|| Tamaso ma Jyotirgamaya ||
Shri Someshwar Shikshan Prasarak Mandal's

Phone (02112) 282728 283187

SOMESHWAR SCIENCE COLLEGE

Someshwarnagar, Tal. Baramati, Dist: Pune (Pin: 412 306) Maharashtra, India
(Affilliated to Savitribai Phule Pune University, Pune) Est. 2007

Govt. Reg. No. N.G.C. 2007(189/07) Mashi-3, Dt. 2 July 2007 College Code 827 University Appvl. No. IDNo. PU/PN/S/284/2007

Ref.No: SVM/

Date:- 06/06/2023

Document for SSR

The documents regarding the **7.1.3** are attached herewith this letter.

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Someshwar Science College COLLEGE CODE 827

Principal
Someshwar Science College, Someshwarnagar

Shri Someshwar Shikshan Prasarak Mandal's

Someshwar Science College,

Someshwarnagar, Baramati.

At Someshwar Science College, Someshwarnagar, we are committed to creating an environmentally conscious and sustainable campus that fosters awareness, responsibility, and active participation in environmental preservation. Our environmental policy encompasses a range of objectives and practices to ensure the well-being of our campus and the surrounding ecosystem.

Environmental Policy:

1. Awareness and Education:

We strive to create awareness among our students, faculty, and management regarding environmental policies and practices. Regular workshops, seminars, and awareness campaigns are conducted to ensure that everyone is well-informed about environmental issues and the importance of sustainable living.

2. Pollution-Free Campus:

To maintain a pollution-free environment, the use of tobacco, pan-masala, and chewing of such substances is strictly prohibited within the campus premises. This policy extends to all members of the college community, including students, faculty, and staff.

3. Plastic-Free Campus:

We are dedicated to maintaining a plastic-free campus in accordance with government regulations. One-time use plastic, plastic wrappers, and plastic pens are strictly prohibited on campus. Signboards emphasizing the plastic-free policy are prominently displayed throughout the campus.

4. Renewable Energy:

We actively promote the use of solar energy on campus. Solar lamps and solar water heaters have been installed in the girls' hostel, reducing our dependence on conventional energy sources and minimizing our carbon footprint.

5. Water Conservation:

We emphasize the safe and sustainable use of potable drinking water by providing purified drinking water facilities through RO aqua-guards across the campus. Furthermore, rainwater harvesting systems have been implemented to collect and recharge groundwater, reducing water wastage and promoting water conservation.

6. Paperless Office:

We actively promote the use of information and communication technology (ICT) to minimize paper usage and move towards a paperless office environment. Digital communication, electronic documentation, and online submission systems are encouraged to reduce paper consumption and waste.

7. Waste Management:

We adopt sustainable waste management practices by utilizing vermi-composting techniques to convert solid waste into fertilizer on campus. Standard colored code dustbins are placed strategically to segregate dry and wet waste, ensuring a clean and hygienic campus environment.

8. Biodiversity Conservation:

The protection and nurturing of flora and fauna within the campus are of utmost importance. We actively conserve and promote biodiversity by preserving natural habitats, planting native species, and creating awareness among the college community about the importance of ecological balance.

We believe that by implementing and adhering to these environmental policies, we can collectively contribute to a greener and more sustainable future. We encourage all members of our college community to actively participate in and support these initiatives for the benefit of our environment and future generations.

Someshwar Science College COLLEGE CODE 827

Principal
Someshwar Science College,Someshwarnagar

GREEN AUDIT REPORT
(2021-22)

Someshwar Science College, Someshwarnagar

Taluka- Baramati, Dist: Pune, Maharashtra- 412306

E-mail Id: svm.principal@yahoo.com
Website: https://someshwarsciencecollege.org

Prepared by

Supreme Electrical Energy and Consultancy Services, LLP, Pune

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Preface

We are very grateful to the Management and Principal of "Someshwar Science College, Someshwarnagar" for giving us an opportunity to carry out Green Audit of the institute. Further, we sincerely thank to all other college staff for providing us necessary facilities, required data and co-operation during the Green Audit. This helped us to complete the Green Audit successfully.

Further, we hope, this will boost the new generation to create healthy environment in the campus and propagate these views for many generations to come.

Dr. Sanjay A. Deokar

Green Auditor

SUPREME
Electrical Energy and Consultancy Services

CERTIFICATE

This is to certify that "Supreme Electrical Energy and Consultancy Services, LLP", Pune has conducted Green Audit of **"Someshwar Science College, Someshwarnagar, Campus"**. It has been observed that the campus not only have implemented various Green measures in the campus for wellbeing of staff and students in the campus but also **has** separate **Green policy** of the campus which helps to maintain healthy environmental balance.

12/12/2022

Dr. Sanjay A. Deokar

BEE Certified Energy Auditor (EA- 4494)

Indian Green Building Council (IGBC- AP)

Environmental Lead Auditor (ISO:14001-2015)

Indian Green Building Council (IGBC-AP) ID AA 02 EEHE

12/12/2022.

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Table of Contents

1. Executive Summary

Green audit is defined as an official examination of the effects a college has on the environment. It helps to improve the existing practices with the aim of reducing the adverse effects of these on the environment concerned. Several institutions have applied various viewpoints to preserve the environment within the campus such as promotion of energy savings, recycling of waste, water use reduction, water harvesting etc. Green audit visualizes the documentation of all such activities taking stock of the infrastructure of the college, their academic and managerial policies and plans. A green auditor will study an organization's environmental effects in a systematic and documented manner and will produce an environmental audit report. A clean and healthy environment aids effective learning and provides a conducive learning environment.

A clean and healthy environment aids effective learning and provides a conducive learning environment. Educational institutions now a day are becoming more sensitive to environmental factors and more concepts are being introduced to make them eco-friendly. To preserve the environment within the campus, various measures are applied by the several educational institutes to solve their environmental problems such as promotion of the energy management & conservation, waste management, rainwater harvesting etc. The activities pursued by colleges can also create a variety of adverse environmental impacts. Green audit is a way to show for the institute what type of carbon footprint they are leaving on the planet and guide them to reduce it. Green Audit involves the inspection of an institute to assess the total environmental impact of its activities. As a part of such practice, Green Audit was conducted to evaluate the actual scenario in the campus.

Green audit can be a useful tool for an institute to determine how and where they are using the most energy or water or resources, an institute can then consider how to implement changes and make savings. It can also be used to determine the type and volume of waste, which can be used for a recycling project or to improve waste minimization plan. It can also create health consciousness and promote environmental awareness, values and ethics. It guides all staffs and students for better understanding of

green impact in the campus. Green audit promotes financial savings through optimum utilization of resources.

"Someshwar Science College, Someshwarnagar" is deeply concerned about the problem of global warming and environmental hazards due to the development and urbanization. Thus, the institute has taken steps to make campus green by conducting Green Audit.

The baseline data prepared for the "Someshwar Science College, Someshwarnagar" will be a useful tool for campus greening, resource management, planning of future projects, and a document for implementation of sustainable development of the college. Existing data will allow the institute to compare its programs and operations with those of peer institutions, identify areas in need of improvement, and prioritize the implementation of future projects. We expect that the management will be committed to implement the green audit recommendations to promote environment protection and sustainability.

We are happy to submit this green audit report of "Someshwar Science College, Someshwarnagar" to the concerned authorities.

2. About the College

The Institution aims at imparting education that is man making, character building and creating an ideal citizen in the global perspective. Such education is imparted that may boost career opportunities for self-fulfilment.

Shri Someshwar Shikshan Prasarak Mandal's (SSSPM's), Someshwar Science College, Someshwarnagar is a leading and well known Science college in Pune District rural area, Maharashtra. The institute is affiliated to **Savitribai Phule Pune University (SPPU), Pune,** Someshwar Science College, Someshwarnagar, was established in the year 2007 under the able guidance of our respected Hon. Shri. Sharadchandraji Pawar with the objective of providing quality education and to help rural students to match contemporary global requirements. **It is financially supported by Someshwar Sahakari Sakhar Karkhana Ltd. Someshwarnagar Tal: Baramati, Dist: Pune.** The institute offers BSc. cources as per **Savitribai Phule Pune University** Curriculum. The College has well equipped Girls hostel and mess with Wi-Fi facilities. Someshwar Science College, Someshwarnagar has state-of-the-art facilities and its Young faculty have been nurturing students of high academic capabilities. It is having spacious classrooms, well-equipped laboratories and, new age computer facilities and a well-stocked library provide a stimulating educational environment within the College.

