volunteers of the institution. All the teachers and students actively participate and work hard to make all programs successful.

The college has RTM Nagpur University recognized Place of Higher Learning and Research for English and Commerce. To ensure better employability of students, need-based activities and schemes are designed and implemented. The college runs Career Oriented Courses in association with Department of Lifelong Learning and Extension of RTM Nagpur University to sharpen the skills of the students. Efforts are taken to achieve academic advancement through different activities. Innovative projects are designed to give boost to research. The college brings out a Peer Reviewed National Journal of Multidisciplinary Research 'Delta' with an ISSN.

Objective of Green Audit

The Green Audit Team focused on Material³ Issues pertaining to college which have the highest influence on the Green Attributes of the College. To evaluate steps taken by college management towards green campus below material issues are discussed chapter wise:

1. Organization Level Efforts
2. Creation of Awareness
3. Lighting
4. Cooling and Ventilation
5. Operation of Electronic Equipment's
6. Water Management
7. Water Quality
8. Renewable Energy
9. Transportation
10. Purchasing Practices
11. Carbon Footprint
12. Waste Management
13. Plantation Details

Considering the NAAC requirements, the Assessment Team has identified the Material issues which are related to the environmental performance of the college. The disclosures under this report are accordingly chosen so that the most appropriate, relevant and accurate information is made available. Checklist approach is adopted for transparent evaluation of the topics and increase readability for independent reader.

³ Definition: as per Global Reporting Initiative: **GRI 101: FOUNDATION**2016

An organization is faced with a wide range of topics on which it can report. Relevant topics, which potentially merit inclusion in the report, are those that can reasonably be considered important for reflecting the organization's economic, environmental, and social impacts, or influencing the decisions of stakeholders. In this context, 'impact' refers to the effect an organization has on the economy, the environment, and/or society (positive or negative). A topic can be relevant – and so potentially material – based on only one of these dimensions.

1. Organizational Level Efforts

Is the college having campus green team?	Yes, the Green Campus Committee is already in place. This committee is highly active and meets twice in a year.
If yes, who are the stakeholders?	Yes, it included stakeholders. The stakeholders include ➤ Management ➤ Teaching Faculty ➤ Lab Technician ➤ Computer Operator ➤ Students The Green Campus Committee is shared with the Audit Team. Refer Annexure III.
Does it meet regularly?	The Team meets once in a semester. This was confirmed during site visit interviews and the review of the minutes of meeting.
Can the Green Campus Team suggest new environmental initiatives to College Management?	Suggestions on improvement of environmental performance are always welcomed by College Management. Rain water harvestings, tree plantation at various locations around the college etc. was also discussed as part of brain storming sessions within the meetings. These discussions were converted into live projects by the college management. The annexure to this report captures the live projects of the college.
Has the college established an environmental mission/vision for its campus?	The Management of College is persistent and resolved to make the campus eco-friendlier in due course of time. Various efforts are already initiated towards implementation sustainable initiatives, application of efficient technologies to save energy, plantation etc. There is no separate environmental mission/vision.
Is the college encouraging sustainable behaviour via: o education campaigns? o Posters, placards, messages o incentives? o contests? o awards?	College conducts various activities to create awareness amongst the students and society on environment safety and protection. College has established 'Green Campus Committee' which has conducted various Environmentally Friendly Activities / Trainings: ➤ Rashtrasant Tukdoji Maharaj Yuva Jagruti Abhiyan was organized on 13th August 2019 at Santaji Mahavidyalaya. ➤ Lecture on Traffic Awareness and Effect of Drugs on 9th July 2019 at Santaji Mahavidyalaya. ➤ International Tobacco Free Day was organized on 11th July 2019 at Santaji Mahavidyalaya.

	➤ Death Anniversary of Lokmanya Tilak was observed on 1st August 2019 at Santaji Mahavidyalaya. ➤ Blood Donation Camp in association with Lata Mangeshkar Blood Bank, Digdoh, Nagpur on 10th August 2019 at Santaji Mahavidyalaya, in which 72 students donated blood. ➤ Foundation Day of N.S.S. was organized on 24th September 2019 at Santaji Mahavidyalaya. ➤ 150th Birth Anniversary of Mahatma Gandhi was celebrated on 2nd October 2019 at Santaji Mahavidyalaya. ➤ National girl child day was celebrated on 24th January 2020 at Santaji Mahavidyalaya. ➤ NSS Foundation Day was celebrated at Santaji Mahavidyalaya on 24th September 2020. ➤ "Majhi Vasundhara" program was organized at Santaji Mahavidyalaya on 14th January 2021. ➤ National Voters Day was celebrated at Santaji Mahavidyalaya on 25th January 2021. Please refer Annexure IV for details. Community Based Initiative's by college: ➤ Participation in "Vruksh Dindi" and Tree Plantation at RTM Nagpur University new building premises on 2nd July 2019. ➤ Help for flood affected victim in Sangli and Kolhapur. ➤ Constitution Day was celebrated on 26th November 2019. ➤ Tree Plantation Drive was carried out. ➤ Road Safety Program was organized. ➤ Safety Equipment's for COVID-19 were distributed. Please refer Annexure XIV for details.
Is the college staff modelling sustainable behaviour for students, peers, and community?	During interviews it was confirmed that There are 65 staff members in the college, out of which: Teaching & Non-Teaching Staff: ➤ 32% staff of the college commute by their own 2 wheelers.

	➤ 25% staff of the college travel by car pooling. ➤ 17% staff of the college utilize the city bus for commuting. ➤ 12% staff commute by walking. ➤ 12% staff utilize the metro for commuting. ➤ 2% staff use bicycle for commuting. Please refer above assessments for additional details
Do students model sustainable behaviour for staff, peers, and community?	Total 2700 students are enrolled for 2020-21 session. Approximately: ➤ 35% students of the college commute by public transport (Citybus/Metro) ➤ 30% students of the college commute by bicycle. ➤ 24% students of the college commute by walking. ➤ 11% students of the college commute by their college by their own 2 wheelers. Please refer above assessments for additional details Students participate in activities conducted by college on environment and sustainable development. In addition, please refer above assessments.
Is the college sharing learning internally via o Posters, placards, messages? o assemblies? o classroom presentations? o training/professional development? o posters/bulletin boards? o newsletter? o website?	Data is shared via posters, placards and messages. The assessment team is apprised that the awareness poster includes topics related to minimization of energy usage by avoiding wastage, improvements on energy efficiency, minimization of water wastages, proper disposal of wastes. Please refer Annexure XIII for details.
Does the college offer energy conservation lessons?	Yes, College organizes lectures and motivates students for Energy and Environment conservation.
Is the college sharing its learning externally via o Paper presentations? o newsletter? o website?	The students are encouraged to present projects on topic related to environmental aspects. College is extensively engaged in the research work. The college is also going to make the Green Audit Report public so that learning's of college are shared.
Further Scope of Improvement: ➤ At organization level, the college needs to establish long term improvement objectives to further reduce energy consumption, water consumption and reflect the same in form of dedicated Environment Policy. ➤ College need to install solar PV modules on the terrace to generate renewable electricity.	
Conclusion: ➤ Active involvement of Organization is observed.	

- Adequate awareness amongst the students and other stakeholders (faculty, other staffs, service providers, etc. is observed and reflected from their behavior.
- College Management is in advanced stages of techno-economic evaluation of solar PV power plant.

2. Creation of Awareness

Are the objectives of green audit clearly understood by the institute	Yes To spread awareness amongst the students and the surrounding community about the environmental impact due to operations associated with their teaching institution. ➤ To sensitize them how to address the situation at the local and personal level by conducting programs, camps and other means as feasible ➤ To reduce the negative environmental footprint ➤ To explore possibilities to use renewable energy sources to avoid GHG emissions and also reduce power cost ➤ To introduce renewable energy and to continuously improve its share in total energy mix ➤ To continue the use of efficient LED based lighting ➤ To introduce the automatic controls on the lighting systems ➤ To mitigate the carbon emission or offset them ➤ To increase the green cover ➤ To vigorously and responsibly position the Institute for active contribution in Clean India Mission undertaken by the Governments. ➤ To identify ways and means to sustainably contribute and reduce gaps and become environment friendly ➤ To support community to combat various environmental and social issues as feasible. ➤ To align the college activities to be in line with the requirements of the Clean and Smart Campus Initiatives (https://www.aicte-india.org/initiatives/clean-green-campus) Key Recommendation by the Green Audit Team: ➤ College needs to install Solar PV system. ➤ College should apply for the Clean and Smart Campus Initiatives award
Are there posters/guidance displayed to remind students and staff of good practices?	Yes
Are the students aware of energy sources?	The major source of energy is electricity (grid electricity) followed by usage of diesel in the DG as back in case of failure of grid electricity. Students are aware of these sources of energy which are utilized by the college.

Is college tracking its electrical energy usage?	There is a single meter, which measures the electricity imported by the college. The readings of electricity consumption are included as part of this report under chapter 11.
Is college offering energy conservation lessons and programs?	➤ College has created awareness among the faculty and students to reduce energy wastage. ➤ The college has appropriately disabled the screen savers and programmed the computers for sleep mode operations. ➤ The usage policy of photocopiers, fax machines and other equipment users is "POWER ON" when in use and "POWER OFF" when not in use. There is no idle power consumption. Please refer Annexure V and VI for details.
Do students and staff know where their water comes from?	The source of water is well. Well water is utilized for drinking (after purification), in the wash rooms and for cleaning purpose.
Is college encouraging responsible water use via: o posters, placards? o incentives? o contests? o awards?	Yes, by posters, placards, contests and winner of contest are awarded.
How is trash managed outside the campus?	The waste is given to the Municipal Corporation for disposal.
Further Scope of Improvement ➤ College may calculate the water footprint to compare its performance with national and international consumption standards and communicate with its stakeholders. ➤ College needs to install Solar PV system. ➤ College should apply for the Clean and Smart Campus Initiatives award.	
Conclusion ➤ Visible communication on environmental issues. ➤ Effective use of notice boards and signs. ➤ Water footprint may be calculated in future.	

3. Lighting

How college is utilizing daylight?	The college building is situated in such a manner that it is getting the full advantage of good airflow enabling good ventilation and sun light. It is a building having large windows and open space in all directions. During the day time, it is possible to carry out activities without air conditioners and air fans during operational days.
Is college utilizing any incandescent lights? Can they be replaced with compact fluorescents (energy saving	The college timings are from 7:00 AM to 5:00 PM. Thus, requirement of daytime lighting (powered by electricity) is limited.

bulbs)?

Energy efficient lighting system is followed. the contemporary best practices will recommendations on lighting by Bureau of Energy Efficiency, Book-3, Chapter 8, table 8.1

Type of Lamp	Lumens / Watt		Colour Rendering Index	Typical Application
	Range	Avg.		
Incandescent	8-18	14	Excellent (100)	Homes, restaurants, general lighting, emergency lighting
Fluorescent lamps	46-60	50	Good w.r.t. colour (65-77)	Offices, shops, hospitals, homes
Compact fluorescent lamps (CFL)	40-50	60	Very good (85)	Hotels, shops, homes, offices
High pressure mercury (HPMV)	44-57	50	Fair (45)	General lighting in factories, garages, car parking, flood lighting, etc.
LED lamps	30-50	40	Good (70)	Reading lights, desk lamps, night lights, spotlights, security lights, signage lighting, etc.

Thus, LED's are considered for installation as night lights, security street lights by the college. The term reading light⁴ normally refers to lamps or lights which focus light dedicated for readings, thus LEDs were not considered for class room lightings initially. Fluorescent lamps were utilized for class rooms (as the same are stated to be suitable for office illumination level requirements). LED lights started replacing the conventional tube light as a replacement measure after failure. LED lighting survey was also undertaken by the Audit Team. Please refer below assessments in details.

During the onsite visit the Audit Team visited each department and physically counted the installed lights by their types (Fluorescent tube lamp, CFL and LED). It is confirmed that there is no incandescent light installed for lighting purpose.

As per the published article: http://www.usalighting.com/stuff/contentmgr/files/1/92feb328de0f4878257999e7d46d6e4/misc/lighting_comparison_chart.pdf

LED light has lumen/ watt in the range of 80-100 whereas CFL has lumen/ watt in the range of 70-90

Has the college evaluated existing lighting for opportunities to reduce lighting in over-lit areas?

The lighting arrangements are well balanced with arrangements to switch ON and OFF lights independently. There are therefore practically no over lit areas.

Are the light switched duly labelled to make more obvious which switches relate to which appliances?

Switch arrangements are lucid. The fan switches are adjacent to fan speed regulators. Light switches are arranged in order of lighting. The buttons are marked.

Are the lights switched off to make use of daylight? (e.g. lights parallel to windows or in corridors)

There is minimum or practically negligible use of lights during day time as the building structure has possibility of daylight usage. The lux level in the classrooms was measured and found approximately 250. On the outcast days some places register lower lux level. The locations were pinned and college management confirmed to take subsequent corrective actions.

Is the college utilizing natural lighting when possible?

Yes, natural lighting is first preference.

⁴<https://www.collinsdictionary.com/dictionary/english/reading-light>

For the spaces like store rooms, toilets, kitchen areas, copying rooms, corridors etc is there scope for automatic lighting controls?	No. The college has not installed sensor based lighting system. Recommendation: The students and staff washrooms can be equipped with the proximity sensors to control the lighting arrangements.
Can main lighting ever be switched off and dedicated lighting be used?	As such there are no dedicated lamps which can replace overhead lighting. However, redundant lighting can be switched off when it is not required.
Are the light fittings clean?	The staff is responsible for day to day cleaning was interviewed during onsite visit. Cleanliness is well maintained. In-house light fittings are cleaned regularly some light fittings need cleaning. However, the installed fittings were not cleaned as Covid-19 Pandemic caused shortage of staff.
Do windows and skylights need cleaning to allow in more natural light?	The window and skylight were not clean as Covid-19 Pandemic caused shortage of staff.
Has the college installed lighting occupancy sensors?	No, lights are negligibly operated during day time. The lights are operated manually.
Is there mechanism in place to immediately report inoperable occupancy light sensors?	No. Recommendation: The college needs to install sensor based lighting system for lights which are operative at night.
What is the % contribution of the LED lighting?	We have evaluated the % LED installation at Passage and ground and all other floor. The value is determined and presented under Annexure V.
Further Scope of Improvement	
➤ The college needs to install sensor based lighting system for lights which are operative at night. ➤ The students and staff washrooms can be equipped with the proximity sensors to control the lighting arrangements.	
Conclusion	
➤ The students and employees were interviewed and no complains was identified within respect to the sufficiency of lighting measures. ➤ Sufficient lux levels approximately 250 are common in class rooms and work-stations based on the survey of audit team. ➤ Negligible lighting load is observed during day time as college makes good use of daylight.	

4. Cooling and Ventilation

How are the Air Conditioning Controls? For the local controls, how it is ensured that AC is working only ON	The AC usage is very high as the temperature in Nagpur district is (Max temperature is above 42°C ⁵) hottest day in Nagpur was
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⁵<http://www.imd.gov.in/section/climate/climateimp.pdf>

when necessary. What is temperature setting of the AC?	registered with temperature of 47.9°C). The AC temperature is set at 28°C. Awareness is created and measures are implemented in line with the recommendations of Ministry of Power (https://www.cseindia.org/a-step-in-the-right-direction-says-cse-of-power-ministry-s-move-to-fix-starting-temperature-of-room-air-conditioners-at-24oc-and-not-lower-to-save-energy-8814)
What is the mechanism of reducing heat in-grace? Are the closing blinds or fitting reflective film to windows installed to reduce solar gain?	The building is designed to make best use of day light and avoid the heat in-grace. Blinds are available in office to control unnecessary heat in-grace.
Are all external doors and windows closed when air conditioning is on?	There are 13 number of AC's in college. Based on interviews, it is confirmed that the practice of closing doors and windows is maintained when air conditioning is in operation.
Is there a scenario where air conditioning is wasted in unused spaces, such as cupboards, corridors?	There are no such instances observed. Arrangements are duly implemented to avoid losses.
Are Efficient and energy labelled AC's utilized for cooling purposes?	There are 13 number of AC's in the college out which 2 are 2 star they run for 4-5 hours during summer and rainy season, 9 are 3 star and 2 are 3 star they run for 5-6 hours during all college days. Recommendation: The 2 start AC are not the most economical AC for the sustained working hours of 4-5 hours for approximately 100 days a year. It is recommended to replace the AC with more energy efficient AC (at least 3 Star ratings or above). Below guidelines can be considered by college in future while selecting between the AC and evaporative cooling. Evaporative Cooling System (for computer lab) The Assessment team has undertaken document review and analysis of the data for the assessment of the air conditioning system. Based on the same it was found that there exists scope for the use of evaporative based cooling which is energy effective compared to the reversed Bryon cycle i.e. Vapour Compression Cycle. The basic reason for the same installed system has COP of 1.5 kW/TR of refrigeration compared to evaporative cycle which draws 0.3-0.5 kW based on the size of installation.
Further Scope of Improvement ➤ The 2 start AC are not the most economical AC for the sustained working hours of 5-6 hours for approximately 100 days a year. It is recommended to replace the AC with more energy efficient AC (at least 3 Star ratings or above). ➤ Evaporative cooling can be availed for computer lab.	
Conclusion	

⁶<https://timesofindia.indiatimes.com/city/nagpur/Nagpur-records-all-time-high-temperature-at-47-9-C/articleshow/20216419.cms>

- The 2 star AC need to be replaced by at least 3 Star AC or better at the end of their technical lifetime.
- Evaporative cooling can be availed for computer lab.

5. Operation of Electronic Equipment

Are computers, printers, photocopiers and other equipment switched off at the end of the day?	Yes
Is there any mechanism by which the screens and other equipment be controlled during the day?	The college has availed the services of the Green Audit. The college has appropriately disabled the screen savers and programmed the computers for sleep mode operations. Please refer to Annexure VI.
Are the screen savers disabled?	Yes, please refer above assessment.
Are computers programmed to 'power down' mode?	Computers are programmed for the sleep operation.
Is the user entrusted with the rights to modify standby settings? (E.g. TVs, LCD projectors, printers etc.)	No, the college has the administrative rights. Such changes cannot be initiated by users.
What is status of the photocopiers, fax machines and other equipment? Are they programmed on 'Energy Saver' mode during the day?	The equipment like photocopiers, fax machines are shutdown when not in use, computers are turned to sleep mode whenever not in use.
Are the power management settings enabled on all the computers/ monitors/ all-in-one machines?	All machines are governed by the college. All are equipped by power management settings as already described above.
Conclusion:	
➤ The Electrical Equipment's are well operated. Redundant operations are avoided.	

6. Water Management

Are any water leaks identified?	The urinals are flushed periodically and manually. The urinals need to be equipped with push button taps. Please refer below recommendation.
Are taps left running? Are there any dripping taps? Do taps need maintenance?	No such instance was observed.
Are push button taps utilized?	Toilet washrooms are not equipped with the push buttons. Please refer below recommendation.
Is water escaping from	No such instance was identified during onsite audit.

overflows either inside or outside buildings?	
Has the college installed low-flow faucets, automatic faucets, and/or faucet aerators?	Recommendation: The college Management needs to consider dedicated flush at urinals (in place of periodic manual flushing), low-flow faucets, automatic faucets, and/or faucet aerators as the replacement for the existing conventional taps.
Has the college installed low-flow shower heads at Hostel?	NA
Has the college harvested rainwater?	Yes, the rain water is harvested over the college building.
Is the college collecting the condensation from A/C units for onsite watering needs?	Yes, The condensed water is gathered in buckets and the water used for watering plants.
Has the college optimized its irrigation system for gardening to o operate at night or early morning hours to minimize evaporation? o water the minimum time and frequency necessary for the applicable vegetation?	No, As per the latest publication from "The Hindu" drip irrigation is one of the most important measures to achieve "more crop per drop". Share of Agriculture consumption is approximately 83 per cent of India's water resources, thus approximately 17 per cent water resources are available for domestic and industrial use (http://www.thehindubusinessline.com/opinion/time-to-focus-on-more-crop-per-drop/article9778971.ece). College campus is having fully grown trees which do not require watering. Small shrubs are planted in pots which are watered with the remaining water from the water bottles by the staff.
What is amount of rain water harvested?	Total area of roof top of college building is 351.17 m ² . The rainfall for Nagpur Region is approximately 1018.2 mm. Total rain water harvesting is 321 m ³ at the run off coefficient of 0.9. The college has also laid the cement blocks and constructed pits. This enables the rain water falling on the cement blocks to flow into the pits and get harvested. The area under the cement block is 512.72 m ² . The run off coefficient is considered as 0.3 based on the Manual on Artificial Recharge of Ground Water, issued by Government of India, Ministry of Water Resources, Central Ground Water Board, September 2007. The water rain water harvested from the cement blocks is 156 m ³ . Total quantity of water harvested = 321 + 156 = 477 m ³ Please refer Annexure XVIII for details.
Are there any community based projects implemented by the college?	Yes. Activities by NSS have been undertaken by the college. Refer Chapter 1 and Annexure XIV for details.

Further Scope of Improvement:

Long Term Measure:

- The college Management needs to consider dedicated flush at urinals (in place of periodic manual flushing), low-flow faucets, automatic faucets, and/or faucet aerators as the replacement for the existing conventional taps.
- College needs to install the metering arrangement to measure the water drawn from bore well.
- College can undertake determination of water footprint and calibrate its specific water consumption with the established National and International Norms.

Conclusion:

- The college is having 01 no. of bore well and a Municipal Corporation water connection as source of water.
- Toilet urinals can be equipped with the push buttons.

7. Water Quality

Is the college campus maintained clean to minimize litter polluting water table?	The college premise is kept clean. Thus, the chances of litter polluting water table are negligible. The Assessment Team has also observed that the effluent from the chemical lab is directly sent to sewer line without treatment. Recommendation: College needs to perform study of all the effluent chemicals (volume, weight, impact) used and accordingly develop mitigation measures under its sustainable strategy.
Is the college monitoring drinking water quality regularly? If yes, what is the frequency?	Yes. Water testing is done by the college in their labs. Water Quality Test Reports are included as part of Annexure VII of this Report.
Further Scope of Improvement: ➤ External testing of drinking water can be performed ➤ College needs to perform study of all the effluent chemicals (volume, weight, impact) used and accordingly develop mitigation measures under its sustainable strategy.	
Conclusion: ➤ The students, staff members and guests have access to clean, safe and potable water with the RO system.	

8. Renewable Energy

Is the college having solar, wind, or other forms of renewable energy?	No. Recommendation: The college needs to install Solar PV System in the college.
Is the college purchasing renewable power from third party or renewable energy certificates for its electricity use?	No,
Is the college offering renewable energy lessons / programs?	This already assessed under chapter 01 of this report.

Further Scope of Improvement

- College Management needs to install (solar PV) system in college.

9. Transportation

Is college encouraging transportation measures like bicycle, Bulk transport, walking?

Students: Total 2700 students are enrolled for 2020-21 session.

Approximately:

- 35% students of the college commute by public transport (Citybus/Metro)
- 30% students of the college commute by bicycle.
- 24% students of the college commute by walking.
- 11% students of the college commute by their college by their own 2 wheelers.

Students participate in activities conducted by college on environment and sustainable development. In addition, please refer above assessments.

Faculties: During interviews it was confirmed that

There are 65 staff members in the college, out of which:

Teaching & Non-Teaching Staff:

- 32% staff of the college commute by their own 2 wheelers.
- 25% staff of the college travel by car pooling.
- 17% staff of the college utilize the city bus for commuting.
- 12% staff commute by walking.
- 12% staff utilize the metro for commuting.
- 2% staff use bicycle for commuting.

Please refer above assessments for additional details.

Is the college providing eco-friendly or less GHG intensive transportation matching services? (Example carpools, college buses etc)

Refer above response.

What are the good practices pertaining to Transport?

Recommendation:

College Management should encourage use of bi-cycle and mass transport systems amongst students and faculties.

Further Scope of Improvement:

- College Management should encourage use of bi-cycle and mass transport systems amongst students and faculties.

Conclusion:

- The college management, its employees and the students observe satisfactory practices of transportation/ commutation.

10. Purchasing Practices

Describe the purchasing that confirms the better environmental performance?	Printers with duplex printing facility is installed at the computer lab and Library. There is culture of the two-sided printing. Paper is not wasted.
How does the college limit the purchase of single-serve bottles and containers?	The college has RO system; guests are served with water from RO system. Single serve bottles are not utilized unless requested by the guest.
Is the college having water fountains/stations to promote easy filling of reusable water bottles?	Yes, the water dispensers are connected to output of RO system. Clean and potable water is available to staff, student and guests.
Further Scope of Improvement: The college should further emphasize on the purchase of: ➤ no- to low-odor (VOC) markers ➤ no- to low-VOC paints? (via Facilities) ➤ paper/paper products with maximum recycled content ➤ refillable pens/pencils ➤ compostable bags for compost collection	
Conclusion: ➤ Focus of the recommendation pertaining to the environmental preference of evaporative cooling over AC needs to be considered. ➤ One sided paper is utilized by college to avoid use of fresh papers ➤ Policy for the disposal of Archived paper Records needs to be formed by college	

11. Energy and Carbon Footprint

Has the College undertaken energy audit?	Yes, the energy audit was undertaken and electrical measurements were undertaken at the college. Please refer the Annexure –XV of this report. Energy audit is an effective tool in identifying and perusing a comprehensive energy management program. Energy Audit highlights the areas of energy savings, thereby reducing the energy costs. The following are the major consumers of electricity in the facility: ➤ Computers ➤ Lighting ➤ Air-Conditioning ➤ Fans ➤ Pumps ➤ Other Lab Equipment
What are the steps undertaken during the	The Assessment Team undertook the analysis of the college premise: ➤ To study electricity bills ➤ Study of lighting system and its measurement. ➤ Air conditioner

energy audit?	➤ Identification of energy saving opportunity and energy conservation.																														
What methodology was adopted?	The energy assessment involved desk review and onsite measurements. Review of energy bill received from MSEDCL was undertaken. Review of lighting, HVAC, fuel usage, pumping systems etc. was undertaken. Energy conservation and saving opportunities are identified and included below.																														
What are the suggested energy conservation measures?	Below energy conservation measures are suggested ➤ The one switch for college concept should be implemented in the college. This will avoid unwanted operation and wastage of electricity. ➤ Air conditioner shall be operated between temperature range of 24-28⁰C to maintain lower cooling load on compressor to save energy. ➤ The existing 2 star labelled AC's and reached end of their service life. The AC's should be replaced by the 5-star AC's. <table><thead><tr><th></th><th>0.75 ton</th><th>1 ton</th><th>1.5 ton</th><th>2 ton</th></tr></thead><tbody><tr><td>1 Star AC (mostly non inverter)</td><td>722</td><td>845</td><td>1240</td><td>1640</td></tr><tr><td>2 Star AC (mostly non inverter)</td><td>595</td><td>600</td><td>1184</td><td>1625</td></tr><tr><td>2 Star AC (mix. of inverter and non inverter)</td><td>562</td><td>747</td><td>1104</td><td>1445</td></tr><tr><td>4 Star (mostly Inverter)</td><td>454</td><td>645</td><td>945</td><td>1290</td></tr><tr><td>5 Star (mostly Inverter)</td><td>400</td><td>564</td><td>810</td><td>1113</td></tr></tbody></table> <i>Annual Electricity Consumption (Units or kWh) for 1600 hrs based on data from BEE</i> ➤ All Class Rooms and labs must sensitize students regarding optimum use of electrical appliances in the room like, lights, fans, and computers. ➤ The comfort air conditioning temperature to be set between 24°C to 28°C. ➤ Lights in toilet area may be kept OFF during day time. Additional sensors can be installed in washrooms to automatically regulate the light and exhaust fans.		0.75 ton	1 ton	1.5 ton	2 ton	1 Star AC (mostly non inverter)	722	845	1240	1640	2 Star AC (mostly non inverter)	595	600	1184	1625	2 Star AC (mix. of inverter and non inverter)	562	747	1104	1445	4 Star (mostly Inverter)	454	645	945	1290	5 Star (mostly Inverter)	400	564	810	1113
	0.75 ton	1 ton	1.5 ton	2 ton																											
1 Star AC (mostly non inverter)	722	845	1240	1640																											
2 Star AC (mostly non inverter)	595	600	1184	1625																											
2 Star AC (mix. of inverter and non inverter)	562	747	1104	1445																											
4 Star (mostly Inverter)	454	645	945	1290																											
5 Star (mostly Inverter)	400	564	810	1113																											
Has the college calculated its carbon footprint?	For the first time college is calculating the carbon footprint. The data applicable to Scope-2 emission (electricity purchase from grid) is available. The emissions pertaining to Scope-01 are limited to HSD use in DG, College Bus and LPG usage in Labs.																														
How is college promoting zero emission transportation options?	Not applicable. There is no internal transportation within the college.																														
Are all the applicable emission sources calculated?	The emission source pertaining to grid-based electricity source is calculated. Scope-01 emission source data pertaining to DG, HSD consumption in DG, LPG consumption in labs are calculated, Scope 2 emission on account of electricity imported from grid is considered.																														

Scope-01 Emissions:

Year	HSD Consumption in DG	LPG consumption in Labs
Session	lit	kg
2019-20	25.8	45
2020-21	25.8	30

Equivalent Scope-01 Emissions are as below⁷:

Year	HSD Consumption in DG	LPG consumption in Labs	Total GHG Emission (Scope-1)
Session	tCO ₂	tCO ₂	tCO ₂
2019-20	0.09	0.17	0.26
2020-21	0.09	0.11	0.21

Scope -2 Emissions are tabulated as follows⁸:

Year	Annual Electricity Consumption	Total GHG Emission (Scope-2)
Session	kWh	tCO ₂
2019-20	19124 + 40328 = 59452	19.12 + 40.33 = 59.45
2020-21	9924 + 22359 = 32303	9.94 + 22.36 = 32.30

Total CO₂ emissions = Scope-01 + Scope-02

Year	Total GHG Emission (Scope-1)	Total GHG Emission (Scope-2)	Total GHG Emission (Scope-1+2)
Session	tCO ₂	tCO ₂	tCO ₂
2019-20	0.26	59.45	59.71
2020-21	0.21	32.30	32.51

⁷With 5 % uncertainty as all values are sourced from bills⁸With 5 % uncertainty as all values are sourced from bills

12. Waste Management

How the college reduces its paper waste via:
o encouraging digital reading, note-taking, and activities?

o setting printers and computers to default to duplex (double-sided) printing?

o reducing margins and white space on documents that must be printed?

o printing multiple pages per sheet?

o minimizing paper correspondence with families?

o opting out of unwanted mail?

Is the college undertaking recycling collection for additional recyclable materials—like plastic bags, CFL (spiral) light bulbs, batteries, drink pouches, candy wrappers, and electronics?

➤ The class room and labs are well ventilated and spacious. This minimizes suffocation to students by improving air changes and hence the air quality

➤ The college has adopted the duplex printers, which enables the complete usage of the paper areas.

➤ College has taken initiatives towards plastic free campus. The students are encouraged to use waste bins which are placed in the college.

➤ The internal correspondences and various functionalities are taken care by the electronic means like emails, sms etc.

➤ The recycling / disposal system adopted by the college is as below.

Different types are generated within campus which include.

➤ **E-Waste:** The E-waste generally includes the tube-lights, CFL, LED, computer waste, etc. are stored into the scrap bin and given to the ragman.

➤ **Plant Waste:** The plant waste is converted manure in compost pit within the campus area.

➤ **Sewage Waste:**
The liquid waste from lavatories and other sources are disposed through sewer line.

➤ **Chemical Waste:**
Chemical waste is flown into the sewer line. College needs to improve the waste disposal method for the chemical waste handling for chemical labs.

➤ **Cellulose and Paper Waste:**
Cellulose and paper waste is stored in a particular place and given to the ragman.

➤ **Biomedical Waste:**
The generated waste is segregated as per rules at collection end point in Colour Coded Bags and handed over to

the agency for proper disposal. MOU of Biomedical waste handling is executed. Please refer Annexure XIII for details.

Recommendations:

- College needs to improve the waste disposal method for the chemical waste from chemical labs.
- College needs to improve the waste disposal method for E-waste.
- College needs to improve the waste disposal method for Cellulose waste.

Further Scope of Improvement:

- College needs to improve the waste disposal method for the chemical waste handling for chemical labs.
- College needs to improve the waste disposal method for E-waste.
- College needs to improve the waste disposal method for Cellulose waste.

Conclusion:

- College is appropriately bringing its discards for gainful utilization. The material like iron rods, roller, etc. have been shared with the other institutions of the group.
- There is regular exchange of furniture and other useful material leading to avoidance of disposal of material as waste.

13. Plantation by College

The College campus has several trees.

Every year, plantation programme is carried out in the campus as well as outside the campus. Students are also involved in plantation programme in surrounding locality. In the current session, the institution planted several trees in the vicinity.

There are 40 fully grown trees as wells as shrubs in the campus.

SANTAJI MAHAVIDYALAYA, NAGPUR

Botanical Garden

Session 2019-20

Herb	Shrub	Trees	Climber	Aquatic Plants	Xerophytes	Indoor Plants
<i>Oxalis</i> many	<i>Dracaena</i> (3)	<i>Bixa aurelina</i> (1)	<i>Bougainvillea</i> (1)	<i>Hydrilla</i>	<i>Euphorbia milli</i> (4)	<i>Syngonium</i> (2)
<i>Mimosa pudica</i> (3)	<i>Spider dracaena</i> (3) V(2), R(1)	<i>Mangifera indica</i> (1)	<i>Gillroy</i> (2)	<i>Nymphaea</i>		<i>Diffen backiana</i> (5)
<i>Ocimum sanctum</i> (30)	<i>Hibiscus rosa-sinensis</i> (6) R(4), P(2)	<i>Cassia siamea</i> (1)	<i>Asparagus</i> (1)	<i>Echhornia sp.</i>	<i>Alea vera</i> (5)	<i>Aglaonema</i> (5)
<i>Pentascornea</i> (5)	<i>Rose</i> (1)	<i>Ficus religiosa</i> (1)	<i>Pothos</i> (2)	<i>Pistia</i>	<i>Opuntia</i> (2)	<i>Fan palm</i> (1)
<i>Spider lily</i> (1)	<i>Vitex nigunda</i> (1)	<i>Royal palm</i> (9)	<i>Allamanda cathartica</i> (1)	<i>Azolla</i>	<i>Bryophyllum</i> (1)	
<i>Tradescantia</i> (4)	<i>Nerium</i> (4)	<i>Bauhinia variegata</i> (1)	<i>Clematis</i> (1)	<i>Trapa</i>		
<i>Chrysanthemum</i> (5)	<i>Cistrium nocturnum</i> (1)	<i>Morus alba</i> (1)				
<i>Coleus</i> (2)	<i>Cymbopogon citrates</i> (1)	<i>Christmus tree</i> (1)				
<i>Catharanthus roseus</i> (4)	<i>Balleria crstrata</i> (1)	<i>Terminalia catappa</i> (3)				
	<i>Adhatoda vasica</i> (1)	<i>Casuarina</i> (1)				
	<i>Thuja sp.</i> (3)	<i>Magnolia champaka</i> (1)				
	<i>Cycas revoluta</i> (1)	<i>Plumeria obtusa</i> (2)				
	<i>Calliandra</i> (5)	<i>Casuarina</i> (1)				
	<i>Jatropha</i> (1)	<i>Gulmohar red orange</i> (1)				
	<i>Ixora</i> (4)					
	<i>Costus paciosa</i> (1)					
	<i>Jasminum sambac</i> (1)					
	<i>Croton</i> (3)					
	<i>Nephrolepis</i> (2)					
Total : 54	Total : 43	Total : 25	Total : 08	Many	Total: 12	Total : 13

SANTAJI MAHAVIDYALAYA, NAGPUR

Botanical Garden

Session 2020-2021

Herb	Shrub	Trees	Climber	Aquatic Plants	Xerophytes	Indoor Plants
<i>Oxalis</i> many	<i>Dracaena</i> (3)	<i>Ficus elastic</i> (1)	<i>Bougainvillea</i> (3)	<i>Hydrilla</i>	<i>Euphorbia</i> <i>milii</i> (7)	<i>Syngonium</i> <i>podophyllum</i> (2)
<i>Mimosa pudica</i> (4)	<i>Spider dracaena</i> (3)	<i>Mangifera indica</i> (1)	<i>Gillay</i> (2)	<i>Nymphaea</i>	<i>Bravophyllum</i> (4)	<i>Diffen backlania</i> (5)
<i>Ocimum sanctum</i> (30)	<i>Hibiscus rosa-sinensis</i> (9)	<i>Cassia siamea</i> (1)	<i>Asparagus</i> (2)	<i>Echhornia</i> sp.	<i>Aleo vera</i> (5)	<i>Aglaonema</i> (5)
<i>Pentascornea</i> (7)	<i>Rose</i> (6)	<i>Ficus religiosa</i> (1)	<i>Pothos</i> (2)	<i>Pistia</i>	<i>Opuntia</i> (2)	<i>Fan palm</i> (1)
<i>Spider lily</i> (1)	<i>Vitex nigunda</i> (1)	<i>Royal palm</i> (9)	<i>Allamanda cathartica</i> (1)	<i>Azolla</i>		<i>Snake plant</i> (6)
<i>Tradascantia</i> (5)	<i>Nerium</i> (6)	<i>Bauhinia variegata</i> (1)	<i>Clematis</i> (1)	<i>Trapa</i>		
<i>Chrysanthemum</i> (10)	<i>Cistrium nocturnum</i> (1)	<i>Morus alba</i> (1)	<i>Passiflora foetida</i> (2)			
<i>Coleus</i> (2)	<i>Cymbopogon citrates</i> (1)	<i>Christmas tree</i> (1)				
<i>Catharanthus roseus</i> (8)	<i>Barleria cristata</i> (2)	<i>Terminalia catappa</i> (3)				
<i>Cordyline fruticosa</i> (5)	<i>Adhatoda vasica</i> (1)	<i>Casuarina</i> (2)				
	<i>Thuja</i> sp. (3)	<i>Magnolia champaka</i> (1)				
	<i>Cycas revoluta</i> (2)	<i>Plumeria obtusa</i> (2)				
	<i>Calliandra</i> (5)					
	<i>Jatropha</i> (1)	<i>Caesalpinia pulcherrima</i> red orange (1)				
	<i>Ixora</i> (12)					
	<i>Costus speciosus</i> (2)					
	<i>Jasminum sambac</i> (1)					
	<i>Croton</i> (3)					
	<i>Nephrolepis</i> (2)					
Total : 72	Total : 63	Total : 25	Total : 13	Many	Total: 18	Total : 19



List of trees in the campus

Annexure

Annexure – I: List of Interviewed College Staff / Students



Shri Santaji Shikshan Vikas Santha's
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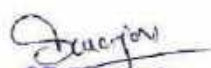
No.

Date: 17/06/2020

To,

List of Teaching and Non-teaching staff present during Green Audit for 2019-20

Sr. No.	Name	Position
1.	Dr. Priya D. Wanjari	Principal
2.	Dr. Shrikant R. Pajankar	Associate Professor
3.	Dr. Neeha R. Sheikh	IQAC Coordinator
4.	Dr. Shrikant M. Sontakke	Associate Professor
5.	Mr. Vijay Kandalkar	Assistant Professor
6.	Mr. Jagdish Watmode	Assistant Professor
7.	Mr. Suraj Mathane	Assistant Professor
8.	Mr. Vikrant Bhasme	Clerk


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22/02/2021

**List of Teaching and Non-teaching staff
present during Green Audit for 2020-21**

Sr. No.	Name	Position
1.	Dr. Priya D. Wanjar	Principal
2.	Dr. Shrikant R. Pajankar	Associate Professor
3.	Dr. Neehal R. Sheikh	IQAC Coordinator
4.	Dr. Shrikant M. Sontakke	Associate Professor
5.	Mr. Vijay Kandalkar	Assistant Professor
6.	Mr. Jagdish Watmode	Assistant Professor
7.	Mr. Amit Rehpade	Assistant Professor
8.	Mr. Suraj Mathane	Assistant Professor
9.	Dr. Rajita Lonare	Assistant Professor
10.	Mr. Vikrant Bhasme	Clerk


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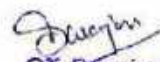
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17/06/2019

**List of students
present during Green Audit for 2019-20**

Sr. No.	Name	Class
1.	Aaditya Charpe	B. A. I
2.	Kajal Y. Shahare	B. Com II
3.	Adesh H. Raut	BCCA II
4.	Shailja S. Gupta	BCA III
5.	Palak S. Shahu	BBA II
6.	Gunjan V. Godghate	M. A. I (Eng)
7.	Chetan P. Hinge	M. Com I
8.	Komal R. Atkare	M. Sc. I


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23/02/2024

**List of students
present during Green Audit for 2020-21**

Sr. No.	Name	Class
1.	Aditi Kahu	B. A. I
2.	Vaibhav Thakre	B. Com II
3.	Achal A. Sahare	BCCA II
4.	Diksha S. Yadav	BCA III
5.	Abhay C. Jangade	BBA II
6.	Neha A. Tarekar	M. A. I (Eng)
7.	Kajal A. Tajane	B. Sc III
8.	Ketki V. Shejal	M. Sc. I


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Nagpur-15.