Education here is the summing up of our top ideals in the hope that it can become a medium to serve our nation by developing a highly educated, well-organised and ethical pool of rural human resources. Recently college has signed LOU with French multinational company CAPGEMINI to enhance skills in the existing as we as passed out students in the campus. Under this LOU, Capgemini has established Digital Training Academy in the institute campus to train our students to meet industry needs with various skills.

Vision: Our vision is to achieve excellence in education and make the engineers for socio-economic development of rural India.

Mission:

- To prepare rural students for a productive and rewarding career in engineering profession.
- To provide students with comprehensive knowledge and fundamentals of engineering.
- To create barrier free environment through education in rural area. Development of human resource for socio-economic development of rural India.
- To impart value education and skill through education.

3. Objectives of the Study

The main objective of the green audit is to promote the environment management and conservation in the college campus. The purpose of the audit is to identify, quantify, describe and prioritize framework of environment sustainability in compliance with the applicable regulations, policies and standards. The main objectives of carrying out the Green Audit are:

- To introduce and aware students to real concerns of environment and its sustainability.
- To secure the environment and cut down the threats posed to human health by analyzing the pattern and extent of resource use on the campus.
- To establish a baseline data to assess future sustainability by avoiding the interruptions in environment that are more difficult to handle and their corrections requires high cost.
- To identify, quantify, describe and prioritize framework of environment sustainability in compliance with the applicable regulations, policies and standards.
- To promote the environment management and conservation in the college campus.

4. Methodology

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

- Water Management.
- Energy Management & Conservation.
- Wastewater Management.
- Green area Management.
- Indoor Environment

5. Observations and Recommendations

5.1 Water Management

This point towards level of water consumption, types of water sources, water storage strategies, water appliances and fixtures. A water audit is an on-site survey and assessment to determine the water use and hence improving the efficiency of its use.

a) Observations

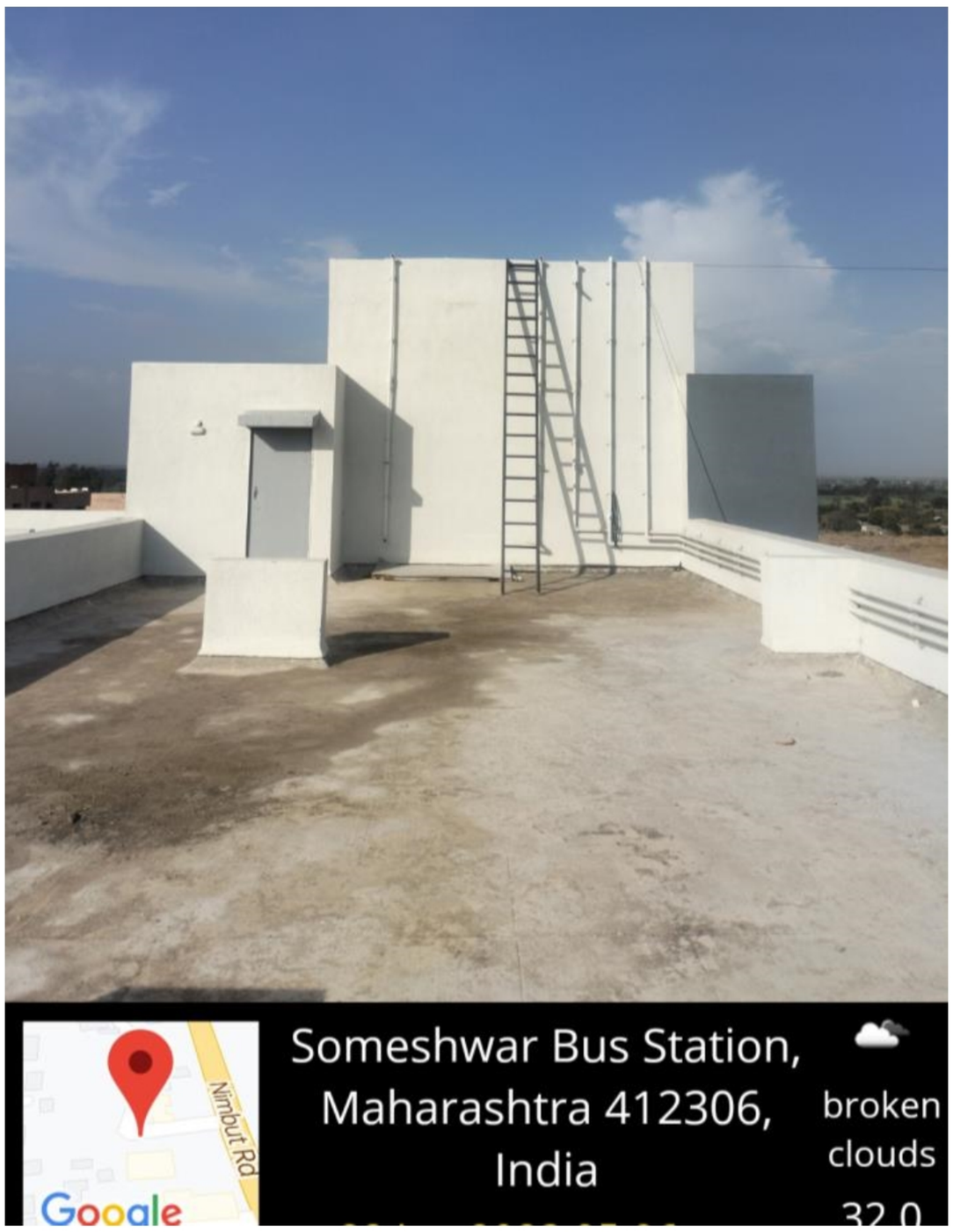
The study observed that the well belonging of Someshwar co-operative Sugar factory with **45-diameter X 38 ft. depth having more than 15 lack liter of water storing capacity** is the main source of drinking water. The Campus has separate rain water harvesting tank for general use and for gardening. Liquid waste from the points of generation like the canteen, mess, girl's hostel and all buildings toilets etc. is being let out as effluent into a proper drainage facility. Internal staff do the cleaning twice in a year and register is maintained. The institute has separate R.O plant as well as separate individual filters with coolers at various locations in the buildings for drinking water purpose.

(Drinking Water Well_)

(R.O. water purifier in the college building)

- It has been observed that no water leakage is found at cooler side or in toilets also.
- Institute has constructed **rooftop rainwater harvesting system** for water conservation. The rainwater collected through network of PVC pipeline which outlets into the soil for water conservation. Institute has separate R.O. Plant at the roof top as well as has individual water filters in the campus.

Energy Efficient Water Management: Natural head for both drinking water and general use water tank is more **than 55M from** ground level. Without electrical energy consumption, natural head of water tank is utilized to fill up overhead **drinking water and general use water tanks (Capacity: 65000 liters)** of the institute and all other buildings in the campus. All types of trees and plants have drip irrigation system for **efficient water** use without use of electricity.



(Overhead Water Storage Tank with Capacity: 65000 Liters)

(Rainwater harvesting storage tank in the institute campus)

Drinking water (Capacity: 3, 85,000 Liters) and General use water (Capacity: 2, 63,000 Liters) use arrangement and filtration plant in the Campus)

Water filter is installed to filter general use water to filter out suspended solids particles before letting the water into the buildings general use water overhead tanks.

Rain Water Harvesting arrangement at Girls Hostel)

(Rain Water Harvesting arrangement at institute building)

b) Recommendations

- Need of monitoring, controlling overflow is essential and periodically supervision drills should be arranged.

- Water efficient fittings & taps to be installed in toilets, bathrooms & to save water. Efficient and proper waste water disposal and recycling arrangement must be done.

- Drinking water testing has to be done once in 3 months. Water level monitoring & controlling overflow of water is necessary, for this implementation of automatic water level controller is essential.

- Use pervious paver blocks in the campus to avoid the rain water run-off.
- The tank cleaning should be done twice in a month. Adopt IGBC Green policy in the campus.

- Install efficient water flush fixtures. Ensure continuous monitoring of water consumption, both on supply and demand side, to identify improvement opportunities in potable water efficiency.