Annexure – II: Reference Documents / Surveys

Sr. No	Reference Documents / Surveys pertaining to
1.	Functionality of RO water plant
2.	Roof top area by College
3.	Setup for rain Water Harvesting
4.	Information regarding Garden Waste Management
5.	Information regarding Liquid Waste Management
6.	Measures for maintaining Cleanliness in Campus.
7.	Measures for Garbage Collection and disposal
8.	Plantation Measures
9.	Electricity Bills for duration of April 2019 to January 2021
10.	Nature Conservation Club Composition
11.	Declaration on Operational Controls of System Department with Respect to IT Management & Other Electronic Equipment's.
12.	Roll of Staff, Students & Management to Save Electricity In Campus.
13.	Lighting Survey undertaken by the Green Audit Team
14.	AC Survey undertaken by the Green Audit Team
15.	Water Harvesting Survey undertaken by the Green Audit Team
16.	Waste Water Management Survey undertaken by the Green Audit Team

Annexure –III: Green Campus Committee

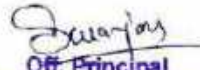


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17/06/2019

Green Campus Committee Academic Session 2019-20

1. Dr. Priya D. Wanjari, Principal- Chairperson
2. Ms. Vaishnavi Telrandhe - Member
3. Mr. Abhishek Thakre, - Member
4. Mr. Atish. B. Thool- Member
5. Ms. Harsha Kanojiya- Member
6. Shri Vikrant Bhasme- Member
7. Shri. Samyak Ukey- Member
8. Ms. Deeksha Kamble- Member
9. Mr. Mithila Patil- Member
10. Dr. Rajita Lonare- Member Secretary


Off. Principal
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Pt. Jawaharal Nehru Marg,
Nagpur-15.



Shri Santaji Shikshan Vikas Santha's
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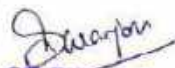
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Green Campus Committee
Academic Session 2020-21

18/06/2020

1. Dr. Priya D. Wanjari, Principal- Chairperson
2. Mr. Abhay Wankhede- Member
3. Mr. Abhishek Thakre - Member
4. Mr. Atish. B. Thool- Member
5. Ms. Harsha Kanojiya- Member
6. Shri Vikrant Bhasme- Member
7. Shri. Samyak Ukey- Member
8. Ms. Deeksha Kamble- Member
9. Mr. Mithila Patil- Member
10. Dr. Rajita Lonare- Member Secretary


Off. Principal
Santaji Mahavidyalaya
Pl. Jawaharlal Nehru Marg,
Nagpur-16.

Green Campus Committee 2020 – 21

Annexure – IV: List of Awareness Program Undertaken By College



Rashtrasant Tukdoji Maharaj Yuva Jagruti Abhiyan was organized on 13th August 2019 at Santaji Mahavidyalaya.



Lecture on Traffic Awareness and Effect of Drugs on 9th July 2019 at Santaji Mahavidyalaya.



International Tobacco Free Day was organized on 11th July 2019 at Santaji Mahavidyalaya.



Death Anniversary of Lokmanya Tilak was observed on 1st August 2019 at Santaji Mahavidyalaya.



Blood Donation Camp in association with Lata Mangeshkar Blood Bank, Digidoh, Nagpur on 10th August 2019 at Santaji Mahavidyalaya.



N.S.S. Foundation Day was celebrated on 24th September 2019 at Santaji Mahavidyalaya.



150th Birth Anniversary of Mahatma Gandhi was celebrated on 2nd October 2019 at Santaji Mahavidyalaya.



National girl child day was celebrated on 24th January 2020 at Santaji Mahavidyalaya.



NSS Foundation Day was celebrated on 24th September 2020 at Santaji Mahavidyalaya.



"Majhi Vasundhara" program was organized on 14th January 2021 at Santaji Mahavidyalaya.



National Voters Day was celebrated on 25th January 2021 at Santaji Mahavidyalaya.

Annexure –V: Lighting Survey (2020 – 21)

List of Assumptions:

- During the survey specific hours for each class room, wash room, office space was assessed and accordingly average daily hours were considered
- The kW ratings of the installed lights is taken from the College data
- The calculations cover the two approaches
 - Approach: Calculation of LED contribution based on the total lighting load energy consumption.

Note: The Lumen/Watt for 28 W tube light is up to 110; which is almost same as LED is: 110-120⁹

- The Green Audit Team acknowledges the criteria for introduction of LED lights as LED lights do not have disposal problems. Tube lights face problem of mercury contamination.
- Conversely the college also faces the problem of disposal of existing tube lights. The sudden disposal of tube lights on large scale and within their service life will lead to huge amount of e-waste which has critical impact on environment. The college management is thus looking for the replacement policy and lighting (tube light, CFL) will be upgraded to eco-friendly LED after failure of existing lighting system.

Lux Levels observed at working place - Above 250

Calculated Contribution of various lighting arrangements: Calculated for 200 working days

Light Sources	Daily Wh Consumption
Tube light	34240
LED	9020
CFL	3070

Light Sources	% Contribution
Tube light	55%
LED	37%
CFL	8%

Light Sources	Number
Tube light	169
LED	115
CFL	24

Light Sources	% Contribution
Tube light	74%
LED	19%
CFL	7%

⁹<https://www.google.co.in/amp/s/www.bijlibachao.com/lights/comparing-led-lights-with-fluorescent-lights.html%3fisamp=1>

Lighting Survey 2020 – 21

Sr. No	Room Name/no.	Tube light	Watts	Daily Average hrs.	W.hr	CFL	Watts	Daily Average hrs.	W.hr	LED	Watts	Daily Average hrs.	W.hr
1	Micro Biology Lab	3	40	5	600	-	-	-	-	10	12	5	600
2	Staff Room (Senior)	7	40	5	1400	-	-	-	-	-	-	-	-
3	Office	8	40	5	1600	-	-	-	-	-	-	-	-
4	Research Room	-	-	-	-	-	-	-	-	4	12	5	240
5	Chairman Cabin	-	-	-	-	-	-	-	-	10	12	2	240
6	Staff Room (Junior)	3	40	5	600	-	-	-	-	-	-	-	-
7	Class Room No. 1	4	40	5	800	-	-	-	-	-	-	-	-
8	Store Room	1	40	5	200	-	-	-	-	-	-	-	-
9	Cultural Department	2	40	5	400	-	-	-	-	-	-	-	-
10	Computer Lab	1	40	5	200	13	32	5	2080	1	20	5	100
11	Language Lab	2	40	5	400	-	-	-	-	-	-	-	-
12	Principal Office	-	-	-	-	11	15	6	990	8	10	6	480
13	Admin Office	3	40	8	960	-	-	-	-	-	-	-	-
14	Class Room No. 3	1	40	1	40	-	-	-	-	-	-	-	-
15	Seminar Hall	-	-	-	-	-	-	-	-	16	20	2	640
16	Library	8	40	8	2560	-	-	-	-	4	20	8	640
17	Gents Toilet	2	40	2	160	-	-	-	-	-	-	-	-
18	Ladies Toilet	6	40	2	480	-	-	-	-	-	-	-	-
19	Corridor	9	40	5	1800	-	-	-	-	-	-	-	-
20	Botany Lab	7	40	5	1400	-	-	-	-	-	-	-	-
21	Chemistry Lab	5	40	5	1000	-	-	-	-	-	-	-	-
22	Class Room No. 6	4	40	5	800	-	-	-	-	-	-	-	-
23	Class Room No. 7	4	40	5	800	-	-	-	-	-	-	-	-
24	Class Room No. 8	4	40	5	800	-	-	-	-	-	-	-	-
25	Class Room No. 9	4	40	5	800	-	-	-	-	-	-	-	-

Integrated Energy and Green Audit: Shri Santaji Shikshan Vikas Santha's Santaji Mahavidyalaya, Nagpur

26	Class Room No. 10	4	40	5	800	-	-	-	-	-	-	-	-
27	Class Room No. 11	4	40	5	800	-	-	-	-	-	-	-	-
28	Class Room No. 12	4	40	5	800	-	-	-	-	-	-	-	-
29	Class Room No. 13	4	40	5	800	-	-	-	-	-	-	-	-
30	Class Room No. 14	2	40	5	400	-	-	-	-	-	-	-	-
31	Class Room No. 15	2	40	5	400	-	-	-	-	-	-	-	-
32	Class Room No. 16	5	40	5	1000	-	-	-	-	-	-	-	-
33	Girls Common Room	1	40	5	200	-	-	-	-	-	-	-	-
34	Corridor	8	40	2	640	-	-	-	-	-	-	-	-
35	Class Room No. 14 - A	-	-	-	-	-	-	-	-	14	20	5	1400
36	Class Room No. 14 - B	-	-	-	-	-	-	-	-	15	20	5	1500
37	Class Room No. 15 - A	-	-	-	-	-	-	-	-	15	20	5	1500
38	Class Room No. 16 - A	3	40	5	600	-	-	-	-	-	-	-	-
39	Class Room No. 17	2	40	5	400	-	-	-	-	-	-	-	-
40	Class Room No. 18	4	40	5	800	-	-	-	-	-	-	-	-
41	Class Room No. 19	4	40	5	800	-	-	-	-	-	-	-	-
42	Class Room No. 20	4	40	5	800	-	-	-	-	-	-	-	-
43	Class Room No. 21	4	40	5	800	-	-	-	-	-	-	-	-
44	Fashion Designing	-	-	-	-	-	-	-	-	8	20	5	800
45	Physics Lab	7	40	5	1400	-	-	-	-	-	-	-	-
46	Tissue Culture Lab	10	40	8	3200	-	-	-	-	-	-	-	-
47	Staff Room	1	40	5	200	-	-	-	-	-	-	-	-
48	Corridor	3	40	2	240	-	-	-	-	-	-	-	-
49	Chemistry Lab	2	40	5	400	-	-	-	-	6	20	5	600
50	Servant Quarter	1	40	8	320	-	-	-	-	2	15	8	240
51	Servant Quarter	2	40	8	640	-	-	-	-	2	10	2	40
Total		169	1720	214	34240	24	47	11	3070	115	231	68	9020



On & Off culture practiced in college



Use of LED lights in college

Annexure –VI: Undertaking by the System Department regarding control of Electronic Equipment's



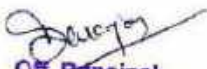
17/06/2020

Certificate about Operation of Electronic Equipments

Academic Session 2019-20

The rights of computer settings are with the administrative department of the college. As part of the sustainable and eco-friendly setting, the administrative department has initiated below settings in the computers of all the users-

1. All the computer screen savers are disabled
2. The Computers are turned to sleep mode if they are ideal
3. The computer settings cannot be changes as the rights are with the administrative department.
4. With regard to the user policy of Photocopier and other Equipments 'POWER ON' and 'POWER OFF' mode are to be made.
5. This statement is issued in response to the query raised during the Green Audit.


Off. Principal
Santaji Mahavidyalaya,
Pl. Jawaharal Nehru Marg,
Nagpur-15.



Shri Santaji Shikshan Vikas Santha's
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23/02/2023

Certificate about Operation of Electronic Equipments

Academic Session 2020-21

The rights of computer settings are with the administrative department of the college. As part of the sustainable and eco-friendly setting, the administrative department has initiated below settings in the computers of all the users-

1. All the computer screen savers are disabled
2. The Computers are turned to sleep mode if they are idle
3. The computer settings cannot be changes as the rights are with the administrative department.
4. With regard to the user policy of Photocopier and other Equipments 'POWER ON' and 'POWER OFF' mode are to be made.
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Off. Principal
Santaji Mahavidyalaya
Pt. Jawaharal Nehru Marg,
Nagpur-15.

Annexure –VII: Water Quality Reports

Santaji Mahavidyalaya, Nagpur - 15 Water Analysis Report - 2019-20

Introduction -

Our college provides RO (Aqua Fresh 50 LPH R O water purifier) for drinking purpose. This RO is connected to Municipal corporation water supply. Protecting the health of our students and staffs is a top priority of our college. We moved quickly to remedy each problems identified before college started water analysis can be done. Testing procedure and parameter may be grouped in to physical, chemical bacteriological and microscopic categories.

- Physical test indicates the properties detectable by the senses.
- Chemical test determined the amount of mineral and organic substances that effects the water quality.
- Bacteriological test show the presence of bacteria and pollution.

Report for Water Analysis

Physical Test

Colour:

Colour in water may be cause by presence of mineral such as iron and magnesium or by the substance of vegetable origins such as algae and weeds. Colour test indicates the efficiency of the water system. By observing the colour of water sample from RO it is colourless.

Turbidity:

Turbidity in a water is because of suspended solids and colloidal matter. It may be due to eroded soil caused by dredging or due to the growth of micro-organisms. High turbidity makes the filtration expensive. If sewage solids are presents, Pathogen's may be eneased in the particles and escapes the action of chlorine during disinfections.

By observing we found that no turbidity was present in water sample.

Odour and test:

Odour and test associated with the presence of living microscopic organisms or decaying organic matter including weeds algae or industrial wastes containing ammonia, phenols, halogens and hydrocarbon.

By observing we found that no odour and proper taste present in water sample.



AQUA FRESH 50 LPH R O WATER PURIFIER

Chemical test was done by following parameters

Parameter	Source of Cause	Significance	WHO Range	Observed Range
PH	PH is lowered by acids & acids generating salts & free carbon dioxide.	PH is measured the acid quality of water. Water with pH below 7 is normally harmful	6.5 to 8.5	6.9
Conductivity	Is an indicator of the dissolved mineral contents of water mostly calcium carbonate & another dissolved salts.	Is measured of the electrical conductivity of water & varies with amount of dissolved solids.	0-0.5 ms/cm Good 0.5-1.5 ms/cm Normal >1.5 ms/cm High	0.85 ms/cm
Hardness	Caused by the presence of Ca & Mg	Hard water forms kidney stones.	0-60 mg/l Soft 61-120 mg/l Moderate 120-180 mg/l Hard >181 very hard	115 mg/l
Chlorides	Dissolve forms rocks & soil.	When combined with sodium gives salty taste to drinking water	300 mg/l	238 mg/l
TDS	Dissolved mineral contents from various rocks formation	Considered general indicator of quality of water.	500 mg/l	320 mg/l

Conclusion:

From above physical and chemical testing water sample RO (AquaGuard Reviva 50 LPH basic) our college is good for drinking purposes.

Santaji Mahavidyalaya, Nagpur-15

Water Analysis Report - 2020-21

Introduction-

Our college provides RO (Aqua Fresh 50 LPH R O water purifier) for drinking purpose. This RO is connected to Municipal corporation water supply. Protecting the health of our students and staffs is a top priority of our college. We moved quickly to remedy each problems identified before college started water analysis can be done. Testing procedure and parameter may be grouped in to physical, chemical, bacteriological and microscopic categories.

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By observing we found that no turbidity was present in water sample.

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AQUA FRESH 50 LPH R O WATER PURIFIER

Chemical test was done by following parameters

Parameter	Source of Cause	Significance	WHO Range	Observed Range
pH	pH is lowered by acids & acids generating salts & free carbon dioxide.	pH is measured the acid quality of water. Water with pH below 7 is normally harmful	6.5 to 8.5 pH	6.8 pH
Conductivity	Is an indicator of the dissolved mineral contents of water mostly calcium carbonate & another dissolved salts.	Is measured of the electrical conductivity of water & varies with amount of dissolved solids.	0-0.5 ms/cm Good 0.5-1.5 ms/cm Normal >1.5 ms/cm High	0.73 ms/cm
Hardness	Caused by the presence of Ca & Mg	Hard water forms kidney stones.	0-60 mg/l Soft 61-120 mg/l Moderate 120-180 mg/l Hard >181 very hard	105 mg/L
Chlorides	Dissolve forms rocks & soil.	When combined with sodium gives salty taste to drinking water	300 mg/l	278 mg/L
TDS	Dissolved mineral contents from various rocks formation	Considered general indicator of quality of water.	500 mg/l	340 mg/L

Conclusion:

From above physical and chemical testing water sample RO (Aquaguard Reviva 50 LPH basic) our college is good for drinking purposes.

Water Testing Report for last 2 Years

Annexure– VIII: List of Electronic Equipment's in College



Shri Santaji Shikshan Vikas Santha's

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17/06/2020

Details of Number of Computers, Printers and Scanners

2019-20

Sr. No	Particulars	Value
1	No. of Computers	58
2	Laptop	Sony E series, Intel core i3, RAM 1GB, Windows7 home basic, HDD 320GB
3	Speaker	02
4	Printers	Dot Matrix (80cols.) 03 HP Laser jet 1020 plus (B&W) 01 HP Laser jet P1007 (B&W) 01 HP Desk jet ink 2010 (color) 02 HP Desk jet ink 2050 (color) +scan 01 Canon (copy, scan, fax) 01 HP Laser Jet M1213NFMF all in one 01 Brother Laser HL-3221D(two way) 05
5.	Scanners	03


 O.P. Principal
 Santaji Mahavidyalaya,
 Pt Jawaharlati Nehru Marg,
 Nagpur-15.



Shri Santaji Shikshan Vikas Santha's

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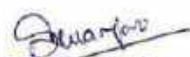
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23/02/2021

Details of Number of Computers, Printers and Scanners

2020-21

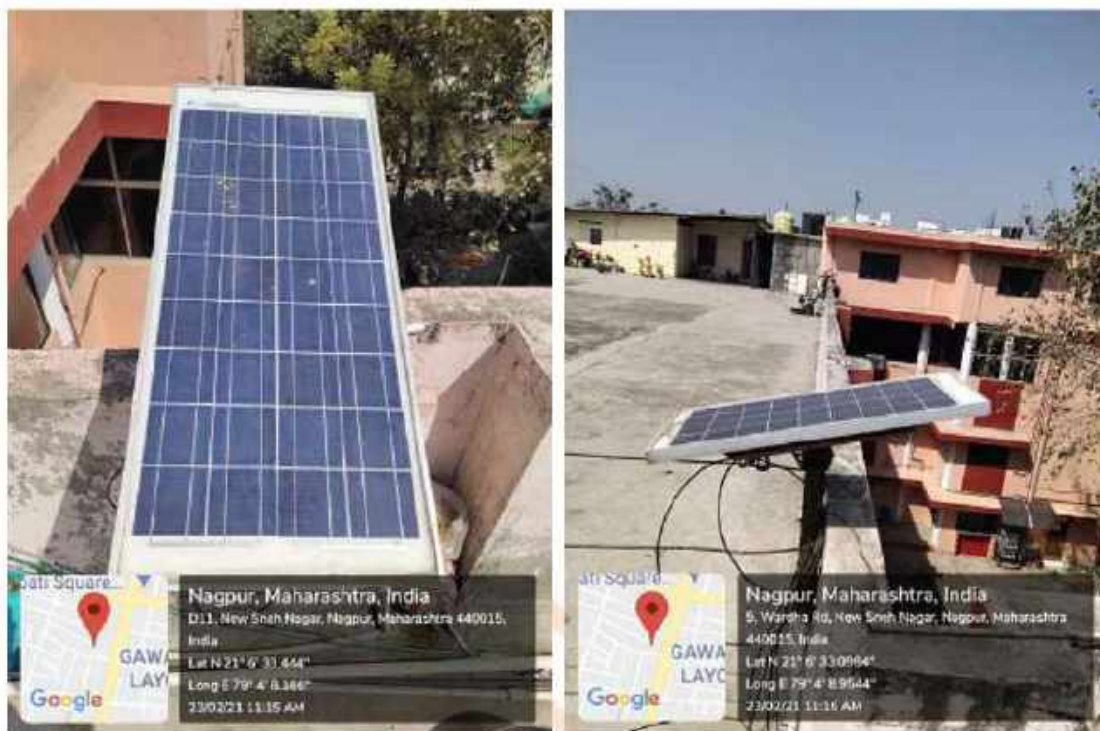
Sr. No	Particulars	Value
1	No. of Computers	58
2	Laptop	Sony E series, Intel core i3, RAM 3GB, Windows7 home basic, HDD 320GB
3	Speaker	02
4	Printers	Dot Matrix (80cols.) 03 HP Laser jet 1020 plus (B&W) 01 HP Laser jet P1007 (B&W) 01 HP Desk jet ink 2010 (color) 02 HP Desk jet ink 2050 (color) +scan 01 Canon (copy, scan, fax) 01 HP Laser Jet M1213NFMF all in one 01 Brother Laser HL-3221D(two way) 05
5.	Scanners	03


Off. Principal
 Santaji Mahavidyalaya
 Pt. Jawaharlal Nehru Marg,
 Nagpur-15.

List of Electronic Equipment's purchased in Last 2 Years.

Annexure –IX: Solar Panel Installations

Note: No Solar PV System Installed in College.



Solar Panels of lights in office and campus



Solar Lights installed in campus and corridors



Solar Lights installed in office

Annexure –X: Water Distribution Data

The water is drawn from 01 no. of bore well. The water drawn is not measured. Recommendation to monitor the water drawn is raised under chapter 6 of this report.

Annexure –XI: Solar Passive Structure / Drip Irrigation

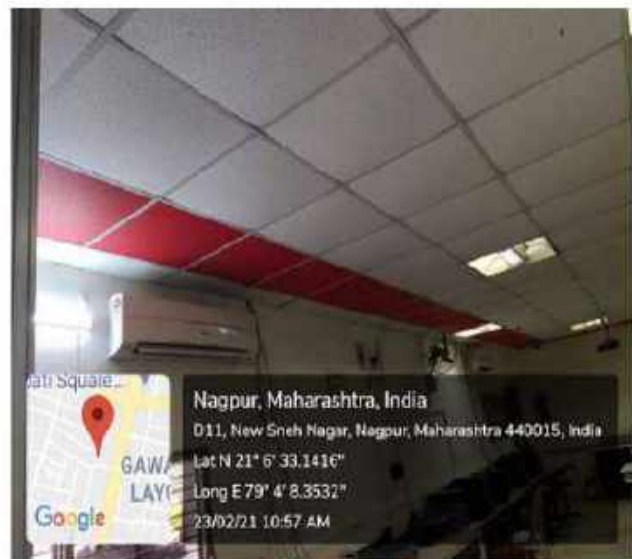
Note: No Drip Irrigation System Installed in College



Adequate light in classrooms without using electrical lighting



Adequate light in labs without using electrical lighting



Use of false ceiling to reduce air-conditioned volume and reducing AC load



Use of blinds for windows to reduce heat



Condensers of AC in shade

Annexure –XII: Water Management



Pipeline of Water Harvesting System



Water Harvesting System



Catchment Area for Water Harvesting



RO water used for drinking purpose



Bore well in college



Taps to be replaced by Faucets



Flush to be replaced by Push Buttons



महाराष्ट्र MAHARASHTRA

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**AGREEMENT FOR COLLECTION, TRANSPORTATION,
TREATMENT AND DISPOSAL OF BIO MEDICAL WASTE.**

THIS AGREEMENT is executed on this 23rd Feb of 2020 at Nagpur.
BETWEEN

M/s. SUPERB HYGIENIC DISPOSALS, Nagpur.

Through **Mr. Rabi Shankar Singh**

(POWER OF ATTORNEY HOLDER) on the behalf of its Managing
Partner, **Mr. ATUL S/O MAROTRAO ZOTING**

Aged about 42 yrs., Occupation – Business

R/O Nagpur. Hereinafter called as service provider (PARTY NO.1)

AND

**Santaji Mahavidyalaya, Wardha Road, Nagpur. (Memb.No.
NGCL1066).**

Hereinafter called waste generator (PARTY NO.2).



..2/-

:: 2 ::

That the service provider / party No. 1 is having a Bio Medical Waste disposal unit. And the service provider / Party No. 1 is engaged in the business of disposal of Bio Medical Waste.

That the waste generator / Party No. 2 is having its College in the Name of Santaji Mahavidyalaya, Wardha Road, Nagpur.

On the request of Party No. 2, Party No.1 has agreed to undertake the work of collection, transportation and disposal of Bio-medical Waste generated in the Laboratories of Party No. 2 on the following terms and conditions.

- 1) **Service** provider / Party No. 1 has accepted the work of collection, transportation and disposal of entire Bio Medical Waste of the waste generator.
- 2) **The** waste generator will arrange itself non-chlorinated coloured plastic bags approved by pollution control board for stocking and packing of Bio-medical waste.
- 3) **The** Waste generator will arrange collection and proper segregation of entire Bio-medical waste generated in its various departments and wards as per the guidelines of the Bio-medical waste management and disposal rules 1998, and its segregation as per details annexed. Party No.1 has agreed to collect the Bio-Medical waste at source during 9 am to 6 pm or any other time, which may be mutually agreed upon.
- 4) **The** waste generator will pack the segregated Bio-medical waste as per rules at the **collection end point** in Colour coded bags label the said bags as per schedule IV (rule 6) of the Bio-medical waste (management and handling) rules 1998 and amended 2003 and amended 2016 as per section 6, 8 and 25 of Environment (Protection) Act 1986. It is the responsibility of the Party No. 1 to collect, Transport and dispose of the Bio-medical waste.
- 5) **The** waste generator undertakes to deliver to the service provider only the segregated Bio-medical waste generated on Alternate Day basis. general waste i.e. *(municipal solid waste)* is not to be put into the service provider's bags at all for any violation of the Bio-medical rules in this regard the waste generator shall be exclusively responsible.
- 6) **That** the waste generator agreed that they would pay service provider disposal charges, as per Annex-I.



..3/-

:: 3 ::

- 7) No change or modification or waiver of any of the terms of this agreement shall be effective unless agreed to in writing and signed by duly authorized officer of each of the parties hereto.
- 8) Party No. 1 the service provider and Waste generator agreed that this agreement is valid from 01/03/2021 to 28/02/2022 and after the expiry of the said period of this agreement, the parties will renew the agreement on fresh terms and conditions as would be mutually agreed upon.
- 9) All disputes and questions in connection with this deed arising between parties shall be referred to the arbitration of the two arbitrator one to be appointed by each party and in case of their disagreement to an umpire appointed by the said arbitrator or in case of their default by the parties.
- 10) In the event there is any objection and / or notice for breach of the rules regarding transportation treatment and disposal of bio-medical waste, Party No. 1 shall be solely responsible in that behalf.
- 11) In the event the party No. 1 commits any default in the service the Party No. 2 shall be at liberty to discontinue this agreement with prior written notice of one month.
- 12) This agreement is executed in Duplicate; one original signed copy will remain with party No. 2.

IN WITNESS WHEREAS the parties have put their signature on the day and year as above mentioned in presence of the following witnesses at Nagpur.

PARTY NO. 1

Rabi S. Singh

For Superb Hygienic Disposals,
Nagpur.



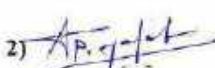
PARTY NO. 2

Off. Principal

Santaji Mahavidyalaya

Pt. Jawahar Lal Nehru Marg,
Nagpur.

WITNESS:- 1) 

2) 

MOU for handling Bio – medical waste



Shri Santaji Shikshan Vikas Sanstha's
SANTAJI MAHAVIDYALAYA
(Affiliated to Rashtrasant Tukdoji Maharaj Nagpur University)

ACCREDITED "A" GRADE BY NAAC

website : www.santajicollege.ac.in • Email : santajicollege@gmail.com

Jawaharalal Nehru Marg, Nagpur - 440015. Ph. : (O) 0712-2283953 / 2286305

**Department of Botany
Standard Operating Procedure**

1) General Laboratory Safety Procedures:

DOs:

1. Know the potential hazards of the materials used in the laboratory. Review the Safety Data Sheet (SDS) and container label prior to using a chemical.
2. Know the location of safety equipment such as telephones, emergency call numbers, emergency showers, eyewashes, fire extinguishers, fire alarms, first aid kits, and spill kits.
3. Review your laboratory's emergency procedures with your Principal Investigator, Lab Supervisor, or Lab Manager to ensure that necessary supplies and equipment are available for responding to laboratory accidents.
4. Practice good housekeeping to minimize unsafe work conditions such as obstructed exits and safety equipment, cluttered benches and hoods, and accumulated chemical waste.
5. Wear the appropriate personal protective apparel for the chemicals you are working with. This includes eye protection, lab coat, gloves, and appropriate foot protection (no sandals or open toed shoes). Gloves must be made of a material known to be resistant to permeation by the chemical in use.
6. Shoes must cover the entire foot. Open toed shoes and sandals are inappropriate footwear in laboratories. Fabric and athletic shoes offer little or no protection from chemical spills. Leather shoes with slip-resistant soles are recommended.
7. Street clothing is to be chosen so as to minimize exposed skin below the neck. Long pants and shirts with sleeves are examples of appropriate clothing. Avoid rolled up sleeves. Shorts (including cargo shorts), capris and, miniskirts are inappropriate clothing in laboratories. Tank tops, sleeveless shirts and midriff-length shirts are not appropriate if not covered by a full length laboratory coat and must not be worn if wearing an apron alone. Synthetic fabrics must be avoided in high-hazard areas where flammable liquids and reactive chemicals are utilized.
8. Wash skin promptly if contacted by any chemical, regardless of corrosivity or toxicity.
9. Label all new chemical containers with the "date received" and "date opened."

10. Label and store chemicals properly. All chemical containers must be labelled to identify the container contents (no abbreviations or formulas) and should identify hazard information. Chemicals must be stored by hazard groups and chemical compatibilities.
11. Use break-resistant bottle carriers when transporting chemicals in glass containers that are greater than 500 millilitres. Use lab carts for multiple containers. Do not use unstable carts.
12. Use fume hoods when processes or experiments may result in the release of toxic or flammable vapours, fumes, or dusts.
13. Restrain and confine long hair and loose clothing. Pony tails and scarves used to control hair must not present a loose tail that could catch fire or get caught in moving parts of machinery.

DON'Ts :

1. Eat, drink, chew gum, or apply cosmetics in rooms or laboratories where chemicals are used or stored.
2. Store food in laboratory refrigerators, ice chests, cold rooms, or ovens.
3. Drink water from laboratory water sources.
4. Use laboratory glassware to prepare or consume food.
5. Smell chemicals, taste chemicals, or pipette by mouth.
6. Work alone in the laboratory without prior approval from the Principal Investigator, Lab Manager, or Lab Supervisor. Avoid chemical work or hazardous activities at night or during off-hours. Have a partner for assistance (use the "buddy-system") at night or during off-hours.
7. Leave potentially hazardous experiments or operations unattended without prior approval from the Principal Investigator, Lab Manager, or Lab Supervisor. In such instances, the lights in the laboratory should be left on and emergency phone numbers posted at the laboratory entrance.

The Laboratory Session: Before, During, and After Class

Biology Laboratory Manager and student worker responsibilities:

1. The lab manager will assign a student worker to each course. The student worker will prepare any chemical reagents and collect required supplies before the class begins. All materials will be left on a cart in the laboratory classroom, with the exception of certain instruments that may be placed on a lab bench. Each week the student worker should coordinate with the instructor regarding reagents, supplies, and equipment.
2. The student worker will put away any supplies and gathered equipment that he or she set out before the class. This does not include microscopes.
3. The student worker will remove all waste reservoir containers from the laboratory following the lab period. However, all test tubes and other containers of waste generated by the students should be collected during the lab period into the appropriate reservoir container so it can be quickly removed from the lab following the class.

Instructor responsibilities:

1. You are responsible for making sure that each student is properly attired upon entry into the lab. Students who are not wearing the proper attire should be asked to leave the laboratory.
2. Each student should be assigned a microscope during the first lab with microscope use. The instructor should keep a record of which microscope is assigned to which student.
 - a. You should make sure the students clean off their microscope at the end of the lab period if immersion oil is used.
 - b. If prepared microscope slides are needed, the instructor should obtain the necessary case(s) from the slide cabinet in 355 prior to the lab session. All cases should be returned to the slide cabinet when done. If another section used them during the lab before your section, they may still be in the lab. If one or more lab section will be using them after you, they may be left in the laboratory.
 - c. Students should return microscopes to the microscope cabinet in the proper order.
4. You should make sure the students dispose off all their wastes in the appropriate containers throughout the lab period. Open containers or tubes containing chemicals should not be left out on benches at the end of the lab period.
5. You should move all collected supplies and equipment back onto the cart at the end of the lab period. All benches should be left clear and clean for the next class. Chairs should be pushed in and not left in the middle of the aisles, as this can block entry by incoming students.
6. Lab practicals should only be left on the bench if another lab section will be using the same set-up after your section. The last section to use a lab practical should dismantle it and return all supplies when they are done, leaving the benches open for the next class.
7. Make sure the doors to the labs are locked at all times when no one is in the lab. Also, students can disturb previously set-up experiments if the lab doors are left open.
8. Students are not allowed to be in the labs unless a faculty member or lab instructor is present.

Student responsibilities:

1. A student must pull out his or her own microscope from the cabinet during the lab period. Prior to returning the microscope to the cabinet, each should clean the microscope at the end of use if immersion oil was used.
2. Each student should dispose off his or her waste in the appropriate container during the lab period.
3. Each student should clean the bench at their workspace and push in their chair when done at the end of the lab period.

2) Procedures for Proper Labelling, Storage, and Management of Chemicals:

1. Proper chemical labelling and storage is essential for a safe laboratory work environment. Inappropriate storage of incompatible or unknown chemicals can lead to spontaneous fire and explosions with the associated release of toxic gases. To minimize these hazards, chemicals in the laboratory must be segregated properly. The storage procedures listed below are not intended to be all-inclusive but should serve instead to supplement more specific procedures and recommendations obtained from container labels, Safety Data Sheets (SDSs), and other chemical reference material. For more information about chemical storage contact the University Environmental Health and Safety for your respective campus. (see Laboratory Safety Contacts).

Labelling

- Manufacturer chemical labels must never be removed or defaced until the chemical is completely used.
- All secondary chemical and waste containers must be clearly labelled with the full chemical name(s) (no abbreviations or formulas).
- Small containers that are difficult to label such as 1-10 ml vials and test tubes can be numbered, lettered, or coded as long as an associated log is available that identifies the chemical constituents. Groups of small containers can be labelled as a group and stored together.
- Unattended beakers, flasks, and other laboratory equipment containing chemicals used during an experiment must be labelled with the full chemical name(s).
- All chemicals should be labelled with the "date received" and "date opened."
- All laboratory chemical waste containers must be labelled with the name of the chemicals contained.
- All full waste containers must be disposed of promptly. Waste containers must NOT be filled to more than 90% of their capacity).
- Chemical storage areas such as cabinets, shelves and refrigerators may be labeled to help the laboratory personnel identify the hazardous nature of the chemicals stored within the area (e.g., flammables, corrosives, oxidizers, water reactives, toxics, carcinogens, and reproductive toxins).

Glassware and Sharps –

Procedures for Safe Handling and Disposal:

Definitions

Sharps - The term "sharps" refers to "any item having corners, edges, or projections capable of cutting or piercing the skin."

Puncture Proof – Commercial sharps containers intended for the disposal of broken glass, syringe needles, scalpels, etc.

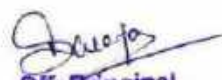
Puncture Resistant – Re-used containers that, when carefully used, will resist puncture by the disposed item.

Examples of “sharps” include:

- Needles
- Broken glass
- Syringes
- Razor blades
- Lancets
- Glass Pasteur pipettes
- Scalpel blades
- Microtome blades
- Exacto knives
- Any other sharp lab waste

Handling

- Glassware and sharps should be handled and stored carefully to avoid damage.
- Reusable syringes that are not biologically contaminated must be capped and put away after use. Cap syringes using the one-handed method of picking up the cap with the needle then carefully securing the cap onto the syringe. Retractable syringes are preferred. A disposable syringe should be used for biological materials and should be placed in a sharps container without recapping.
- Chipped, broken, or star-cracked glassware should be discarded or repaired. Damaged glassware should never be used unless it has been repaired.
- Because of the potential for catastrophic breakage resulting in sharp projectiles, only thick-walled, pressure-resistant glassware may be utilized under positive pressure or a vacuum.
- Use appropriate hand protection when inserting glass tubing into a rubber stopper or when placing rubber tubing on glass hose connections. Use of plastic or metal connectors should be considered.
- Use appropriate hand protection when picking up broken glass or other sharp objects. Small pieces should be swept up using a brush and dustpan.
- Uncontaminated metal or glass sharps should be collected in puncture-proof containers, labelled, sealed, and disposed according to your campus procedures.


O.E. Principal
Santaji Mahavidyalaya
Pt. Jawahar Lal Nehru Marg,
Nagpur-15.

SOP for Botany Department



Shri Santaji Shikshan Vikas Sanstha's
SANTAJI MAHAVIDYALAYA
(Affiliated to Rashtrasant Tukdoji Maharaj Nagpur University)

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website : www.santajicollege.ac.in • Email : santajicollege@gmail.com

Jawaharalal Nehru Marg, Nagpur - 440015 Ph : (O) 0712-2283953 / 2286305

Department of Chemistry

STANDARD OPERATING PROCEDURE

A. General Laboratory Safety Procedures

Do's

1. Know the potential hazards of the materials used in the laboratory. Review the Safety Data Sheet (SDS) and container label prior to using a chemical.
2. Know the location of safety equipment such as telephones, emergency call numbers, emergency showers, eyewashes, fire extinguishers, fire alarms, first aid kits, and spill kits.
3. Review your laboratory's emergency procedures with your Principal Investigator, Lab Supervisor, or Lab Manager to ensure that necessary supplies and equipment are available for responding to laboratory accidents.
4. Practice good housekeeping to minimize unsafe work conditions such as obstructed exits and safety equipment, cluttered benches and hoods, and accumulated chemical waste.
5. Wear the appropriate personal protective apparel for the chemicals you are working with. This includes eye protection, lab coat, gloves, and appropriate foot protection (no sandals or open toed shoes). Gloves must be made of a material known to be resistant to permeation by the chemical in use.
6. Shoes must cover the entire foot. Open toed shoes and sandals are inappropriate footwear in laboratories. Fabric and athletic shoes offer little or no protection from chemical spills. Leather shoes with slip-resistant soles are recommended.
7. Street clothing is to be chosen so as to minimize exposed skin below the neck. Long pants and shirts with sleeves are examples of appropriate clothing. Avoid rolled up sleeves. Shorts (including cargo shorts), capris and, miniskirts are inappropriate clothing in laboratories. Tank tops, sleeveless shirts and midriff-length shirts are not appropriate if not covered by a full length laboratory coat and must not be worn if wearing an apron alone. Synthetic fabrics must be avoided in high-hazard areas where flammable liquids and reactive chemicals are utilized.
8. Contact lenses are not recommended but are permitted. Appropriate safety eyewear is still required for those that use contact lenses. Inform the lab supervisor of the use of contact lenses.
9. Wash skin promptly if contacted by any chemical, regardless of corrosivity or toxicity.
10. Label all new chemical containers with the "date received" and "date opened."
11. Label and store chemicals properly. All chemical containers must be labeled to identify the container contents (no abbreviations or formulas) and should identify hazard information. Chemicals must be stored by hazard groups and chemical compatibilities.

12. Use break-resistant bottle carriers when transporting chemicals in glass containers that are greater than 500 milliliters. Use lab carts for multiple containers. Do not use unstable carts.

13. Use fume hoods when processes or experiments may result in the release of toxic or flammable vapors, fumes, or dusts.