5.2 Energy Management and Conservation

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

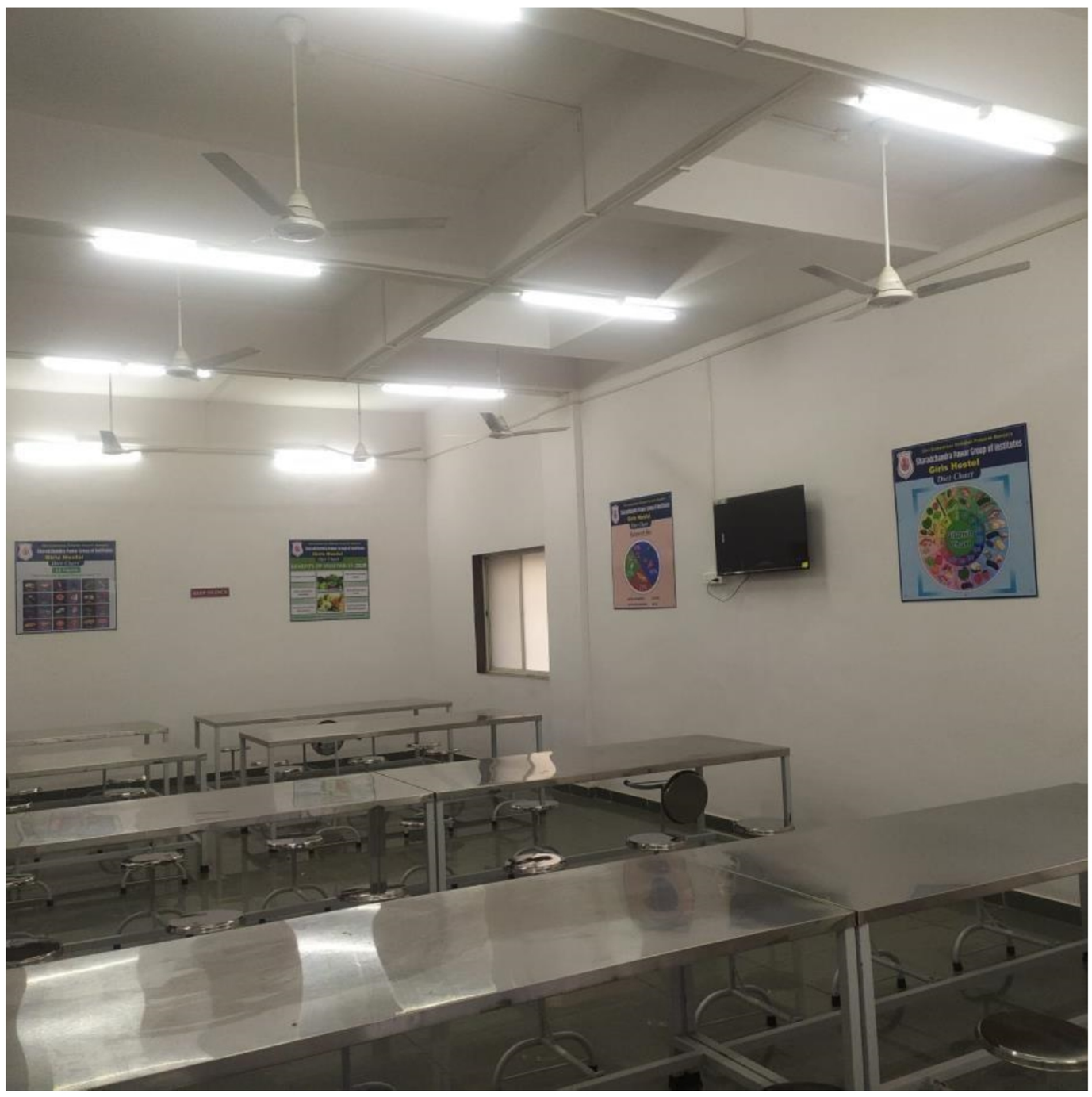
a) Observations:

The Campus of Someshwar Science College, Someshwarnagar is HT consumer with 200 KVA contract demand.

The total electricity bill for the year 2021-22 was Rs. **20,43,065./-** The average monthly electricity bill of the campus for the year 2021-22 was **Rs. 1,70,256/-** The total energy consumption for the year 2021-22 was **92,345** units. The average monthly energy consumption of the campus was **7696** KWh (units). In the year 2021-22, the average billing demand was 130 **KVA.**

It has been observed that the institute has installed solar PV roof top hot water system at the girls hostel, and energy efficient BLDC fans with 28 W capacity and all energy efficient LED clusters which helps to minimize the environmental impacts of generating energy through fossil fuels. The institute is also using 28W slim tubes from beginning itself, there is no single conventional FTL in use. LED Street lights with 100W/200W are in use in the campus.

(Solar PV Hot Water Arrangement at Girls Hostel with Capacity: 4000 Liters per Hour)



(28 W BLDC Fans and 18 W LED Tube Lights installed in the girls hostel)

(LED Street light 100/200W cluster in the Campus)

b) Recommendations

- Install integrated solar-based LED street lights (12W/20W/30W) as per requirement. It can be fitted with timers to start & stop them automatically. Replace the existing ceiling fan (80W) by energy efficient brushless DC 28-Watt fans in a phased manner
- Use occupancy sensors in office & staff rooms.
- Use sensor based 5-Watt LED bulbs in toilets and bathrooms.
- Enhance energy efficiency in the interior spaces, to optimize energy consumption, thereby reducing environmental impacts.

5.3 Waste Management

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

a) Observations

It is observed that solid waste is the highest source of waste out of total waste generated. Journal papers, Record files are the main sources of solid waste. The solid waste disposal method adopted by institute is that paper is collected in bins and handed over to concerned authority. The wet waste is generated only in common canteen and hostel mess. The large amount of waste generated from mess and canteen of the campus is collected and then it is sent through local municipal authority (Grampanchayat) for processing. Institute has signed MOU with Grampanchayat for 3 Years. There is no hazardous waste generated at college, whereas the used chemicals are diluted with water and then discharged in sand pit. The institution's key operations have less impact on the environment as the college is very conscious of generating negligible waste. Waste characterization is the first critical step

in successful waste management. Institute have a simple solid waste management system. It involves everything from collection to disposal. Paper and paper products, pens, disposable drink containers, waste food in canteen and compostable organic material etc. are the waste products in college campus. Adequate number of trash cans and dust bins are placed all over the campus. Waste is separately collected at different locations in bins based on the properties like disposable and non-disposable waste material. The vegetable waste from the canteen are arranged to be disposed regularly to keep the campus clean. Liquid waste generated from canteen comprises of food wastes, dairy products and domestic waste water is discharged in soak pit. The toilet waste is collected through piping system and discharged into septic tank.

There is a proper arrangement for building wastes segregation like dry, wet, and plastic, paper, glass and biological wastes in the campus.

E-waste of computers, electronic and electrical instruments/equipments is used for demonstration purpose to the students. Whereas outdated and scrap e-waste is handed over to local authorised scrap vendor. UPS batteries are exchanged with new batteries considering scrap values from the suppliers. The institute also takes benefit of the various buy back offers from the suppliers.

(Segregation of Dry Waste, Wet Waste and E-Waste)

b) Recommendations

1. Reduce the absolute amount of waste that is produced from college staff offices. Make full use of all recycling facilities provided by local local authority and private suppliers, including glass, cans, white, colored and brown paper, plastic bottles, batteries, print cartridges, cardboard and furniture.

2. E-waste should be collected by approved E-waste Management Company.

3. Provide sufficient, accessible and well-publicized collection points for recyclable waste, with responsibility for recycling clearly allocated.

4. Encourage the use of green consumables in the interior space that have low impacts on human health and the environment.

5.4 Green Area Management

This includes the plants, greenery and sustainability of the campus to ensure that the buildings conform to green standards. This also helps in ensuring that the Environmental Policy is enacted, enforced and reviewed using various environmental awareness programs.

a) Observations

Campus is located in very environment friendly area. Various tree plantation programs are being organized at college campus and surrounding areas by institute. This program helps in encouraging eco-friendly environment which provides pure oxygen within the institute and awareness among students. The plantation program includes various types of indigenous species of ornamental and medicinal wild plant species. Total green area in the campus is 1560 Square Meter. During trees/plants counting survey it is observed there are various trees in the institute campus which includes Neem, Sagwan, Kanchan, Bottle brush, Suru,Gulmohar, Rubber tree, Mango, Fig tree, Ashok, Badam, Chapa, Bakul, Arjun, Rain tree and many others which helps to keep healthy environment in the campus for the wellbeing of staffs and students. There are **total 291 tress of 21 varieties i**n the institute campus. There are many initiatives taken by the college to make the campus ecofriendly.