14. Restrain and confine long hair and loose clothing. Pony tails and scarves used to control hair must not present a loose tail that could catch fire or get caught in moving parts of machinery.

DON'Ts

1. Eat, drink, chew gum, or apply cosmetics in rooms or laboratories where chemicals are used or stored.

2. Store food in laboratory refrigerators, ice chests, cold rooms, or ovens.

3. Drink water from laboratory water sources.

4. Use laboratory glassware to prepare or consume food.

5. Smell chemicals, taste chemicals, or pipette by mouth.

6. Work alone in the laboratory without prior approval from the Principal Investigator, Lab Manager, or Lab Supervisor. Avoid chemical work or hazardous activities at night or during off-hours. Have a partner for assistance (use the "buddy-system") at night or during off-hours.

7. Leave potentially hazardous experiments or operations unattended without prior approval from the Principal Investigator, Lab Manager, or Lab Supervisor. In such instances, the lights in the laboratory should be left on and emergency phone numbers posted at the laboratory entrance.

B. Procedures for Proper Labeling, Storage, and Management of Chemicals

Proper chemical labeling and storage is essential for a safe laboratory work environment. Inappropriate storage of incompatible or unknown chemicals can lead to spontaneous fire and explosions with the associated release of toxic gases. To minimize these hazards, chemicals in the laboratory must be segregated properly.

a. Labeling

1. Manufacturer chemical labels must never be removed or defaced until the chemical is completely used.

2. All secondary chemical and waste containers must be clearly labeled with the full chemical name(s) (no abbreviations or formulas).

3. Small containers that are difficult to label such as 1-10 ml vials and test tubes can be numbered, lettered, or coded as long as an associated log is available that identifies the chemical constituents. Groups of small containers can be labeled as a group and stored together.

4. Unattended beakers, flasks, and other laboratory equipment containing chemicals used during an experiment must be labeled with the full chemical name(s).

5. All chemicals should be labeled with the "date received" and "date opened."

6. All laboratory chemical waste containers must be labeled with the name of the chemicals contained.

7. All full waste containers must be disposed of promptly. Waste containers must NOT be filled to more than 90% of their capacity).

8. Chemical storage areas such as cabinets, shelves and refrigerators may be labeled to help the laboratory personnel identify the hazardous nature of the chemicals stored within the area (e.g., flammables, corrosives, oxidizers, water reactives, toxics, carcinogens, and reproductive toxins).

b. Safety Data Sheets

1. The SDS for the exact chemical or mixture provided by the manufacturer of the product must be available. The chemical identity and manufacturer found on the label must match the chemical identity and manufacturer found on the SDS.

2. All personnel must know how to access the SDS whether they are maintained on paper or electronically.

3. All personnel must know how to read and understand an SDS. Additional guidance on how to read, understand, maintain and (if necessary)

c. Storage

HAZARD GROUPS

1. Flammable/Combustible Liquids 2. Unstable (shock-sensitive, explosive)

3. Flammable Solids 4. Carcinogens & Reproductive Toxins

5. Inorganic Acids 6. Toxins, Poisons

7. Organic Acids 8. Non-Toxics

9. Oxidizing Acids (Nitric, etc.) 10. Gases:

11. Caustics (Bases) Toxic Gases

12. Oxidizers Flammable Gases

13. Water Reactives Oxidizing Gases

14. Air Reactives Corrosive Gases

Inert Gases

15. A defined storage place should be provided for each chemical and the chemical should be returned to that location after each use.

16. Chemical containers must be in good condition before they are stored. Containers must be managed to prevent leaks.

17. Maximum quantities of chemicals that can be in storage and use in laboratories are found in the Uniform Building Code. These codes place specific quantity limits on storage of chemicals in all hazard classes and some are very low, such as those for highly toxic gases and organic peroxides.

18. Chemicals (including waste) must be separated and stored according to their hazard group and specific chemical incompatibilities. Chemicals within the same hazard group can be incompatible, therefore, it is important to review the chemical label and Safety Data Sheet (SDS) to determine the specific storage requirements and possible incompatibilities.

19. Special attention should be given to the storage of chemicals that can be classified into two or more hazard groups. For example, acetic acid and acetic anhydride are both corrosive and flammable. In addition, nitric and perchloric acids are both corrosive and strong oxidizers. Separate organic acids

from oxidizing acids using secondary tubs or trays in the corrosives cabinet. Refer to the Safety Data Sheet (SDS) for proper storage procedures.

20. Chemicals should be separated by distance. Physical barriers such as storage cabinets and secondary containers should be used to prohibit contact of incompatible chemicals in the event that they are accidentally released or spilled.

21. Secondary containers are highly recommended for the storage of liquid chemicals. Secondary containers must be made of a material that is compatible with the chemical(s) it will hold and must be large enough to contain the contents of the largest container.

22. Liquids should not be stored above dry chemicals unless they are stored in secondary containers.

23. Stored chemicals should not be exposed to heat or direct sunlight.

24. Storage shelves and cabinets should be secure to prevent tipping. Shelving should contain a front-edge lip or doors to prevent containers from falling.

25. Flammable and corrosive storage cabinets should be used when possible.

26. Flammable liquids in quantities exceeding a total of 10 gallons in each laboratory must be stored in an approved flammable storage cabinet.

27. Only explosion-proof or laboratory-safe refrigerators may be used to store flammable liquids.

28. Liquid chemicals should be stored below eye level to avoid accidental spills.

29. Chemicals must not be stored in areas where they can be accidentally broken and spilled such as on the floor or on the edge of a bench top.

30. Chemicals must not be stored in areas where they obstruct aisles, exits, and emergency equipment.

B. Chemical Inventory Management

All reportable chemicals must be inventoried. A list of reportable chemicals can be found in the appendices of at IUEHS. In addition to reportable chemicals, all chemicals should be inventoried. Inventories provide a method for tracking chemicals for ordering and re-ordering, waste disposal, complying with the maximum allowable quantity limits in accordance with the International Building and Fire Codes, hazard communication, community right-to-know requirements, and tracking dangerous or time-sensitive chemicals for safety and security reasons. Inventories should contain all pertinent information including the following data:

1. Chemical name (synonym or trade name found on the Safety Data Sheet), if mixture list composition and percent of components.
2. Chemical Abstract Service (CAS) number.
3. Manufacturer.
4. Product number.
5. Physical state.
6. Hazard class.
7. Container size.
8. Units of measure.
9. Quantity or number of containers.

10. Principal Investigator, Lab Manager, Lab Supervisor, or Chemical Hygiene Officer.
11. Owner or researcher.
12. Location (e.g., building, room number, cabinet).
13. Receiving date.
14. Opened container date.
15. Expiration date.

Other information such as cost can be recorded as necessary for accounting purposes. Expiry dates are of particular importance for time-sensitive chemicals that can become dangerous with age. Several noteworthy time-sensitive laboratory chemicals include:

16. Chemicals that form peroxides.
17. Picric acid and other multi-nitro aromatics.
18. Chloroform.
19. Hydrogen fluoride and hydrogen bromide.
20. Liquid hydrogen cyanide.
21. Formic acid.
22. Alkali metals (such as potassium, sodium, and lithium).

a. Acquisition control

1. Do not hoard chemicals
2. Do not over-purchase quantities
3. Use just-in-time purchasing whenever possible
4. Dispose of unused portions

b. Track Laboratory Chemicals

1. Maintain a chemical inventory and check expiration dates regularly
2. Define inspection interval for each chemical
3. Log the date of inspection and re-inspect without fail

c. Corrosive Chemicals – Procedures for Safe Handling and Storage

Corrosives (liquids, solids, and gases) are chemicals that cause visible destruction or irreversible alterations to living tissue by chemical action at the site of contact. Corrosive effects can occur not only to the skin and eyes, but also to the respiratory tract through inhalation and to the gastrointestinal tract through ingestion. Corrosive liquids have a high potential to cause external injury to the body, while corrosive gases are readily absorbed into the body through skin contact and inhalation. Corrosive solids and their dusts can damage tissue by dissolving rapidly in moisture on the skin or within the respiratory tract when inhaled. In order to minimize these potential hazards, precautionary procedures must be observed when handling corrosives.

d. Handling

1. Appropriate personal protective equipment (e.g., gloves, fire-resistant or all cotton lab coat, and safety goggles) must be worn when working with corrosive chemicals. A face shield, rubber apron, and rubber booties may also be appropriate depending on the work performed.
2. Appropriate protective gloves that are resistant to permeation or penetration from corrosive chemicals must be selected and tested for the absence of pin holes prior to use.
3. Eyewashes and safety showers must be readily available in areas where corrosive chemicals are used and stored. In the event of skin or eye contact with a corrosive chemical, the affected area should be immediately flushed with water for 15 minutes. Contaminated clothing should be removed and medical attention sought.
4. Corrosive chemicals should be handled in a fume hood to ensure that any possible hazardous or noxious fumes generated are adequately vented.
5. When mixing concentrated acids with water, add the acid slowly to the water. Allow the acid to run down the side of a container and mix slowly to avoid violent reactions and splattering. Never add water to acid.
6. Appropriate spill clean-up material should be available in areas where corrosive chemicals are used and stored.
7. Protective carriers shall be used when transporting corrosive chemicals.

C. Storage

1. Containers and equipment used for storage and processing of corrosive material must be corrosion resistant.
2. Corrosive chemicals must be stored below eye level, preferably near the floor to minimize the danger of their falling from cabinets or shelves.
3. Acids and caustics (i.e. bases) must be stored separately from each other. Secondary containers or trays must be used to separate acids and bases or other incompatible corrosives within a corrosive cabinet.
4. Oxidizing acids must be separated from organic acids and flammable/combustible materials (oxidizing acids are particularly reactive with organics and flammable/combustible materials).
5. Acids must be segregated from active metals (e.g., sodium, potassium, and magnesium) and from chemicals that can generate toxic gases (e.g., sodium cyanide and iron sulfide).
6. Corrosive gas cylinders must be returned for disposal every two year

a. Flammable and Combustible Liquids – Procedures for Safe Handling and Storage

Chemicals which exist at ambient temperatures in a liquid form with sufficient vapor pressure to ignite in the presence of an ignition source are called flammable or combustible liquids (note that the flammable/combustible liquid itself does not burn; it is the vapor from the liquid that burns). According to the National Fire Protection Association (NFPA) classification system, "flammables" generate sufficient vapor at temperatures below 100 oF (37.8o C), whereas "combustibles" generate sufficient vapor at temperatures at or above 100 oF. Invisible vapor trails from these liquids can reach remote ignition sources causing flashback fires. In addition, these liquids become increasingly hazardous at elevated temperatures due to more rapid vaporization. For these reasons, precautionary measures must be observed when handling and storing flammables and combustibles.

b. Classification

NFPA Classification Flash Point| Boiling Point

Flammable Liquid

Class IA <73° F (22.8 ° C) <100° F (37.8° C)

Class IB <73° F >100° F

Class IC >73° F and <100 ° F NA

Combustible Liquid

Class II >100° F and <140° F (60°C) NA

Class IIIA >140° F and <200° F (93°C) NA

The minimum temperature at which liquid gives off enough vapor in sufficient concentration to form an ignitable mixture in air near the surface of a liquid.

c. Handling

1. Appropriate personal protective equipment (e.g., gloves, fire-resistant or all cotton lab coat, and safety goggles) must be worn when working with flammable/combustible liquids.
2. Flammable/combustible liquids must never be heated using open flames. Preferred heat sources include steam baths, water baths, oil baths, hot air baths, and heating mantels.
3. Ignition sources must be eliminated in areas where flammable vapors may be present.
4. Flammable/combustible liquids should only be dispensed under a fume hood. Ventilation is one of the most effective ways to prevent the formation and concentration of flammable vapors.
5. When pouring from conductive containers with a capacity of 1 gallon (3.8 liters) or greater, make sure both containers involved are electrically interconnected by bonding to each other and to a ground. The friction of flowing liquid may be sufficient to generate static electricity, which in turn may discharge, causing a spark and ignition.
6. Flammable/combustible liquids in containers with a volume greater than 1 gallon (3.8 liters) should be transferred to smaller containers that can be easily manipulated by one person.
7. Appropriate fire extinguishers must be available in areas where flammables are used.

D. Storage

1. Flammable/combustible liquid in quantities exceeding a total of 10 gallons (38 liters) within a laboratory must be stored in approved flammable storage cabinets or safety cans.
2. Flammable/combustible liquid stored outside of flammable storage cabinets in the laboratory should be kept to the minimum necessary for the work being done.
3. Containers with a volume greater than 5 gallons (19 liters) shall not be stored in the laboratory without prior approval of IUEHS for the respective campus.

4. Flammable/combustible liquid stored in glass containers shall not exceed 1 gallon (3.8 liters).
5. Storage cabinets and safety cans must not be altered or modified.
6. Safety cans with damaged screens (spark arrestors) or faulty springs (that do not close tightly) do not meet the required specifications of a safety can and must be taken out of service immediately and repaired or replaced.
7. Flammable liquids must only be stored in explosion-proof or laboratory-safe refrigeration equipment.
8. Flammable/combustible liquid containers, filled or empty, must not be stored in hallways or obstructing exits.
9. Bulk waste flammable/combustible liquids should be stored in safety cans.
10. Flammables and combustibles must not be stored near oxidizers, corrosives, combustible material, or near heat sources. Make sure all chemicals stored near flammables and combustibles are compatible.

E. Glassware and Sharps – Procedures for Safe Handling and Disposal

Definitions

Sharps - The term "sharps" refers to "any item having corners, edges, or projections capable of cutting or piercing the skin."

Puncture Proof – Commercial sharps containers intended for the disposal of broken glass, syringe needles, scalpels, etc.

Puncture Resistant – Re-used containers that, when carefully used, will resist puncture by the disposed item.

Examples of "sharps" include:

- a) Needles b) Broken glass
- c) Syringes d) Razor blades
- e) Lancets f) Glass Pasteur pipettes
- g) Scalpel blades h) Microtome blades
- i) Exacto knives j) Any other sharp lab waste

a. Handling

1. Glassware and sharps should be handled and stored carefully to avoid damage.
2. Reusable syringes that are not biologically contaminated must be capped and put away after use. Cap syringes using the one-handed method of picking up the cap with the needle then carefully securing the cap onto the syringe. Retractable syringes are preferred. A disposable syringe should be used for refiltration process.
3. Chipped, broken, or star-cracked glassware should be discarded or repaired. Damaged glassware should never be used unless it has been repaired.

4. Because of the potential for catastrophic breakage resulting in sharp projectiles, only thick-walled, pressure-resistant glassware may be utilized under positive pressure or a vacuum.

5. Use appropriate hand protection when inserting glass tubing into a rubber stopper or when placing rubber tubing on glass hose connections. Use of plastic or metal connectors should be considered.

6. Use appropriate hand protection when picking up broken glass or other sharp objects. Small pieces should be swept up using a brush and dustpan.

b. Disposal

Sharps waste is categorized by the type of contamination present. Specific disposal methods are dictated by category, but all categories require packaging in puncture resistant cardboard or plastic containers in order to minimize the risk of injuries.

1. Uncontaminated Sharps

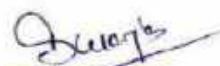
Uncontaminated metal or glass sharps should be collected in puncture-proof containers, labeled, sealed, and disposed according to your campus procedures found in the IU Waste Management Program.

Note: Disposable items such as pipette tips and wood swabs that are not sharps but may perforate the liners of the waste receptacles present a hazard to custodians. These may be placed in any puncture resistant container such as a non-breakable plastic jar, bottle, thick plastic bag or other type of container and placed in the waste receptacle. Custodial services will remove this waste.

2. Chemically Contaminated Sharps

Chemically contaminated metal or glass sharps that are grossly contaminated with hazardous chemicals, should be collected in puncture-proof containers, labeled, sealed, and disposed according to your campus procedures found in the IU Waste Management Program.

Caution: To avoid dumpster fires, boxes may only be used if the chemical contamination is compatible with the organic cellulose of the box material. Materials contaminated with oxidants should be placed in glass, metallic, or chemically resistant plastic containers.


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SOP for Chemistry Department



Shri Santaji Shikshan Vikas Sanstha's
SANTAJI MAHAVIDYALAYA
(Affiliated to Rashtrasant Tukdoji Maharaj Nagpur University)

ACCREDITED "A" GRADE BY NAAC

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DEPARTMENT OF BIOTECHNOLOGY

Standard Operating Procedure

I. Laboratory equipments

- *Provide Basic information regarding-*
 - i. various parts of commonly used laboratory equipments
 - ii. use of equipments
 - iii. maintenance of laboratory equipments.

II. Cleaning & Disinfection

- *Provide Basic information regarding-*
 - i. cleaning of new & reusable glassware and containers for sample collection.
 - ii. commonly used disinfectants

III. Sterilization

- *Provide Basic Information regarding-*
 - i. various equipments & methods used for sterilization.
 - ii. preparation and procedure for sterilization.
 - iii. Precautions & quality control to be observed in sterilization procedure.

IV. Waste management

- *Provide Basic information regarding-*
 - i. collection, segregation & disposal of waste.

V. Safe laboratory practices.

- *Provide basic information regarding-*
 - i. various bio-safety levels.
 - ii. standard precautions and safe laboratory practices.

VI. STAINING TECHNIQUES

- *Provide basic Information regarding-*
 - i. commonly used staining procedures.
 - ii. preparation of various stains

VII. BACTERIOLOGICAL MEDIA

- *Provide basic information regarding-*
 - i. different types of media and their use.
 - ii. Method of preparing different laboratory media.
 - iii. culture techniques.
 - iv. Method of processing cultures.

VIII. Antibiotic susceptibility testing

- *Provide basic information regarding-*
 - i. method of antibiotic susceptibility testing.
 - ii. Interpretation , quality control & quality assurance of antibiotic susceptibility testing.
 - iii. Antibiotics recommended for use against different organisms for various samples.

IX. Collection of specimens

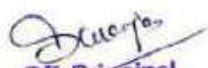
- *Provide basic information regarding-*
 - i. proper collection of specimens from various sites.
 - ii. Basic criteria of acceptance and rejection of specimens.
 - iii. proper transportation of specimens.

X. SEROLOGY

- *Provide basic information regarding-*
 - i. principle and procedure of various serological tests.
 - ii. interpretation of results.

XI. Bacteriological examination of water

- *Provide basic Information regarding-*
 - i. collection & transportation of water from various sources.
 - ii. Processing of samples & interpretation of results.


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Annexure –XIV: Awareness / Posters



Participation in "Vruksh Dindi" and Tree Plantation at RTM Nagpur University new building premises on 2nd July 2019.



Help for flood affected victim in Sangli and Kolhapur.



Constitution Day was celebrated on 26th November 2019.

Integrated Energy and Green Audit: Shri Santaji Shikshan Vikas Santha's Santaji Mahavidyalaya, Nagpur



Tree Plantation Drive was carried out.



Road Safety Program was organized.