1) The college maintains the plants and greenery around the campus
2) The Tree Plantation drive are being conducted regularly.
3) Landscaping with trees and plants by using native species of Baramati region to promote natural ecological conditions.
4) NSS volunteers had actively participated in cleaning & green area awareness activity organized at historical places.
5) Use of Bicycles/ Battery powered vehicles for intercampus transport.
6) Pedestrian Friendly pathways with pervious nature to prevent rainwater runoff.
7) Ban on use of plastics in campus.
8) Restricted use of vehicles- Organization of no Vehicle Days in the campus.

(Trees Plantation activities and Greenery in the Campus)

b) Recommendations

- Establish an institute level **Environmental Committee** that will hold responsibility for the enactment, enforcement and review of the Environmental Policy. The Environmental Committee shall be the source of advice and guidance to staff and students on how to implement this Policy.
- Ensure that green audit is conducted annually and action is taken on the basis of audit report, recommendation and findings. Promote environmental awareness as a part of course work in various curricular areas, independent research projects, and community service.
- Encourage students and staff for Green campus conversion: Green Campuses can have tremendous benefits, both tangible and intangible. The most tangible benefits are the reduction in water and energy consumption right from day one of occupancy. The energy savings could range from 20 - 30 % and water savings around 30-50%.

5.5 Indoor Environment

a) Observations:

Good indoor environmental quality is essential to the health, happiness and productivity of occupants. It is observed that indoor environment of the institute is moderate. The indoor plant species are not sufficient to create healthy environment. The requirement is to have at least one plant in every 100 sq.ft of carpet area of regularly office spaces. Plants like these help in absorbing toxins like formaldehydes. This can improve the indoor air quality inside the space, besides enhancing the aesthetics. There are several factors which impact the quality of indoor environment such as:

- Access to Day lighting
- Indoor air quality
- Availability of fresh Air
- Thermal Comfort
- Cleanliness and hygiene
- CO2 monitoring
- Ergonomics and Acoustics
- Connection to the outdoor environment

b) Recommendations:

- In Future encourage the use of eco-certified interior products that consider impacts through the life cycle, thereby resulting in lower environmental impacts.
- Provide adequate outdoor air ventilation, to avoid pollutants affecting indoor air quality.
- Provide good working environment to enhance the productivity and well-being of occupants.

- Minimize the exposure of building occupants and maintenance persons to hazardous indoor and outdoor pollutants, thereby enhancing indoor air quality and occupant health.
- Promote occupant wellbeing so as to enhance physical, emotional and spiritual well-being of building occupants (Staff and students).Encourage use of indoor plants like Bamboo palm/Areca palm, Lady palm, Rubber Plant, Peace Lily, Spider Plant, Money plant, Kentia palm, Queensland Umbrella, Boston fern, Aloe Vera, Snake Plant, Mother in law's tongue, Corn or cornstalk plant which helps to removes air pollutants, removes formaldehydes, benzene, trichloroethylene, removes household chemicals & carcinogens, absorbs carbon dioxide, gives off oxygen, resistance to insects and absorbs VOC.

Bio-diversity in the Campus: Biodiversity – the variety of all living things forms the foundation of the processes that we rely on for life: clean air, clean water, soil formation, carbon and nutrient cycling and pollution remediation. The five ways in which biodiversity supports our economies and enhances our wellbeing and has the potential to do even more.

- **Biodiversity helps fight disease**
- **Biodiversity ensures health and food security**
- **Biodiversity benefits business**
- **Biodiversity provides livelihoods**
- **Biodiversity protects us**

Institute has created good atmosphere and clean environment in the campus by planting various trees to maintain biodiversity in the campus.

(Someshwar Science College's Campus Biodiversity)

6. Conclusion

In the Someshwar Science College, Someshwarnagar, the audit process involved initial interviews with management to clarify policies, activities, records and the co-operation of staff and students in the implementation of mitigation measures. Staff and students were given training how to collect the data for the green audit process In addition, the approach ensured that the management and staff are active participants in the green auditing process in the college. The baseline data prepared for the Someshwar Science College, Someshwarnagar will be a useful tool for campus greening, resource management, planning of future projects, and a document for implementation of sustainable development of the college. Existing data will allow the college to compare its programs and operations with those of peer institutions, identify areas in need of improvement, and prioritize the implementation of future projects. The green audit reports assist in the process of attaining an eco-friendly approach to the sustainable development of the college. Hope that the results presented in the green auditing report will serve as a guide for educating the college community on the existing environment related practices and resource usage at the college as well as spawn new activities and innovative practices. We expect that the management will be committed to implement the green audit recommendations. We are happy to submit this green audit report to the authorities of Someshwar Science College, Someshwarnagar, Tal: Baramati, Dist:Pune. Based on the Green audit conducted at your institute you are complying with all-important requirements of NAAC committee.

CERTIFICATE

This is to certify that "Supreme Electrical Energy and Consultancy Services, LLP", Pune has conducted Energy Audit of "Someshwar Science College, Someshwarnagar, Tal: Baramati, Dist: Pune-412306". It has been observed that the campus has taken initiatives to implement various energy efficiency measures (ECM's) by identifying various energy conservation opportunities (ECO's) to conserve electrical energy but also started utilizing energy from hybrid renewable energy sources like wind Power and roof top Solar PV system.

Sanjay A. Deokar
R.No.
EA 4494
Certified Energy Audit

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Dr. Sanjay A. Deokar

BEE Certified Energy Auditor (EA- 4494)

Indian Green Building Council (AP)

Environmental Lead Auditor (ISO:14001-2015)

Energy Audit Report For

Someshwar Science College,Someshwarnagar

Taluka- Baramati, Dist:Pune, Maharashtra- 412306 Phone No: 02112-283187

E-mail Id: svm.principal@yahoo.com

Website: https://www.someshwarsciencecollege.org

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Supreme Electrical Energy and Consultancy Services LLP, Pune.

Year:2021-22

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PREFACE

Energy management and audit is a process including Inspection, Survey & Analysis of energy flows for energy conservation in a building, a process or a system to reduce the amount of energy input into the system without negatively affecting the output. It is the translation of conservation ideas into realities, by evolving technically feasible solutions with economic and other organizational considerations within a specified time.

An energy audit is a study of a plant or facility to determine how and where energy is used and to identify methods for energy savings. There is now a universal recognition of the fact that new technologies and much greater use of some that already exist provide the most hopeful prospects for the future. The opportunities lie in the use of existing renewable energy technologies, greater efforts at energy efficiency and the dissemination of these technologies and options.

This Energy Audit of Someshwar Science College, Someshwarnagar, Tal: Baramati, Dist: Pune-412306 campus is just one step towards our destination of achieving energy efficiency and we would like to emphasize that an energy audit is a continuous process. We have compiled a list of possible actions to conserve and efficiently utilize our scarce resources and identified their savings potential. The next step would be to prioritize their implementation. We look forward with optimism that the institute authorities, staff and students shall ensure the maximum execution of the recommendations and the success of this work. We are also thankful to the other staff members who were actively involved while taking measurements and conducting field study.

Dr. Sanjay A. Deokar
BEE Certified Energy Auditor (EA- 4494)
Indian Green Building Council (AP)
Environmental Lead Auditor (ISO:14001-2015)

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Dr. Sanjay A. Deokar

BEE Certified Energy Auditor (EA- 4494)

Indian Green Building Council (AP)

Environmental Lead Auditor (ISO:14001-2015)

LIST OF INSTRUMENTS USED:

Three Phase Power Analyzer (Dranetz, USA)

Single Phase Power Analyzer (ALM 10, Germany)

Lux meter, Power guard, Multimeter, Contact Thermometer, Tachometer.

SITE VISIT

Organization Name:	Someshwar Science College, Someshwarnagar.
Site Name & Address:	At/Post: Someshwarnagar, Taluka- Baramati, Dist: Pune, Maharashtra- 412306. Website: www.secsomeshwar.ac.in
Energy Auditor:	1. Dr. Sanjay A. Deokar (ME, PhD-Electrical Engg.) BEE Certified Energy Auditor (EA- 4494) Indian Green Building Council (AP) Chartered Engineer(IEI) Environmental Lead Auditor (ISO:14001-2015) [supremeelectricalenergy@gmail.com] [M:9823141287] 2. Dr. Laxman Godse (ME, PhD-Electrical Engg.) BEE Certified Energy Auditor.(M:8856844936)

1. INTRODUCTION

1.1 Energy Audit

Energy plays a key role in the development and growth of the economy. The Government of India has put special emphasis to ensuring adequate, reliable, secure and cost effective supplies and to utilizing energy resources efficiently while minimizing the negative impacts on the environment. To ensure that there is sustainability of energy in the future, energy audit activities are necessary to determine suitable steps to be undertaken to use energy efficiently. An energy audit is an examination of the energy consumption of the equipment or system to ensure that energy is being used efficiently. This is one of the responsibilities of the Registered Electrical Energy Manager (REEM). This is a guideline for Registered Electrical Energy Manager (REEM) during their energy audit exercise. REEM should not be bound with this guideline but they have to establish their own justification in order to meet the facilities requirement according to the types and purposes such as offices, hotels, shopping complexes, hospital, college/universities etc
Objectives:

i) To set minimum standards for undertaking detailed energy audit.

ii) To guide REEM, asset owner and/or operator to identify Energy Conservation Measures (ECMs) in buildings.