Safety Equipment's for COVID-19 were distributed





Fully grown trees in the college campus



Pedestrian friendly pathways



Posters displayed in college



Diesel Generator in college

Integrated Energy and Green Audit: Shri Santaji Shikshan Vikas Santha's Santaji Mahavidyalaya, Nagpur



Green Audit Team interviewing the staff members



Green Audit Team in discussion with the Principal



Fire Fighting System and Fire Extinguishers installed in college

Annexure –XV: Onsite Measurements (Sample Pictures)



Onsite measurements taken by Green Audit Team



Lux Meter readings

Integrated Energy and Green Audit: Shri Santaji Shikshan Vikas Santha's Santaji Mahavidyalaya, Nagpur



Energy Audit Readings / Power Factor and Harmonics Study

Annexure –XVI: Energy Audit Report

Table 1 : FOLLOWING TABLE SHOW VOLTAGE, CURRENT AND FREQUENCY

TIME	VOLTAGE SINGLE PHASE			VOLTAGE LINE TO LINE			CURRENT			Frequency
	R	Y	B	Hz	YB	BR	R	Y	B	Hz
10:27:57 AM	239	240	236	410	413	414	5.62	3.42	12.12	50.0
10:28:00 AM	238	241	236	410	413	414	6.37	3.30	12.02	50.0
10:28:30 AM	238	241	236	411	413	415	5.64	3.31	12.03	50.0
10:29:00 AM	238	241	236	411	413	415	5.63	3.30	12.03	50.0
10:29:30 AM	238	241	236	412	413	414	5.62	3.30	12.01	50.0
10:30:00 AM	238	242	236	412	414	415	5.63	3.29	12.01	50.0
10:30:30 AM	239	242	235	413	414	414	5.64	3.27	11.95	50.0
10:31:00 AM	240	242	236	414	415	415	5.64	3.27	12.00	50.1
10:31:30 AM	238	243	235	412	414	414	5.64	3.27	11.97	50.1
10:32:00 AM	237	243	235	412	414	413	5.64	3.29	11.95	50.1
10:32:30 AM	237	242	235	411	413	413	5.65	3.28	11.97	50.1
10:33:00 AM	236	243	235	411	413	413	8.27	3.23	11.98	50.1
10:33:30 AM	238	242	233	411	413	411	5.63	3.29	11.86	50.1
10:34:00 AM	238	244	234	412	414	413	5.88	3.60	11.91	50.0
10:34:30 AM	237	243	233	410	413	411	5.62	3.57	11.87	50.0
10:35:00 AM	237	243	232	410	413	411	5.62	3.57	11.81	50.0
10:35:30 AM	238	244	233	412	414	412	5.64	3.58	11.90	50.0
10:36:00 AM	238	244	233	412	414	412	5.62	3.59	11.87	50.0
10:36:30 AM	238	244	234	412	415	412	5.63	3.57	11.93	50.0
10:37:00 AM	239	244	234	414	415	413	5.66	3.60	11.95	50.0
10:37:30 AM	238	243	235	412	414	413	5.63	3.59	11.98	50.0

TIME	VOLTAGE SINGLE PHASE			VOLTAGE LINE TO LINE			CURRENT			Frequency
	R	Y	B	Hz	YB	BR	R	Y	B	Hz
10:38:00 AM	238	243	235	412	414	412	5.63	3.60	11.97	50.0
10:38:30 AM	238	242	235	412	414	412	5.63	3.58	11.95	50.0
10:39:00 AM	237	243	235	412	413	412	5.62	3.62	11.94	50.0
10:39:30 AM	237	241	233	410	411	410	5.64	3.71	11.44	50.0
10:40:00 AM	239	242	234	412	413	412	5.64	3.72	11.16	49.9
10:40:30 AM	240	243	236	414	416	415	5.67	3.71	11.23	50.0
10:41:00 AM	238	242	236	411	413	414	5.63	3.70	11.22	50.0
10:41:30 AM	237	239	235	409	411	413	5.65	3.69	11.23	50.0
10:42:00 AM	236	240	236	409	411	412	7.56	3.66	11.31	50.0
10:42:30 AM	237	241	237	411	413	414	6.79	3.69	11.29	50.0
10:43:00 AM	237	240	236	410	412	413	6.40	3.69	11.23	50.0
10:43:30 AM	237	240	236	410	412	413	5.74	3.70	11.27	50.0
10:44:00 AM	237	240	236	410	412	413	5.61	3.71	11.28	50.0
10:44:30 AM	235	240	238	410	412	414	5.59	3.70	11.37	50.0
10:45:00 AM	235	240	239	410	412	414	5.60	3.69	11.44	50.0
10:45:30 AM	236	238	238	410	410	414	5.61	3.69	11.39	50.0
10:46:00 AM	235	238	239	409	411	414	5.64	3.69	11.42	50.0
10:46:30 AM	235	239	239	409	411	414	6.59	3.66	11.43	50.0
10:47:00 AM	236	240	239	411	413	415	5.86	3.67	11.42	50.0
10:47:30 AM	236	240	238	410	412	414	5.97	3.70	11.38	50.0
10:48:00 AM	236	240	237	410	412	413	5.62	3.70	11.34	50.0
10:48:30 AM	235	240	237	409	412	413	5.62	3.69	11.35	50.0
10:49:00 AM	238	241	237	412	413	414	5.62	3.69	11.35	50.0
10:49:30 AM	239	242	236	414	414	414	5.67	3.69	11.29	50.0
10:50:00 AM	239	241	234	412	412	412	5.74	3.68	11.20	49.9
10:50:30 AM	239	241	234	413	412	412	5.71	3.68	11.21	50.0
10:51:00 AM	240	242	234	413	413	413	5.71	3.69	11.20	50.0

TIME	VOLTAGE SINGLE PHASE			VOLTAGE LINE TO LINE			CURRENT			Frequency
	R	Y	B	Hz	YB	BR	R	Y	B	Hz
10:51:30 AM	239	242	234	413	413	413	5.64	3.70	11.14	50.0
10:52:00 AM	239	241	233	411	412	412	5.69	3.68	11.11	50.0
10:52:30 AM	238	242	234	411	412	412	6.86	3.68	11.13	50.0
10:53:00 AM	238	242	234	411	412	412	5.99	3.71	11.13	50.0
10:53:30 AM	238	242	233	411	412	411	5.98	3.71	11.09	50.0
10:54:00 AM	238	241	232	410	411	411	5.68	3.72	11.05	50.0
10:54:30 AM	238	241	232	410	411	411	5.68	3.70	11.28	50.0
10:55:00 AM	238	241	232	410	411	411	5.66	3.66	11.86	50.0
10:55:30 AM	238	241	231	410	410	409	5.64	3.66	11.79	50.0
10:56:00 AM	237	240	232	409	410	409	5.63	3.68	11.84	50.0
10:56:30 AM	239	241	232	411	412	411	5.66	3.67	11.83	50.0
10:57:00 AM	238	241	233	410	412	410	7.32	3.64	10.08	50.0
10:57:30 AM	238	242	234	412	413	412	6.26	3.67	8.76	50.0
10:58:00 AM	238	242	234	412	413	412	5.93	3.68	9.01	50.0
10:58:30 AM	239	242	234	412	414	413	5.63	3.70	8.79	50.0
10:59:00 AM	238	241	233	411	412	411	5.63	3.67	8.74	50.0
10:59:30 AM	238	241	234	410	412	412	5.62	3.65	8.85	50.0
11:00:00 AM	238	242	234	411	413	412	5.64	3.65	9.16	50.0
11:00:30 AM	237	243	236	412	415	414	5.63	3.66	9.24	50.0
11:01:00 AM	238	242	234	412	414	412	5.64	3.67	9.14	50.0
11:01:30 AM	239	241	234	412	413	412	5.64	3.66	9.12	50.0
11:02:00 AM	239	242	235	413	414	413	5.64	3.67	9.19	50.0
11:02:30 AM	239	242	237	414	415	414	5.66	3.65	9.25	50.0

Table 2: Following Table show Voltage and Current Harmonic Distortion

Voltage Distortion			Current Distortion		
R	Y	B	R	Y	B
2.6	3.2	2.7	20.1	13.0	5.1
2.5	3.3	2.7	18.6	13.6	4.5
2.5	3.3	2.7	20.8	14.0	4.5
2.5	3.3	2.7	20.8	13.9	4.5
2.4	3.3	2.7	21.0	13.7	4.5
2.5	3.4	2.7	20.8	13.3	4.5
2.5	3.4	2.8	20.9	13.1	4.6
2.6	3.4	2.8	20.3	12.9	4.7
2.5	3.4	2.7	21.3	12.8	4.6
2.4	3.3	2.6	22.0	13.2	4.6
2.4	3.3	2.7	22.1	13.3	4.6
2.4	3.3	2.6	15.8	13.5	4.6
2.4	3.3	2.7	21.8	12.5	4.6
2.5	3.4	2.8	20.7	11.0	4.7
2.4	3.4	2.7	21.6	11.1	4.8
2.5	3.5	3.0	21.3	10.9	4.6
2.5	3.4	2.8	21.2	11.2	4.9
2.6	3.4	2.9	20.6	11.2	4.6
2.6	3.4	2.8	20.9	11.0	4.7
2.7	3.4	2.9	20.7	11.4	4.5
2.5	3.1	2.6	21.8	12.5	5.3
2.4	2.8	2.5	23.7	14.4	6.3
2.4	2.8	2.5	23.8	13.8	6.2
2.4	3.0	2.5	22.4	12.8	5.3
2.2	2.7	2.3	24.3	13.4	6.3

Voltage Distortion			Current Distortion		
R	Y	B	R	Y	B
2.2	2.8	2.5	23.6	13.4	6.4
2.4	3.5	2.8	21.3	10.5	4.6
2.3	3.4	2.7	21.7	10.8	4.7
2.2	2.9	2.6	25.3	13.7	6.8
2.1	2.8	2.4	19.7	13.4	6.8
2.5	3.6	2.8	18.5	10.9	4.6
2.4	3.2	2.6	21.4	12.3	5.6
2.5	3.1	2.6	23.5	12.9	5.9
2.6	3.5	2.7	21.1	11.5	4.4
2.7	3.6	2.9	20.8	11.1	4.3
2.6	3.6	2.8	21.2	11.3	4.3
2.6	3.6	2.9	21.0	11.3	4.2
2.5	3.7	2.9	22.0	11.3	4.3
2.4	3.6	2.9	19.2	11.3	4.5
2.4	3.6	2.9	21.5	11.2	4.6
2.3	3.0	2.5	24.1	13.0	6.2
2.3	3.2	2.6	23.6	12.1	5.7
2.3	2.7	2.3	25.9	13.4	7.0
2.5	3.2	2.6	23.1	12.2	5.9
2.8	3.6	2.9	20.7	10.8	4.4
2.7	3.5	2.9	21.7	11.0	4.5
2.7	3.5	2.8	21.3	10.8	4.4
2.7	3.5	2.9	20.9	10.7	4.4
2.8	3.6	3.0	20.1	10.4	4.2
2.5	3.5	2.8	21.6	10.8	4.5
2.5	3.6	2.9	18.0	10.7	4.5

Voltage Distortion			Current Distortion		
R	Y	B	R	Y	B
2.5	3.6	2.9	20.8	10.7	4.4
2.5	3.6	2.9	20.7	10.8	4.3
2.5	3.6	2.9	21.4	10.9	4.2
2.5	3.6	2.9	21.3	10.9	4.3
2.6	3.7	3.1	20.9	10.1	3.8
2.6	3.6	3.0	20.7	10.2	3.9
2.6	3.6	2.9	21.0	10.3	3.8
2.8	3.7	3.1	20.4	10.0	3.8
2.6	3.6	2.9	16.4	10.8	5.2
2.7	3.6	3.0	19.4	10.9	6.3
2.6	3.6	3.0	20.5	10.7	6.1
2.6	3.7	3.1	20.5	10.6	6.4
2.5	3.5	2.9	21.3	10.8	6.5
2.3	3.5	2.8	21.6	10.8	6.8
2.5	3.7	3.0	21.4	10.4	6.5
2.5	3.7	3.0	21.3	10.3	6.6
2.6	3.7	3.1	21.3	10.4	6.4
2.5	3.7	3.0	21.1	10.5	6.7
2.7	3.7	3.0	20.6	10.3	6.9
2.7	3.7	3.0	20.6	10.3	7.0

Table 3 : Following table shows Power Factor

KW in R phase	KW in Y phase	KW in B phase	POWER FACTOR IN R	POWER FACTOR IN Y	POWER FACTOR IN B
1.23	0.81	2.57	0.917	0.984	0.898
1.40	0.78	2.54	0.921	0.982	0.896
1.23	0.78	2.54	0.917	0.981	0.896
1.23	0.78	2.54	0.917	0.981	0.896
1.23	0.78	2.54	0.917	0.981	0.896
1.23	0.78	2.54	0.917	0.982	0.895
1.23	0.78	2.52	0.915	0.982	0.897
1.24	0.78	2.53	0.915	0.982	0.897
1.23	0.78	2.52	0.916	0.982	0.896
1.23	0.78	2.52	0.916	0.982	0.897
1.23	0.78	2.52	0.917	0.982	0.897
1.82	0.77	2.52	0.929	0.983	0.897
1.22	0.78	2.49	0.915	0.982	0.900
1.27	0.87	2.50	0.907	0.987	0.899
1.22	0.86	2.49	0.917	0.987	0.900
1.22	0.86	2.47	0.916	0.987	0.901
1.23	0.86	2.50	0.916	0.987	0.901
1.23	0.86	2.49	0.916	0.987	0.901
1.23	0.86	2.51	0.917	0.987	0.899
1.24	0.87	2.51	0.916	0.987	0.899
1.23	0.86	2.52	0.917	0.986	0.898
1.23	0.86	2.52	0.915	0.984	0.897
1.23	0.85	2.51	0.915	0.985	0.896
1.22	0.87	2.51	0.916	0.986	0.897
1.22	0.88	2.42	0.916	0.987	0.907
1.23	0.89	2.38	0.914	0.987	0.912
1.24	0.89	2.41	0.914	0.989	0.910
1.23	0.88	2.41	0.916	0.989	0.909
1.22	0.87	2.41	0.915	0.987	0.911
1.62	0.87	2.43	0.911	0.987	0.911

KW in R phase	KW in Y phase	KW in B phase	POWER FACTOR IN R	POWER FACTOR IN Y	POWER FACTOR IN B
1.46	0.88	2.43	0.905	0.990	0.910
1.37	0.88	2.41	0.904	0.988	0.910
1.24	0.88	2.42	0.914	0.988	0.909
1.22	0.88	2.42	0.918	0.989	0.909
1.21	0.88	2.46	0.920	0.989	0.907
1.21	0.87	2.48	0.920	0.989	0.906
1.22	0.87	2.46	0.919	0.989	0.906
1.22	0.87	2.47	0.919	0.989	0.905
1.40	0.86	2.47	0.906	0.989	0.906
1.27	0.87	2.47	0.913	0.989	0.906
1.27	0.88	2.45	0.905	0.988	0.907
1.22	0.88	2.44	0.917	0.988	0.908
1.21	0.88	2.44	0.916	0.987	0.908
1.22	0.88	2.45	0.916	0.988	0.908
1.24	0.88	2.43	0.916	0.990	0.910
1.25	0.88	2.39	0.915	0.989	0.912
1.25	0.88	2.39	0.915	0.990	0.912
1.25	0.88	2.39	0.915	0.990	0.913
1.24	0.89	2.38	0.915	0.990	0.912
1.24	0.88	2.36	0.915	0.990	0.913
1.48	0.88	2.37	0.904	0.990	0.913
1.29	0.89	2.37	0.905	0.990	0.913
1.29	0.89	2.36	0.906	0.990	0.914
1.24	0.89	2.34	0.916	0.989	0.915
1.24	0.88	2.39	0.916	0.989	0.912
1.24	0.87	2.49	0.916	0.990	0.905
1.23	0.87	2.47	0.916	0.990	0.906
1.22	0.87	2.48	0.917	0.990	0.905
1.24	0.88	2.48	0.914	0.990	0.905
1.58	0.87	1.92	0.910	0.990	0.817
1.35	0.88	1.56	0.907	0.989	0.758

Integrated Energy and Green Audit: Shri Santaji Shikshan Vikas Santha's Santaji Mahavidyalaya, Nagpur

KW in R phase	KW in Y phase	KW in B phase	POWER FACTOR IN R	POWER FACTOR IN Y	POWER FACTOR IN B
1.28	0.88	1.61	0.907	0.990	0.766
1.23	0.89	1.56	0.917	0.990	0.758
1.23	0.87	1.55	0.916	0.990	0.761
1.22	0.87	1.58	0.917	0.989	0.761
1.23	0.87	1.66	0.917	0.990	0.773
1.23	0.88	1.68	0.917	0.990	0.768
1.23	0.88	1.65	0.917	0.990	0.772
1.23	0.87	1.65	0.916	0.990	0.773
1.24	0.88	1.66	0.916	0.990	0.767
1.24	0.88	1.67	0.917	0.990	0.764