1.2 Energy Audit Definitions

There are several definitions of an energy audit. Some guidebooks define energy audit as a systematic, documented verification process of objectively obtaining and evaluating energy audit evidence, in conformance with energy audit criteria and followed by communication of results to the client1 (CIPEC 2002). In the Indian Energy Conservation Act 20012 (BEE 2008), an energy audit is defined as the verification, monitoring and analysis of the use of energy and

submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption. An energy audit is a study conducted to identify where, when and how much energy is being used in the business and how to reduce the cost of energy for the business. Even though there are several definitions, the objective or goal is the same which is to reduce the energy consumption without compromising comfort and quality of the building. This guideline is meant for REEM who have basic understanding on energy audits, for them to conform to the requirements of the Efficient Management of Electrical Energy Regulations 2008 (EMEER 2008).

1.2.1. Walk-through/preliminary Energy Audit

Walk-through audit is a process used to establish an overall picture of the potential of energy savings through visual inspection of the premises including air conditioning system, lighting, metering, building automation, building maintenance and other factors affecting energy consumption of the building. References to the records of equipment ratings, technical catalogues, operation and maintenance (O&M) manuals that are readily available will be very helpful to quickly determine whether equipment or systems are operating efficiently. Calculation, usually simple in nature, should be done to quantify the savings achievable for implementation of the identified Energy Conservation Measures (ECMs).

The walk-through/preliminary energy audit usually is carried out in one or two days by either REEM alone or with a team, depending on the size, complexity of the building and the scope of audit. Usually, simple instruments such as a clamp amp meter, thermometer, hygrometer (humidity meter) and lux meter will serve the purpose.

1.2. 2. Detailed Energy Audit

The detailed energy audit involves in-depth investigations into how the energy is currently being consumed, current performance of the existing systems and identification of various potential Energy Conservation Measures. It also gives the estimated cost and simple payback periods for all recommended Energy Conservation Measures.

The detailed energy audit involves the following four (4) main processes:

i) Data collection

ii) End-use load distribution

iii) Identification of Energy Conservation Measures

iv) Reporting and presentation

1.3. Detail Energy Audit Process

1.3.1. Data Collection

One of the key tasks in Energy Auditing is the collection of all energy related data required by the REEM to apportion the total facility energy consumption into various energy end-uses. The collected data is then used to build a reliable picture of where and how much energy is being consumed and the cost of energy being used at the building. Data collection is one of the most laborious tasks in Energy Auditing and inability to collect the required data will lead to less reliable Energy Audit results.

One of the difficulties faced by the REEM in order to establish the building's major end-use demands (air-conditioning, lighting and general equipment) is the limited or lack of building metering equipment. To be able to estimate reliably the major building's end-use demand, it is recommended that the REEM uses the following three steps to identify the building end-use demand:

a) Desktop data collection

b) Field data collection

c) Cross checking of load demand data

The process of carrying out these three steps of data collection is explained in the following paragraphs:

a) Desktop Data Collection

The purpose of desktop data collection is to minimize the field energy related data collection by using all available facility data. It would be advisable during the initial process to collect preliminary building energy related data using a Building Detailed Audit form. This form allows the REEM to understand the nature of the audited building and areas to focus on during the auditing. The data collection through the form can be used to estimate the time and manpower required for the field data collection activity later.

To minimize the time and manpower for the field data collection, the REEM should try to gather energy related data as much as possible using available resources such as:

i) Architectural drawings (as built drawing)
ii) Mechanical & Electrical drawings
   - Lighting circuit drawings (as built drawing)
   - Air conditioning system drawing and design manual (as built drawing)
   - Single line power supply schematic drawings (as built drawing)
iii) Electrical energy bill historical data (for at least one year)
iv) Load control systems such as timers, building automation system if any and others (as built drawing)

The REEM will use all desktop available energy related data to estimate the current building major energy end-uses.

The desktop data gathering should be considered as a first step of data collection, which will be complemented and verified during the Field Data Collection process.

b) Field Data Collection

The field data collection is a critical step for:

i. Complementing the missing data, which the REEM could not find during the Desktop Data Collection process.
ii. Verifying the accuracy of Desktop Data.
iii. Understanding closely the building operations, energy wastages and building maintenance status.

iv. Carrying out the necessary field measurements required to establish main incoming load profile, major energy end-uses such as Heating Ventilation and Air Conditioning (HVAC), lighting and others. Establishing actual building load apportioning.

c) Cross Checking of Load Demand Data

The accuracy of estimated end-use energy consumption will affect the accuracy of estimated energy savings of various building ECMs. Therefore, for reliable estimate of the building and end-use energy consumption, it is recommended to use the following approach:

Use the field data collected to estimate the building's total and end-use energy consumptions. Due to a number of assumptions used in this method, in particular the equipment loading and time usage factors, the accuracy in estimating the building total end-use energy consumption may vary depending on the loads measured. For instance, due to the predictable nature of lighting load, this method allows reliable determination of the building lighting load.

Use appropriate data loggers to record the building and end-use load cycles. For example, it is recommended to record typical daily load profiles of main incoming for seven (7) days, one (1) to seven (7) days for HVAC system and one (1) hour to one (1) day for other equipments.

The logged data can be used to verify the accuracy of the estimated building total and end-use energy consumption generated by the desktop data collection. If there is a large deviation between the end-use loads estimated by desktop data collection and the end use loads estimated by field data collection, the REEM should alter the assumptions (equipment loading and time usage factors) applied in estimating the building equipment loads used in the desktop data collection to reduce these deviations to an acceptable range. REEM should take into account other factors such as seasonal variations and occupancy changes during the year that may affect overall energy consumption.

1.4 Analysis and Identification of Energy Conservation Measures (ECMs)

The effectiveness of an energy audit is related to the understanding in depth of the nature and operations of the audited building by the REEM. Knowing the acceptable level of comfort

and tolerance for lighting, temperature and humidity level by employees are essential to come up with effective and acceptable ECMs.

1.5 About Institute & Facility Description: -

The Institution aims at imparting education that is man making, character building and creating an ideal citizen in the global perspective. Such education is imparted that may boost career opportunities for self-fulfilment. Shri Someshwar Shikshan Prasarak Mandal's Someshwar Science College, Someshwarnagar is a leading and well known College in Maharashtra. The institute is affiliated to Savitribai Phule Pune University (SPPU).The College was established in 2007 with the objective of providing quality technical education and to help rural students to match contemporary global requirements. It is financially supported by Someshwar Sahakari Sakhar Karkhana Ltd. Someshwarnagar Tal: Baramati, Dist: Pune. The institute offers various UG and PG Courses as per Savitribai Phule Pune University Curriculum.

Vision: To impart excellent quality education to the students, in the field of science & technology so that they become a responsible citizens, dedicated employers & intelligent researcher by which society will leads morally, economically strong, & literate.

Mission:

- To provide excellent quality of education, knowledge & skill to the students.
- To create the research environment in teachers & students.
- To encourage the faculty and students to pursue academic Excellence.
- To inspire the students for global competition in the field of science & technology.
- To enhance leadership qualities among the students.
- To promote the education as vehicle for rural development and capability enhancement of students.
- To sculpture students into responsible citizens for betterment of nation.

1.6 Methodology Adopted -

Pre-audit stage:

Defining scope of energy audit

Forming an energy audit team

Estimating time frame

Collecting building information

Energy audit stage:

Conducting site inspection and measurement

Analyzing data collected

Preparing energy audit report

Post-audit stage:

Implementation of energy management opportunities

Monitoring and review.

Energy Audit has conducted as per the guidelines of Bureau of Energy Efficiency (BEE)

- Relevant Data collection like inventory list of lighting fixtures, pumps, air cconditioner and other equipment's.
- Measurement of main supply Voltage, Current, p.f., kW, kVAR, kVA and Voltage & Current Harmonics are done at the LT side of the Transformer and trend is recorded.
- Measurement of power consumption load centers at distribution panels.
- Analysis of the past data for understanding the consumption pattern.
- Recommendation of energy improvement projects and methods to reduce the energy cost.
- Analysis of Techno-economic feasibility of the project with simple payback.