Figure 1 : FOLLOWING FIGURE SHOW ENERGY STUDY

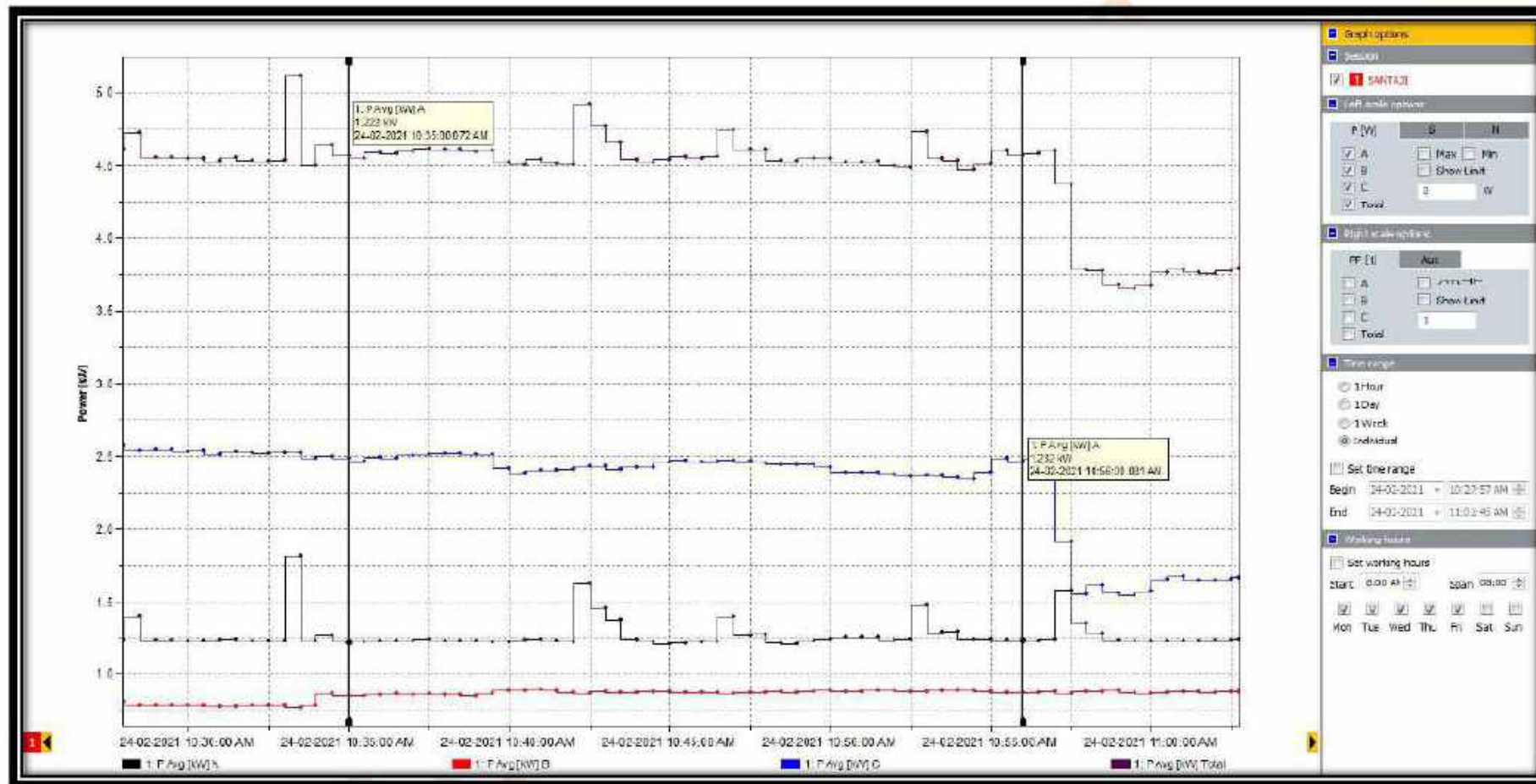


Figure 2: FOLLOWING FIGURE SHOW VOLTAGE HARMONIC

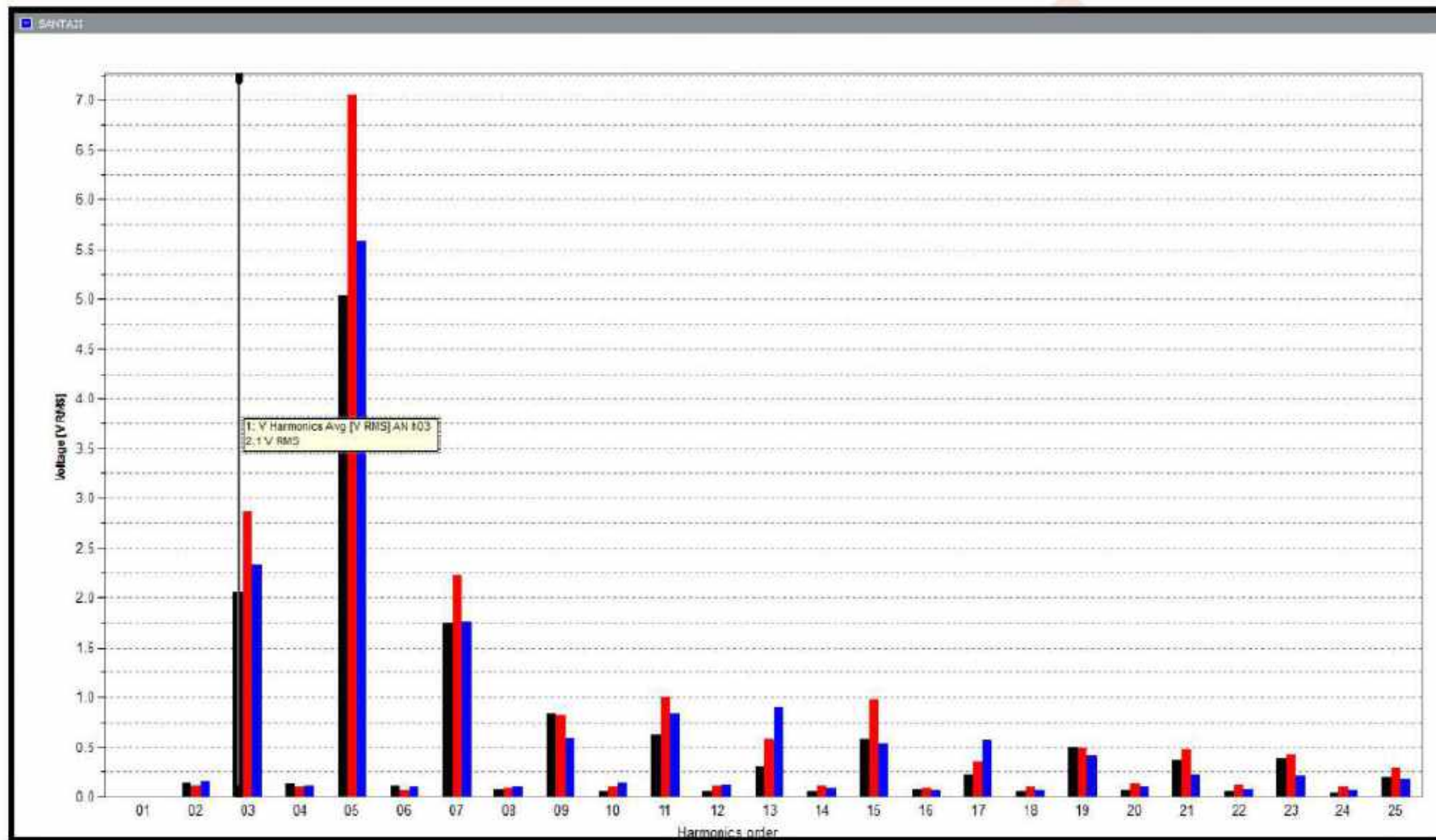
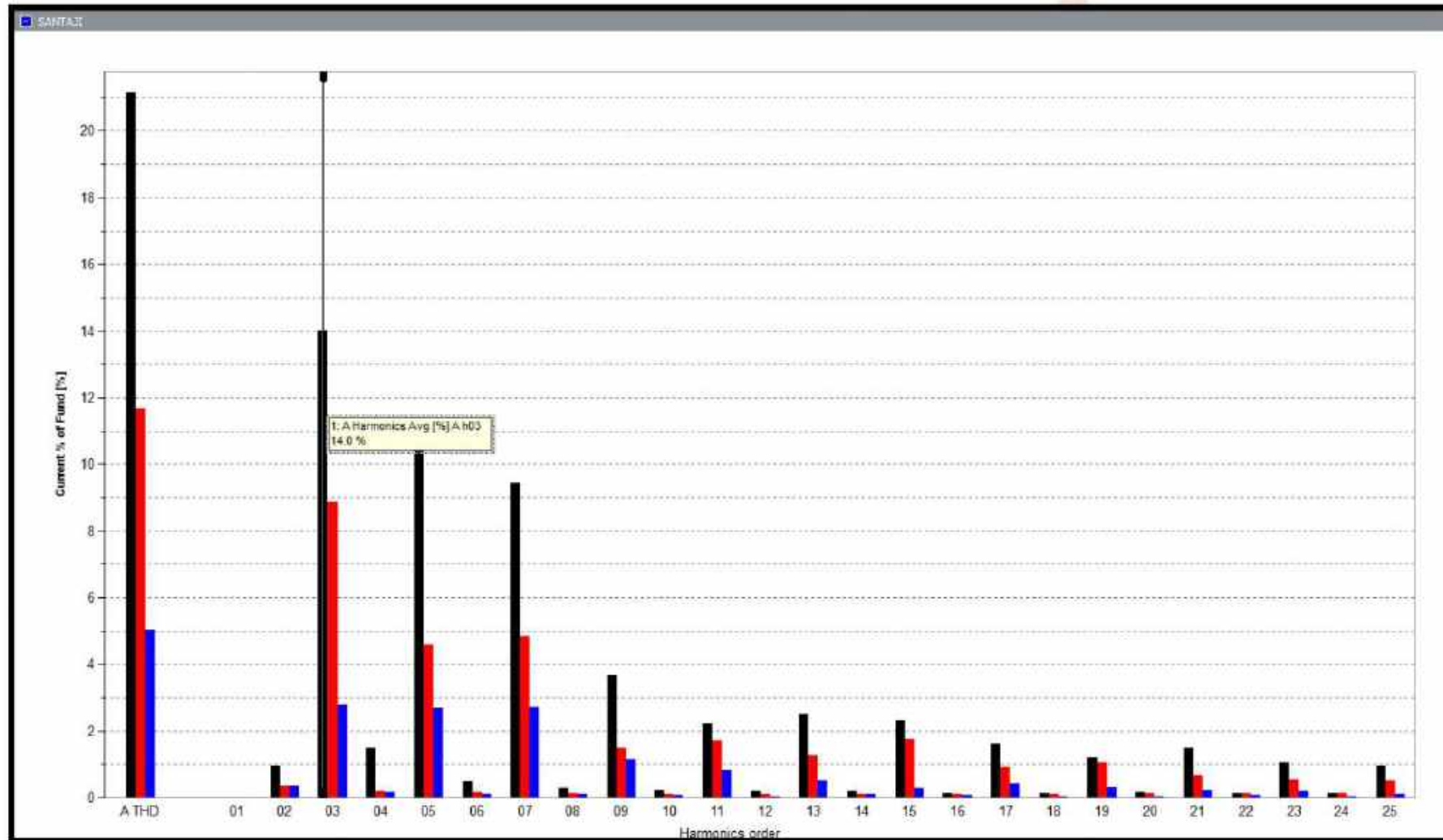


Figure 3: FOLLOWING FIGURE SHOW CURRENT HARMONIC

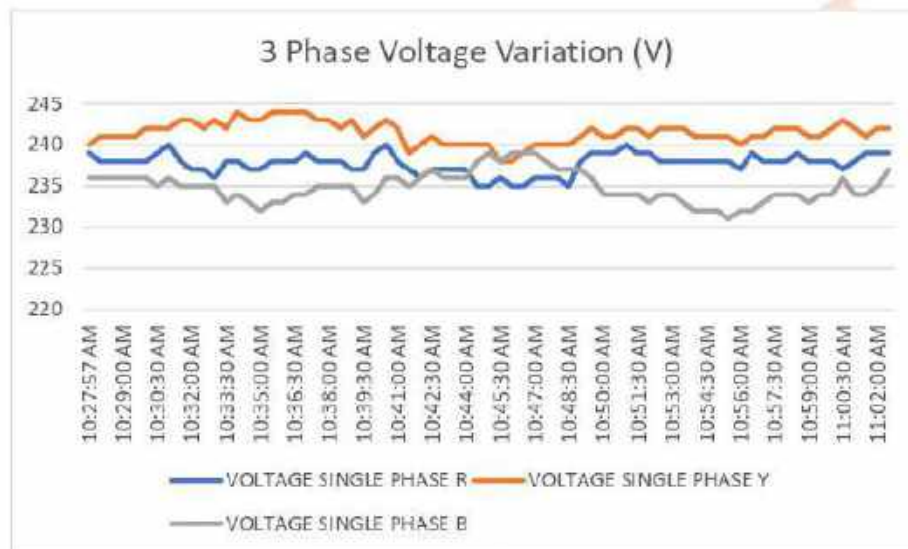


Observations

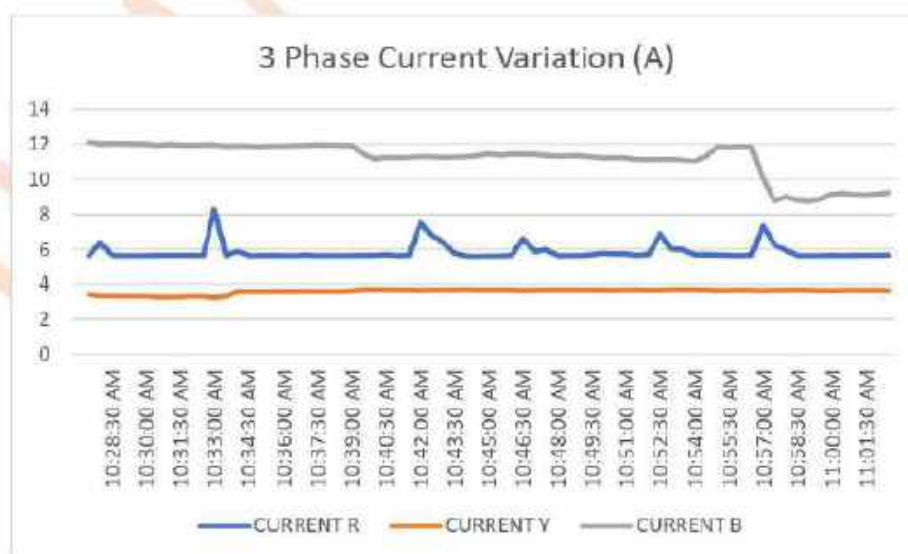
All electrical parameters for main feeder were logged using electrical data logger. The logging was conducted on 24th February 2021 and all the electrical parameters were recorded at 30 seconds intervals. The cycle was logged during day time at normal college working day.

Below are variations observed during from the measurement and Main feeder.

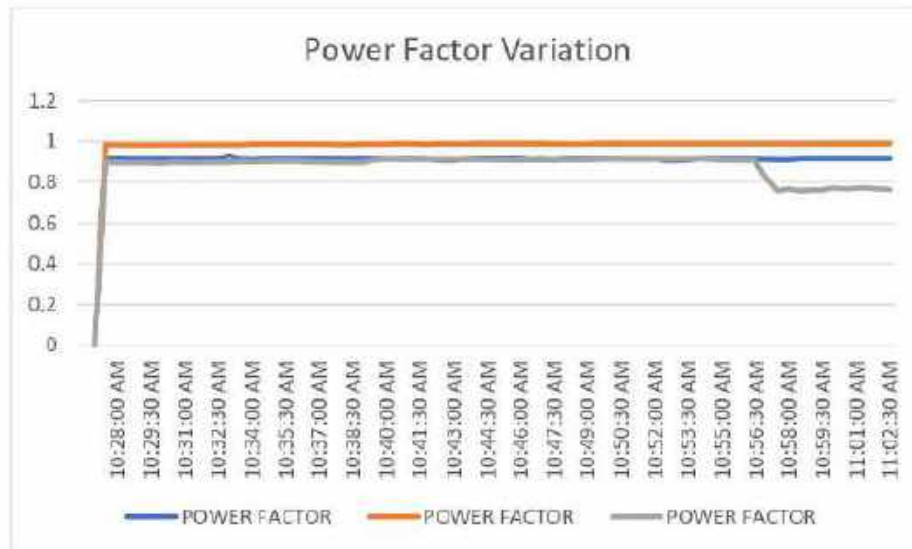
Graph 1. Voltage Variation at Main Feeder



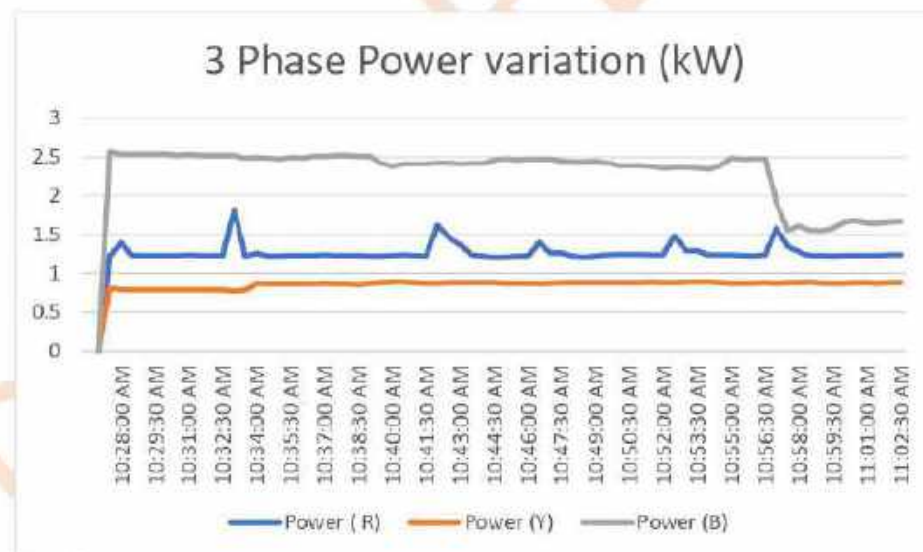
Graph 2. Current Variation at Main feeder



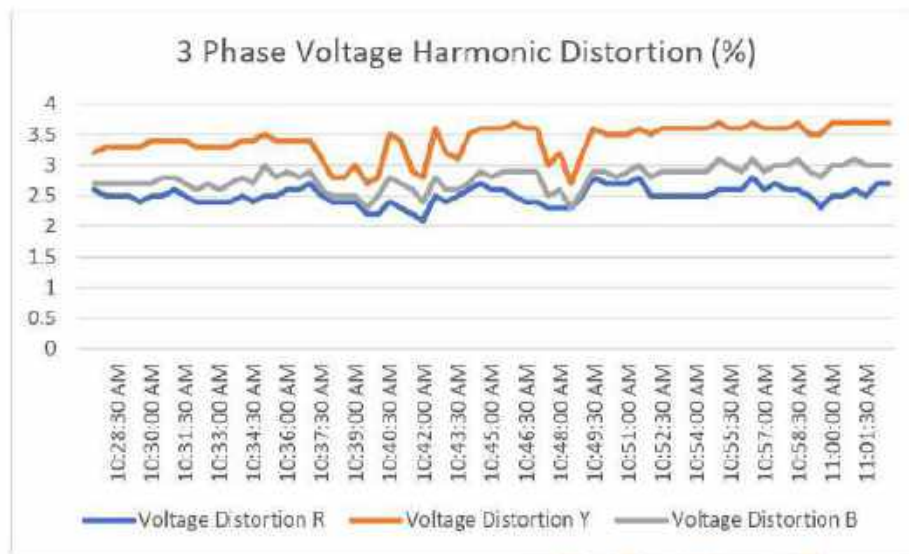
Graph 3. Power Factor Variation at Main Feeder



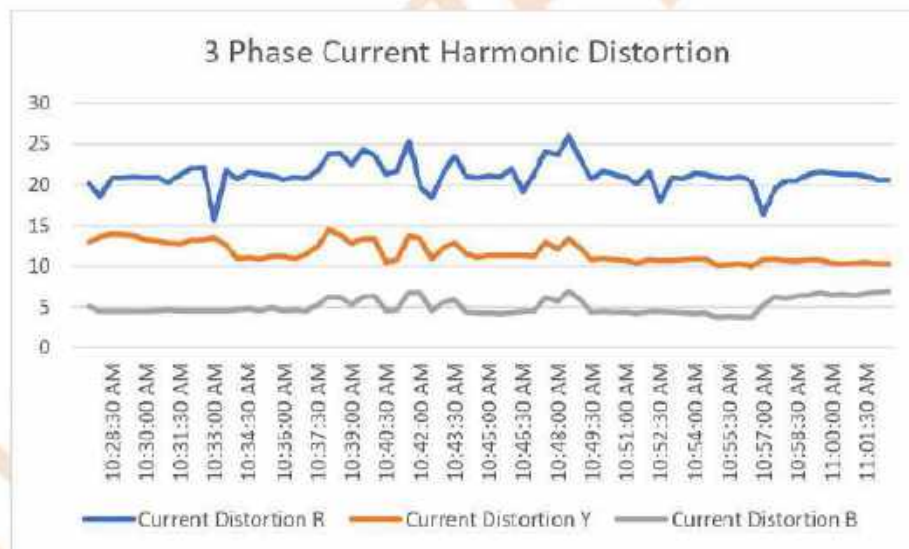
Graph 4. Power Variation at Main Feeder



Graph 5. Voltage Harmonic Distortion at Main Feeder



Graph 6. Current Harmonic Distortion at Main Feeder



The following table gives the results of Voltage and Current data logging for main Feeder.

							Power Factor	Active Power		
	Voltage			Current						
	Volts			Amperes				kW		
	R	Y	B	R	Y	B		R	Y	B
Minimum	235.00	238.00	231.00	5.59	3.23	8.74	0.75	1.21	0.77	1.55
Average	237.72	241.48	234.90	5.83	3.60	11.17	0.92	1.27	0.86	2.32
Maximum	240.00	244.00	239.00	8.27	3.72	12.12	0.99	1.82	0.89	2.57

Observations for Main Feeder Logging

- Power requirement of the complete facility varies between 3 kW to 06 kW during day time maximum power requirement went to about 05.11 kW.
- The Voltage Variation is between prescribed tolerance limits. However the voltage is on higher end. The average measured voltage is 241 Volts. The voltage is balanced through the all phases. The voltage can be reduced to 230 volts using a voltage stabilizer. As voltage is function of power. Reduction in voltage can help in reducing power/energy consumption. Although the savings are less but this will lead to good number over long period. Also life of equipment's is not hampered.
- There is unbalance in current distribution. The unbalance in 3 phases is around 10 – 15 % which is on higher end. The current in **B phase is higher than remaining two phases**.

Solution: Kindly distribute load to remaining two phases and balance loads across all 3 phases.

The unbalance in network was recorded due to improper distribution of load. It is recommend that the single phase loads on each phase to be distributed properly so that the current in each phase will be balanced. Unbalanced network can cause three-phase motors and other three-phase loads to experience poor performance or premature failure because of the following: Mechanical stresses in motors due to lower than normal torque output. Higher than normal current in motors and three-phase rectifiers.

- The facility has satisfactory power factor levels having an average power factor maintained at 0.92. Installation of Automatic Power Factor Corrector, will maintain the power factor at unity. There is huge variation in power factor due to switching loads.

Encon 1. Energy Billing Saving Opportunity by Improving Power Factor.

- The present power factor maintained on average is **0.92**. There is penalty

imposed by MSEDCL for not maintaining power factor above 0.90. There is also incentive provide by MSEDCL for maintaining power factor to unity i.e 1. Previously MSEDCL used to charge consumer based on kWh whereas on they'll be charging based on KVAh i.e. (Active Power (kWh) + Reactive Power (kVARh)). The reactive power occupies the capacity of electricity network and reduces the useful capacity of the system for generation and distribution. The source of the most reactive currents is the poor power factor loads (equipment) connected at the consumer premises. As these loads are not compensated by appropriate capacitor installations by consumers, utilities are burdened for installation of capacitors. It is thus imperative that every section of consumers has to shoulder their responsibility to maintain the system PF within permissible limits only.

- Apart from this, the prime objective of the kVAh billing is to encourage the consumers to maintain near unity Power factor to achieve loss reduction, improve system stability, power quality and improve voltage profile. At the national level, emphasis is being given on energy conservation, energy efficiency and Demand Side Management (DSM) and green energy solutions to optimize the energy usage. By kVAh billing, the consumers will be encouraged to adopt energy efficiency programs and will be benefited by reduced electricity bills.