2. ENERGY CONSUMPTION PATTERN

2.1 Electricity Bills:-

The Electricity Bill of a utility consists of

- Maximum demand
- Load factor
- Power Factor (PF) incentive
- Time of Day Tariff (TOD tariffs)

Maximum Demand:

Maximum demand is the highest average kVA recorded during any one-demand interval within the month. The demand interval is normally 30 minutes, but may vary from utility to utility from 15 minutes to 60 minutes. The demand is measured using a tri-vector meter / digital energy meter.

Load Factor:

Load factor is the ratio of average load to maximum-billed load. It is an indicating parameter to show if maximum demand can be reduced. The monthly load factor is calculated as follows:

$$\text{Load Factor} = \frac{\text{Actual units consumed}}{\text{Maximum demand X No of hours per month X Average P.F.}}$$

P.F incentives:

PF is the ratio of ACTIVE POWER to APPARENT POWER.

Thus,

PF = KW/KVA.

Hence, PF can be maintained by controlling the Maximum Demand.PF can also be improved by installing a capacitor bank at the connected load as per the requirement the rating of the capacitor bank directly depends upon the desired and the existing PF which is given by the relation:

kVAr Rating = kW [tan φ1 – tan φ2]

Where,

KVAr rating= No. of capacitors required.

tan φ1=Existing Power Factor.

tan φ2=Improved Power Factor.

As per the MSEDCL tariff, whenever average power factor in a month, is more than 0.95, following incentives are offered:

For every 0.01 improvement of average PF above 0.95, an incentive of 1% of the amount of monthly energy bill, (excluding Regulatory Liability Charge (RLC), Demand Charges, Fuel and Other Cost Adjustment Charges (FOCA), Electricity Duty) is offered.

For PF of 0E.99 the effective incentive will amount to 5% of the energy charges, and for unity PF the effective incentive will amount to 7% of the energy charges.

TOD Tariff:

Time of Day metering (TOD), also known as Time of Usage (TOU) or Seasonal Time of Day (SToD), metering involves dividing the day, month and year into tariff slots and with higher rates at peak load periods and low tariff rates at off-peak load periods. While this can be used to automatically control usage on the part of the customer (resulting in automatic load control), it is often simply the customer's responsibility to control his own usage, or pay accordingly (voluntary load control). This also allows the utilities to plan their transmission infrastructure appropriately. See also Demand-side Management (DSM).

TOD metering normally splits rates into an arrangement of multiple segments including on peak, off-peak, mid-peak or shoulder, and critical peak. A typical arrangement is a peak

occurring during the day (non-holiday days only), such as from 1 pm to 9 pm Monday through Friday during the summer and from 6:30 am to 12 noon and 5 pm to 9 pm during the winter. More complex arrangements include the use of critical peaks, which occur during high demand periods. The times of peak demand/cost will vary in different markets around the world.

For all HT consumers the Time of Day (TOD) tariff is applicable in Maharashtra. For this purpose the day has been divided into 4 different time zones as given in table

Zone	**Consumption during following hours of the day**	Energy charge (p/u)
A	2200- 0600 hrs	-1.50
B	0600-0900 hrs	0
	1200-1800 hrs	0
C	0900 to 1200 hrs	0.80
D	1800-2200 hrs	1.10

The SSSPM's, **Someshwar Science College,** Someshwarnagar is HT consumer with 200 KVA contract demand.

Sr. No	Unit	Meter No.	Contract Demand	Connected Load	Category
1	1	186769051470	200KVA	400KW	146 HT-VIII B

The total electricity bill for the year 2022-23 (was Rs. **20,43,065./-** The average monthly electricity bill of the campus for the year 2022-23 was **Rs. 1,70,256/-** The total energy consumption for the year 2022-23 was **92,345** units. The average monthly energy consumption of the campus was **7696** KWh (units). In the year 2022-23 the average billing demand was 130 **KVA.** As HT express feeder connection is common for all institute in the campus. At

present connected load of Someshwar Science College, Someshwarnagar is 35 KW which contribute to 25% of total connected load in the campus.

(**Note: 1.** The billing unit & yearly energy consumption is at actual mentioned on Electricity bill.)

Impact of Solar PV Roof Top hot water system System at girls Hostel:

The solar radiation incident on the surface of the earth can be conveniently utilized for the benefit of human society. One of the popular devices that harness the solar energy is solar hot water system (SHWS). A solar water heater consists of a collector to collect solar energy and an insulated storage tank to store hot water. The solar energy incident on the absorber panel coated with selected coating transfers the hat to the riser pipes underneath the absorber panel. The water passing through the risers get heated up and is delivered the storage tank. The re-circulation of the same water through absorber panel in the collector raises the temperature to 80 C (Maximum) in a good sunny day. The total system with solar collector, storage tank and pipelines is called solar hot water system. Broadly, the solar water heating systems are of two categories. They are closed loop system and open loop system. In the first one, heat exchangers are installed to protect the system from hard water obtained from bore wells or from freezing temperatures in the cold regions. In the other type, either thermosiphon or forced circulation system, the water in the system is open to the atmosphere at one point or other. The thermosyphon systems are simple and relatively inexpensive. They are suitable for domestic and small institutional systems, provided the water is treated and potable in quality. The forced circulation systems employ electrical pumps to circulate the water through collectors and storage tanks. The choice of system depends on heat requirement, weather conditions, heat transfer fluid quality, space availability, annual solar radiation, etc. The SHW systems are economical, pollution free and easy for operation in warm countries like ours. Based on the collector system, solar water heaters can be of two types. Flat Plate Collectors (FPC) based Solar Water Heaters The solar radiation is absorbed by Flat Plate Collectors which consist of an insulated outer

metallic box covered on the top with glass sheet. Inside there are blackened metallic absorber (selectively coated) sheets with built in channels or riser tubes to carry water. The absorber absorbs the solar radiation and transfers the heat to the flowing water. There are 60 BIS approved manufacturers of Solar Flat Plate Collectors. Evacuated Tube Collectors (ETC) based Solar Water Heaters Evacuated Tube Collector is made of double layer borosilicate glass tubes evacuated for providing insulation. The outer wall of the inner tube is coated with selective absorbing material. This helps absorption of solar radiation and transfers the heat to the water which flows through the inner tube. There are 44 MNRE approved ETC based solar water heating suppliers. Solar water heating is now a mature technology. Wide spread utilization of solar water heaters can reduce a significant portion of the conventional energy being used for heating water in homes, factories and other commercial and institutional establishments. Internationally the market for solar water heaters has expanded significantly during the last decade. Salient Features of Solar Water Heating System Solar Hot Water System turns cold water into hot water with the help of sun's rays. ¾ Around 60 deg. – 80 deg. C temperature can be attained depending on solar radiation, weather conditions and solar collector system efficiency ¾ Hot water for homes, hostels, hotels, hospitals, restaurants, dairies, industries etc. ¾ Can be installed on roof-tops, building terrace and open ground where there is no shading, south orientation of collectors and over-head tank above SWH system ¾ SWH system generates hot water on clear sunny days (maximum), partially clouded (moderate) but not in rainy or heavy overcast day ¾ Only soft and potable water can be used ¾ Stainless Steel is used for small tanks whereas Mild Steel tanks with anticorrosion coating inside are used for large tanks ¾ Solar water heaters (SWHs) of 100-300 litres capacity are suited for domestic application. ¾ Larger systems can be used in restaurants, guesthouses, hotels, hospitals, industries etc.

Fuel Savings: A 100 litres capacity SWH can replace an electric geyser for residential use and saves 1500 units of electricity annually.

Avoided utility cost on generation: The use of 1000 SWHs of 100 litres capacity each can contribute to a peak load shaving of 1 MW.

Environmental benefits: A SWH of 100 liters capacity can prevent emission of 1.5 tons of carbon dioxide per year.

Life: 15-20 years.

Approximate cost: Rs.15000- 20,000 for a 100 liters capacity system and Rs.110-150 per installed liter for higher capacity systems.

Payback period: 3-4 years when electricity is replaced.

(4000 Liter/hour Solar roof top hot water system at girls hostel)

Impact of Eenergy efficient LED Clusters and BLDC fans at girls hostel:

More then 50 % electrical enegy has saved by using various energy efficiency measures.