Solution:

- Capacitor required for maintaining power factor near unity- 3.5 kVA. Install 5kVA capacity into two steps for maintaining power factor near unity.
- Approximate cost of capacitor with installation = Rs. 5000.00

Harmonic Analysis

What is harmonics?

- In an ideal power system, the voltage supplied to customer equipment, and the resulting load current are perfect sine waves. In practice, however, conditions are never ideal, so these waveforms are often quite distorted. This deviation from perfect sinusoids is usually expressed in terms of harmonic distortion of the voltage and current waveforms.
- Power system harmonic distortion is not a new phenomenon - efforts to limit it to acceptable proportions have been a concern of power engineers from the early days of utility systems. At that time, the distortion was typically caused by the magnetic saturation of transformers or by certain industrial loads, such as arc furnaces or arc welders. The major concerns were the effects of harmonics on synchronous and induction machines, telephone interference, and power capacitor failures. In the past, harmonic problems could often be tolerated because equipment was of conservative design and grounded wye-delta transformer connections were used judiciously.
- Distortions of the fundamental sinusoid generally occur in multiples of the fundamental frequency. Thus on a 50 Hz power system, a harmonic wave is a sinusoid having a frequency expressed by the following formula, where n is an integer:

$$f_{\text{harmonics}} = n * 50\text{Hz}.$$

What are Sources of Harmonics?

- Harmonics are caused by nonlinear loads attached to the power system. Nonlinear loads draw non-sinusoidal current. Resistors, inductors, and capacitors are linear devices. When a resistive load is applied to an AC power system, it draws sinusoidal current. When an inductive or capacitive load is applied, it too draws sinusoidal current although it is phase shifted compared to the resistive load. There are many types of nonlinear loads which cause harmonics. The largest sources of harmonics are converters. Converters range from a huge 1000 MW inverter station for an HVDC line to a 75 W rectifier found in a television. Other nonlinear sources of harmonics include arcing devices such as arc furnaces, transformer magnetizing impedance, fluorescent and high intensity discharge lights. The harmonic current caused by the nonlinear sources can cause harmonic distortion in the system voltage which may cause problems for other devices.

Effects of Harmonics?

The effects of harmonics are divided into four general categories:

- effects on the power system itself
 - effects on consumer load
 - effects on communication circuits
 - effects on revenue billing
-
- On the power system, harmonic currents are the main culprit, causing equipment overheating and thermal loss-of-life. This may be a concern for motors or transformers. The impact is worse when network resonances amplify harmonic currents. Harmonics may also interfere with relaying and metering to some degree.
 - Harmonics can also cause thyristor firing errors in converter and SVC

installations, metering inaccuracies, and false tripping of protective devices. The performance of consumer equipment, such as motor drives and computer power supplies, can be adversely affected by harmonics. In addition, harmonic currents flowing on power lines can induce noise on nearby communication lines.

- Harmonic voltage distortion may cause equipment insulation stress, particularly in capacitors. When harmonics cause the voltage impressed on the capacitor bank to be distorted, the peak voltage may be high enough to cause a partial discharge, or corona, within the capacitor dielectric. This may eventually result in a short circuit at the edges of the foil and failure of the capacitor bank.
- High harmonic currents cause fuse blowing in capacitor banks. This results in a loss of reactive power supply to the system which may cause other problems.
- Harmonic voltage distortion can effect revenue billing by introducing error into kilowatt hour metering systems that rely upon accurate discernment of the voltage zero. And, of course harmonic current sums with fundamental current demanded by facility loads to directly increase net billable kilowatt demand and kilowatt hour consumption charges.

System Problem	Common Causes	Possible Effects	Solutions
Harmonics (non sinusoidal voltages and/or current wave forms)	Office – Electronics, UPSs, variable frequency drives, high intensity discharge lighting and electronic and core coil ballasts.	Over- heating of neutral conductors, motors, transformers, switch gear. Voltage drop, low power factors, reduced capacity.	Take care with equipment selection and isolate sensitive electronics from noisy circuits.

What standards are applicable for Harmonic Measurement? What is the acceptable limit of harmonics?

- American standards regarding harmonics have been laid out by the IEEE in the 519 Standard: IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems. There is a combined effect of all nonlinear loads on utility systems that have a limited capability to absorb harmonic current. Further, utilities are charged with the responsibility to provide a high quality supply in terms of voltage level and waveform. IEEE 519 recognizes not only the absolute level of harmonics produced by an individual source but also their size relative to the supply network.

The permissible harmonic limit for different current (I_{sh}/I_L) as per IEEE standard is given in below table

IEEE 519 Standard - Maximum Harmonics Current /distortion in Percentage of I_L						
Maximum Harmonics Current Distortion in Percent of I_L						
I_{sc}/I_L	<11	$11 \leq h < 17$	$17 \leq h < 23$	$23 \leq h < 35$	$35 \leq h$	Total Demand Distortion
<20	4	2	1.5	0.6	0.3	5
$20 < 50$	7	3.5	2.5	1	0.5	8
$50 < 100$	10	4.5	4	1.5	0.7	12
$100 < 1000$	12	5.5	5	2	1	15
>1000	15	7	6	2.5	1.4	20

Where,

I_{sc} = Maximum short circuit current at point of common coupling and

I_L = Maximum demand load current (fundamental frequency component) at PCC

TDD = Total Demand Distortion

	Voltage Harmonic Distortion			Current Harmonic Distortion		
	%			%		
	R	Y	B	R	Y	B
Minimum	2.10	2.70	2.30	15.80	10.00	3.80
Average	2.50	3.40	2.79	21.20	11.71	5.12
Maximum	2.80	3.70	3.10	25.90	14.40	7.00

Observation Table: Harmonics Measured

The Voltage Harmonics are within permissible limit. However the current harmonics are much higher side than the permissible limits. It is recommend to use harmonic filters to reduce the current harmonics within permissible limit and to avoid any further future penalty.

Solution:

- Installation 5 KVAR Active Harmonic Filter.
- Approximate cost of capacitor with installation = Rs. 5000.00

The penalty for harmonics is still under proposal stage. However the suggested harmonics penalty is 5% additional energy charges (Wheeling charges plus Energy charges) for consumers who do not maintain the harmonics levels specified in IEEE STD 519-2014.

Solar Energy for College

1. Grid Tied Solar PV

1.1 Background

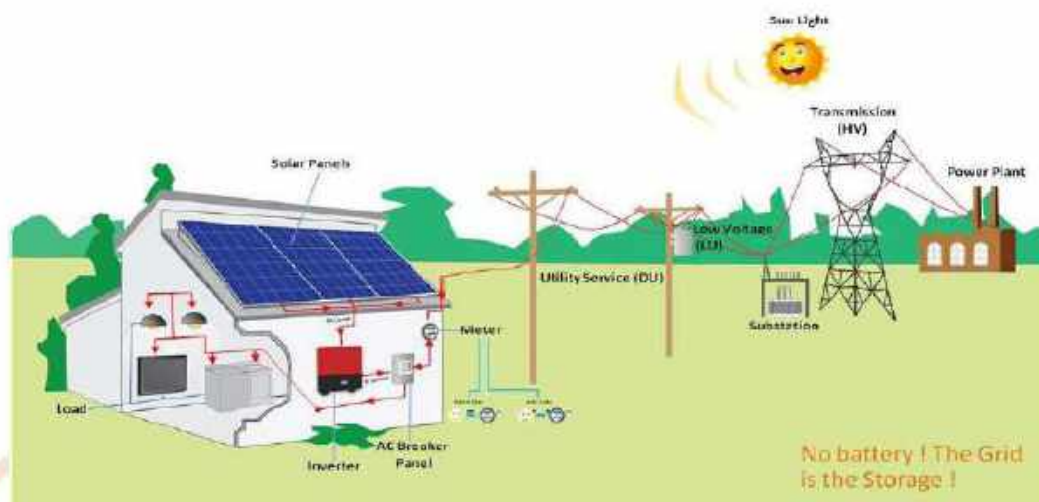
A 10 kWp rooftop Solar Photo Voltaic System is proposed to be installed at your college premises at Santaji Mahavidyalaya

This proposal is based on following points discussed during our meeting/conversation.

- You have a three phase LT connection from Mahavitaran with sanctioned load of 06 kW.
- Average electricity consumption varies around 800-1400 units per month.
- Present average electricity tariff is Rs. 9 /kWh.
- Space required is 800 sq. ft. facing south direction with clear rooftop available.

1.2 Proposed System

Based on your requirement, a grid tied three phase solar system is proposed to be installed on your space available.



A grid tied solar system generates output in synchronization with the electricity supplied from the utility (Mahadiscom).

1.3 Operation Details of proposed system

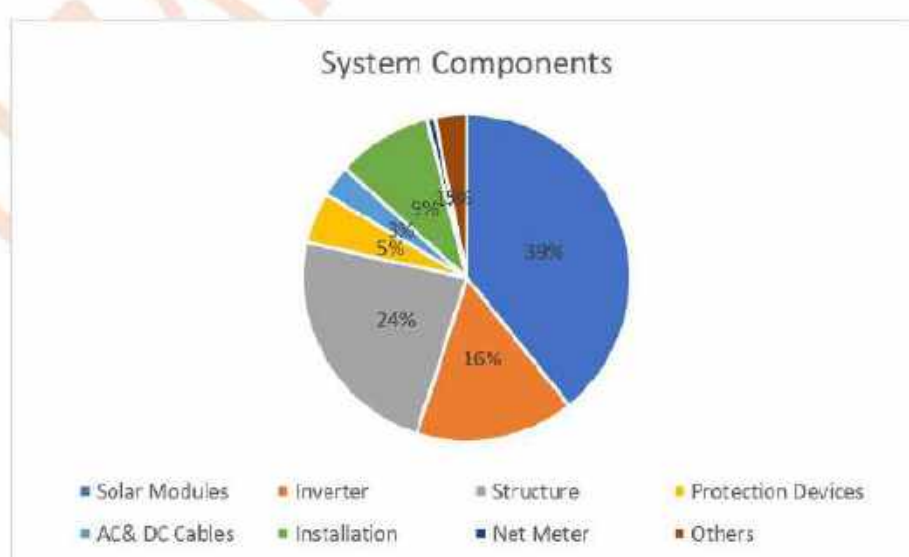
- The generated solar power is used for local consumption decreasing the demand of electricity from the grid.
- As long as the captive power requirement is more than the output of solar, the excess power required is feed by the grid.
- If the captive power requirement is lower than the output of solar, the electricity is exported to grid.
- Whenever there is no power supply from the grid, the solar PV system goes in standby mode and its output cannot be used.

1.4 Advantages and benefits

- The life of solar system is 25 years with 25 years' linear power output warranty from the manufacturer of solar module.
- Dynamic system with no moving parts, hence no wear and tear of systems.
- With no batteries connected, maintenance is limited to cleaning of solar modules once in 15 days.
- Inverter output and grid power are on same bus, there is no effect of load fluctuations on the system.
- Generation of renewable energy results in reduction of carbon footprints.
- The effective cost of power generated from solar energy is as lower as Rs. 3/kWh. Thus any investment in solar system now gives healthy returns over next 25 years.

1.5 Technical Details

SR.NO	DESCRIPTION	DETAILS	MAKE / MODEL
1	Solar PV Module	10 kWp	Trina/Canadian/Renesys/others
2	Grid Tied Inverter	10 KVA	Growatt/Delta/Polycab /Other
3	Module Structures	MS Galvanized	Local Fabricator
4	DC Distribution Box	As required	Phoenix/Others
5	AC Distribution Box	As required	ABB/L&T/others
	Surge Protection	Type 2 for AC and DC	Mersen/Dehn/Equivalent
6	DC Cables	As required	Polycab / Siechem/ others
7	AC Cables	As required	Polycab / Siechem/ others
8	Lightning Arrestor	As required	ISI Complaint
9	Earthing	As required	ISI Complaint
10	Net Meter	Approved by Mahadiscom	Secure/Others



1.6 Scope of Work

Scope of work includes Supply Design, Engineering, Procurement, Supervision, Installation, Testing & Commissioning and one-year warranty on installed Solar PV system.

- Documentations and approvals
 - a. Application to increase the sanctioned load from **present 06 kW to 12 kW** for the purpose of installing 10 kWp solar. (As per MAHAVITRAN Commercial Circular No: 258 dated 25th January 2016, we can install only 80% of the sanctioned load as maximum capacity for solar PV System.)
 - b. Application and approval from MSEDCL for Net metering/Gross Metering purpose.
- Design & Engineering.
 - a. System design.
 - b. Engineering drawings.
 - c. Detailed Bill of Materials & Project Report.
- Procurement and supply of material.
 - a. Solar PV Modules
 - b. Solar Grid Inverter
 - c. Solar Module Mounting Structure
 - d. Solar Grade, UV protected DC Cable
 - e. AC Cable
 - f. DC and AC Distribution Box
 - g. Earthing & Lightning Arrestor
 - h. All other related accessories.
 - i. Net Meter
- Civil Installation Work.
 - a. Module mounting structure installation.
 - i. The structure will be installed on pillars above terrace and on available terrace space will elevation such that a person can easily walk and use terrace.
 - b. Civil work for module mounting structure.
- Electrical Works.
 - a. Wiring of Modules.
 - b. Cabling from modules to DC distribution box.
 - c. Cabling from DC distribution box to Inverter.
 - d. Cabling from Inverter to AC Distribution box.
 - e. Earthing and Lightning Protection.
- Testing & Commissioning.
- Net Metering.

2. Estimated Output & Returns

Detailed estimation of output of solar PV system is done considering location of installation, proposed direction of solar panels, data of solar irradiance at the location, system losses, and other related data.

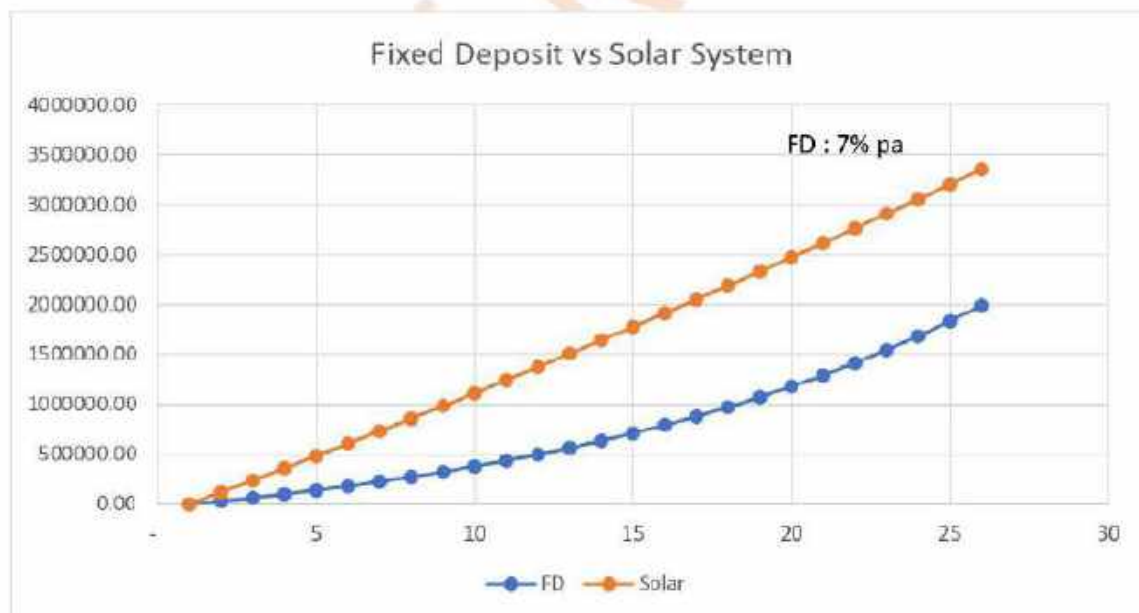
2.1 Basis of estimation

- Solar PV Capacity: 10kWp
- Location: Santaji Mahavidyalaya, Nagpur, Maharashtra
- The solar panels are expected to be free of shadow.
- Generation is based on radiation of 1000W/m² and grid availability.
- Assumed clear sunny 330 days/year.
- Space required is 800 sq.ft facing south direction with clear rooftop available.

2.2 Estimated output

- Daily generation from solar: 45 kWh/day
- Monthly generation: 1350 kWh/month
- Total Annual output: 14850 kWh/annum
- Specific Production: 1485kWh/kWp/annum

2.3 Comparison with Bank Fixed Deposit:



3. Commercial Offer

3.1 Cost of System

Description	Amount (INR)
Supply, Design, Installation, Testing and Commissioning of 10 kWp Grid Tied Solar PV System	Rs.4,50,000.00
Transportation	Included
GST	Extra at Actual
Any other taxes and duties	Nil at present
Structure	Additional Cost if customization required

3.2 Returns

The Solar system gives excellent result as shown below

- Estimated savings of **Rs.1, 30,000** from first year.
- Return on investment: **29 %pa.**
- **Breakeven time of 3.5 years out of operating life of 25 years.**

No	Capital Cost	Savings in Electricity bills	Net Cash Flow	Cumulative cash flow
Year 1	4,50,000.00	133650.00	-316350.00	-316350.00
Year 2		134986.50	134986.50	-181363.50
Year 3		136336.37	136336.37	-45027.14
Year 4		137699.73	1,37,699.73	92672.59
Year 5		139076.73	1,39,076.73	231749.32
Year 5-25	Savings in Electricity of Rs. 1,40,000.00/Annum			

Assumptions:

- Increase in MSEB tariff assumed at 1% pa.
- Present cost of Electricity is Rs. 9/kWh

Annexure –XVIII: Snapshot of Annual Rainfall Data, Grid Emission Factor

Table: Rainfall data of Nagpur District (2002-2011) in mm

Taluka	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
Nagpur City	1176.1	1431.5	702.3	973.4	975.7	741	952.9	954.4	1395	879.4	1018.2
Nagpur Gramin	966.7	1229	589	1274.7	1205.5	966.3	953.2	947.4	1495	913.8	1064
Kamthi	1035.8	1208.7	707.1	1475.8	1178.2	1205	791.6	1032.6	1099	861.3	1059.5
Hingna	489.2	770	583.3	920.4	814.9	806	683.1	724.7	942.2	814.8	753.9
Ramtek	1101.3	822.5	733.9	1435.5	1133	1370.8	865.3	905.2	1184	885.1	1043.7
Parshiwani	850.1	1056.9	858.4	1239.5	1106.2	878.8	1068.6	983.6	1087	1043.8	1017.3
Maudha	904	1171.6	631.3	1679.1	1114.3	1030.9	814.1	1280.4	1521	1366.2	1151.2
Katol	649.6	920.1	555.1	1092.3	937.4	1271.8	773.2	888.4	1028	801.8	891.8
Narkhed	822.8	778	606.7	914.9	768.6	1281.3	671	954.1	1137	764.9	869.9
Savner	823.6	1063.6	812.6	1497.2	974.1	1209	873.6	941.6	1078	945.8	1022
Kalmeshwar	740	1092.2	808.6	1320.9	916.4	1203.4	675.9	780.5	1181	855.2	957.4
Umrer	846.2	1296.8	747.1	1856.3	1014.2	1464	1060.4	925.2	1551	887.1	1164.9
Bhiwapur	923.3	1146.3	740.4	1431.2	1045.5	1341.8	853.2	993.7	1690	1088.4	1125.4
Kuhi	859.2	1057.2	596.4	1543.8	828.6	1286	817.9	950.3	1292	1024.7	1025.6
Average	869.9	1074.7	698	1332.5	1000.9	1146	846.7	947.4	1263	938	1011.8

Web link: <http://www.agri.mah.nic.in>

CEA Database Version-13

Emission Factors (tCO ₂ /MWh) (incl. Imports)	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Weighted Average Emission Rate (2)	0.78	0.83	0.82	0.82	0.82	0.82
Simple Operating Margin (1) (2)	0.97	0.99	1.00	0.99	0.97	0.96
Build Margin (not adjusted for imports)	0.92	0.97	0.95	0.93	0.91	0.87
Combined Margin (1) (2)	0.95	0.98	0.98	0.96	0.94	0.92

Notes:

LET REPORT

Coordinates:

Swapnil Thanekar

Sustainability | Energy | Water

(Certified Energy Auditor – EA4416)

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