(BLDC fans and LED Tube Lights installed in the girls hostel)

(LED Street light 100/200W cluster in the Campus)

3. ENERGY EFFICIECY RECOMMENDATIONS

It has been observed that the load on the campus is not constant as well as during the time of day (TOD) energy consumption also varies significantly. The contribution of lightning load, fan load and computers are found to be dominant. So there is a wide area to reduce energy consumption by replacing the conventional appliances by new highly efficient appliances. This could find the major & economically viable solution to reduce energy consumption & ultimately leads to reduction in electricity bill. For calculating the power consumption, it is required to have the diversity factor, as the facility working period is considered the diversity factor is assumed to be 0.4 (i.e,40%) it signifies that the 40% load consumption out of 100% total connected load. The working days for the college premises are 240 days while working hours are 7 hrs this will give the exact energy consumption. The commercial rate according to tariff scheme is on an average Rs.12.0/unit. The required data will also include the various ratings of conventional as well as efficient appliances.

3.1 Replace existing ceiling fan (80W) by energy efficient fans (28 W BLDC Motor fans).

The overall benefit by this replacement is:

Old Fitting:

Type fitting	: 80W ceiling fans
No of Fitting	: 154Nos.
Total Wattage	: 12320 Watts.
Operating Hours	: 300 days x 7 hours = 2100 hrs.
Electricity Consumed per year	: 25872(Units)
Electricity Rate	: Rs.12.0 per unit
Annual Electricity Cost	**: Rs.3, 10,464.00**

New Fitting:

Type fitting	: **28** W Energy efficient fans
No of Fitting	: 154 Nos.
Cost of fitting	: Rs.3500 (per fitting)
Total Investment for fitting	**: Rs. 5,39,000/-**
Operating Hours	: 330 days x 7 hours = 1680 hrs.
Electricity Consumed per year	: 7245 kWh (Units)
Electricity Rate	: Rs.12.0 per unit
Annual Electricity Cost	**: Rs.86,930.00**

Simple payback period:

Net annual saving	: Rs. 3,10,464.00- Rs.86, 930.00 = **Rs.2,23,534.00/-**
Simple payback period	: Total Investment / Net Annual Saving
	: 2.54 Years**.**

Existing 80 W Fan ***Proposed 28 W BLDC energy efficient fan***

3.2 Sensor based solar operated led outdoor light

An LED based solar street lighting system aims at providing solar electricity for operating LED lights for specified hours of operation per day. Rapid developments in solar cells, LED lighting and energy storage are creating great opportunities for solar-powered solid-state lighting.

It is recommended to installed sensor based all in one integrated solar operated LED street lamp in the campus.

3.3 Principal/Director/Head of Department (HOD) cabin IOT automation:

Mobile based IOT system can be installed in the Principal/Directors/HOD cabin to control electrical devices in the campus. It will helps to reduce energy consumption.

Load Factor Incentive: The Commission has retained the Load factor incentive for consumers having Load Factor above 75% based on contract demand. Consumers having load factor over 75% upto 85% will be entitled to a rebate of 0.75% on the energy charges for every percentage point increase in load factor from 75% to 85%. Consumers having a load factor over 85 % will be entitled to rebate of 1% on the energy charges for every percentage point increase in load factor from 85%. The total rebate under this head will be subject to a ceiling of 15% of the energy charges for that consumer.

Energy Saving in Computers: For energy savings, consider the following guidelines:

- Enable the sleep mode on your monitor if you are not going to use your PC for more than 20 minutes.
- Switch off both the CPU and monitor if you are not going to use your PC for more than 2 hours. **ENERGY STAR-labelled computers use 30%-65% less energy than computers without this designation, depending on usage. Consider buying a laptop for your next computer upgrade; laptops use much less energy than desktop Computers.**

It is strongly recommended to maintain load factor above 0.75 to avail L.F incentives.

Solar PV Roof Top Net Metering System: It is strongly recommended to install 40 KW solar PV roof top net metering system, which will substantially contribute to reduce power consumption from Grid as well as it helps to keep the environment clean. The payback period would be less than 4 years by taking the benefit of 30 % government subsidy.

Important of Carbon Credit:

In India, being a tropical country, solar energy has largest potential than other green energy sources. But all technologies of electricity generation do have carbon footprint (CFP), which is the total amount of CO_2 and other GHG, emitted over the full life cycle of the processes. The utilization of solar energy is usually accomplished by using photovoltaic (PV) cells and modules. This technology is often referred to as low carbon or carbon neutral because they do not emit CO_2 during its operation. However, it is not carbon-free form of energy generation, because CO_2 emissions do arise in other phases of its life cycle such as during extraction, construction, maintenance and decommissioning. These cells are extracted from silica (quartzite sand) at high temperature. Production of silicon cells (called as silicon wafers) from silica can be regarded as the direct non-green part of the technology and contributes significant fraction to CFP.

Solar technology is encouraged due to its low CFP compared with the fossil fuel technology and also for carbon credit (CC) by way of reduction of CO_2 emission in the environment. The CC trading (Emission trading) is an administrative approach that provides economic incentives for achieving reductions in the emission of pollutants and is a tradable permit scheme. International treaties such as the Kyoto Protocol set quotas on the amount of GHG which a country can produce. Countries in turn set quotas on the emissions of businesses. Again, the businesses that are over their quotas must buy CC for their excess emissions, while businesses that are below their quota can sell their remaining credits. Even, the credits can be exchanged between businesses or bought and sold in international markets (Chicago Climate Exchange and European Climate Exchange) at the prevailing market price. Study reveals that during 2005–06,

European and Japanese Companies were the major buyers and China was the major seller of the CC. Again, the amount of CC earned is obviously associated with the amount of solar electricity produced, which usually depends on climatic conditions of the area and also the efficiency of the cells along with other prevailing conditions. Hence, there are large variations on the extent of solar energy production using PV cells and, consequently, on the CC earned as well as on the contribution of CO_2 emission to CFP. The solar energy is considered as an important alternative to mitigate GHG emission in India as the country receives considerable amount of solar radiation. In this context, it is posing a serious question whether this technology is reducing CFP or contributing to CFP and to what extent? This estimation is extremely important for planning the combination of energy generation system to be used in the country. Literature survey reveals that the studies on this aspect are very rare.

This has reinforced the present study to estimate the following: (i) to quantify the degree of solar energy production; (ii) to reveal the amount of carbon credit earned per megawatt-hour per year by using this green technology; and (iii) to quantify the amount of direct CO_2 generation per megawatt-hour per year during the extraction of silicon wafers used in a PV module using real-life data and also to highlight the contribution of this CO_2 to CFP in the India.

Carbon Credit calculation for 40 KW Solar PV Plant:

During 22 years, the 40 kW plant can generate 30000 (Units)/per year with 300 clean sunny days, average 2.5 units per KW), 660000 KWh(Units) Energy(660Mwh).

On considering the average value of 0.932 tonnes of CO_2 emission reduction per megawatt-hour of electricity. In this Plant, CO_2 emission reduction per megawatt-hour for 22 years as per the calculation will be 660 × 0.932 = 618.42 tonnes.

As pointed out earlier, if this value is traded at the rate of 40$/tonnes, at the end of 22 years total amount earned will be 618.42 × 40 = 24,736.80$ *82 = Rs. 20,28,417.60.00.

Energy Efficiency Measures Implanted in the Campus:

3.4 Energy efficiency of Water Pumping systems:

The most significant savings in the energy consumption of a pumping system can be achieved by selecting the most appropriate pump technology and Energy efficient motors star rated motors. For an application with premium efficiency. This selection process starts with gaining a complete understanding of the application, fluid characteristics and flow demands. Matching the most appropriate pump construction with the optimum impeller design will result in the most cost-effective solution, both in terms of initial capital investment and long-term operating costs.

The correct sizing of the pump represents the next most significant economic opportunity to reduce energy consumption. Oversizing often occurs in the design phase by the customer, because it is quite common to add multiple safety factors to the required head and flow values. Therefore, an over-sized pump is selected and, consequently, the pump does not run within its best efficiency area during normal production, resulting in a considerable waste of energy.

Replacing a pump with a new, high-efficiency design reduces the energy consumption normally by between 3% and 20%, but in some cases, there can be as much as a 50% reduction.

Factors such as pipe size (diameter), overall pipe length, pipe surface roughness, as well as control valves will influence the system pressure drop and resulting energy consumption for the system. Replacing an over-sized pump with a more suitable design size brings a great potential for savings. In some cases, significant savings can also be achieved by modifying the existing pump with a different kind of impeller or adding a VSD. At the same time, it is imperative that you take care of energy efficiency while pumping procurement itself. Choosing pump manufacturers who have a good record of accomplishment of energy efficient pumps will be advantageous. A minor drop in the energy efficiency of pumps across the plant can lead to a major cumulative loss to the system. Hence, whenever you are procuring new pumps always keep the energy efficiency of pumps as one of the deciding factors and opt for a reputed pump manufacturer that can provide you with good quality and energy efficient pumps.

- ✓ **Institute has implemented various energy efficiency measures in the campus i.e. 100% use of 9W/18W LED lights (287 Nos) in the College Building and 100/200 Watts 20 LED Street lights in the campus and in hostel building.**
- ✓ **Automatic Power Factor Correction Bank has installed at the distribution side which has helped to maintain power factor almost unity.**
- ✓ **Institute has started utilizing energy from renewable energy resources (i.e. Solar PV hot water system having capacity of 4000 liters per hours).**

CONCLUSION

The total electricity bill for the year **2022-23** was Rs. **20,43,065./-** The average monthly electricity bill of the campus for the year **2021-22** was **Rs. 1,70,256/-** The total energy consumption for the year **2021-22** was **92,345** units. The average monthly energy consumption of the campus was **7696** KWh (units). In the year **2022-23**, the average billing demand was 130 **KVA. At present connected load of the campus is 35 KW,** which includes electric motor load, lighting load, computer load, Laboratory equipment's, and other load. Institute has implemented various energy conservation measures in the campus, which has helped to reduce large amount of Electrical Energy consumption. Management is planning to install 40 kW roof top solar net metering system in the campus.

Clean and Green Campus Initiatives

Clean Campus:

To maintain cleanliness in the campus, our esteemed institution, Someshwar Science College holds a steadfast commitment to the principles of reducing, reusing, and recycling for a sustainable future. As part of our comprehensive environmental policy, we have successfully implemented a plastic-free campus initiative, resulting in a significant reduction of polythene waste within our premises.

To ensure effective waste management, we have implemented a meticulous waste segregation system. This system includes the maintenance of standardized color-coded dustbins, enabling the efficient sorting of different types of waste materials. Furthermore, our emphasis on minimizing paper waste has led us to adopt the practice of utilizing one-sided papers for printing, thus fostering a paperless office environment.

In addition, we are committed to responsible disposal of degradable and non-degradable waste, such as papers, chocolate wrappers and waste generated in the girl's hostel mess. This waste is diligently handed over to the local Grampanchyayat, with whom we have signed a Memorandum of Understanding (MoU) to ensure proper management and disposal.

Through our collective efforts and partnerships, Someshwar Science College is actively working towards creating a sustainable and eco-friendly campus, setting an example for others to follow.

Colored dustbins in campus.

Someshwar Science College COLLEGE CODE 827

Principal
Someshwar Science College,Someshwarnagar

Green Campus:

To make campus filled with greenery we have planted many native and ornamental trees in the campus.

We are running a ‘Project Someshwar Devrai’ in which we have planted more than 400 plants belonging to 110 native, medicinal and ***Nakshatra*** species.

Tree plantation in the college premises

Shri Someshwar Shikshan Prasarak Mandal's

SOMESHWAR SCIENCE COLLEGE

Someshwarnagar, Baramati.

A detailed report on

Project Someshwar Devrai

“Project Someshwar Devrai”

The botanical garden and ex-situ plant conservation project of Shri Someshwar Shikshan Prasarak Mandal’s Someshwar Vidynan Mahavidyalaya, Someshwarnagar, Baramati.

On the occasion of the 61st birthday of Hon. Shri. Ajitdada Pawar (Leader of Opposition, Maharashtra Legislative Assembly) we have developed ‘Someshwar Devrai’ on the premises of Shri Someshwar Shikshan Prasarak Mandal, Someshwarnagar, Baramati. The project ‘Someshwar Devrai’ was headed by the Department of Botany of Someshwar Vidnyan Mahavidyalaya and contains more than 100 native plant species planted on the total ground area of One and Half Acre.

<u>Insights of the Project:</u>

- 4 plants of 100 native species are planted in the Someshwar Devrai.
- The project contains native fruit plants, flowering plants, medicinal plants, and all the Nakshatra plants.
- The conservation of plants is the primary motive of this project
- This project will surely help to nature, and the environment and also be helpful for the students, researchers, and professors of Life Science.

The floral diversity of "Someshwar Devrai", the botanical garden developed by the Department of Botany of SSSPM's Someshwar Vidynan Mahavidyalaya, Someshwarnagar, Baramati.

Flowering Plants / फूल झाडे

***Plumeria alba* L.**	Apocynaceae	चाफा
***Wrightia tinctoria* R.Br.**	Apocynaceae	काळाकुडा
***Tabernaemontana divaricata* R.Br.**	Apocynaceae	तगर
Aristolochia littoralis L.	Aristolochiaceae	बदक वेल
***Dolichandrone falcata* Seem.**	Bignoniaceae	मेढशिंगी
***Heterophragma quadriloculare* K.Schum.**	Bignoniaceae	वारस
***Markhamia lutea* Seem. ex. Baill**	Bignoniaceae	मारखामिया
***Spathodea companulata* Buch.-Ham.**	Bignoniaceae	पिचकारी
***Tabubuia rosea* D.C.**	Bignoniaceae	तबूबुइया
***Cordia dichotoma* G.Forst**	Boraginaceae	भोकर
***Combretum indicum* DeFilipps**	Combretaceae	मधू मालती
***Dillenia indica* L.**	Dilleniaceae	करमळ
***Clitorea ternatea* L.**	Fabaceae	गोकर्ण
***Cassia fistula* L.**	Fabaceae	बहावा
***Erythrina variegata* Murr.**	Fabaceae	पांगारा
***Cleredendrum thomsoniae* Balf. f.**	Lamiaceae	ब्लीडिंग हार्ट
***Gmelina arborea* Roxb.**	Lamiaceae	शिवण

Bauhinia variegata Benth.	Leguminaceae	कांचन
***Saraca asoca* (Roxb) W.J. de Wilde**	Leguminaceae	सीता अशोक
***Butea monosperma* Taub.**	Leguminaceae	पळस
***Lagerstroemia speciosa* (L.) Purs.**	Lythracaeae	ताम्हण
Lagerstroemia indica (L.) Purs.	Lythracaeae	जारूळ
***Magnolia champaca* (L.) Figlar.**	Magnoliaceae	सोनचाफा
***Calophyllum inophyllum* L.**	Malphigiaceae	उंडी
***Hibiscus rosa-sinensis* L.**	Malvaceae	जास्वंद
***Bombax ceiba* L.**	Malvaceae	काटे सावर
Thespesia populnea L.	Malvaceae	भेंडीच झाड
***Memecylon umbellatum* Burm.**	Melastomataceae	अंजन
***Callistemon lanceolatus* (Sm.) Sweet.**	Myrtaceae	बॉटल ब्रश
***Bougainvillea spectabilis* Wild.**	Nyctaginaceae	बोगनवेल
***Jasminum auriculatum* Vahl.**	Oleaceae	जुई
***Jasminum multiflorum* Roth.**	Oleaceae	कुंदा
***Jasminum officinale* L.**	Oleaceae	जाई
***Jasminum sambac* Aiton.**	Oleaceae	मोगरा
***Nyctanthes arbor-tristis* L.**	Oleaceae	पारिजातक
***Clematis gouriana* Roxb. ex DC.**	Ranunculaceae	रानजाई
***Rosa indica* L.**	Rosaceae	गुलाब वेल
***Neolamarckia cadamba* Roxb.**	Rubiaceae	कदंब

***Murraya paniculata* Jack.**	Rutaceae	कामिनी
***Madhuca longifolia* J.F.Macbr.**	Sapotaceae	दक्षिण मोह
***Mimusops elengi* Wight.**	Sapotaceae	बकुळ
***Pterospermum acerifolium* Wild.**	Sterculiaceae	मुचकुंद
***Citharexylum spinosum* L.**	Verbenaceae	सीतारंजन

Fruit Plants / फळ झाडे

***Anacardium oxidentale* L.**	Anacardiaceae	काजू
***Mangifera indica* L.**	Anacardiaceae	आंबा
***Annona squamosa* L.**	Annonaceae	सीताफळ
***Carrisa carandas* Lour.**	Apocynaceae	करवंद
***Phoenix sylvestris* Roxb.**	Arecaceae	शिंदोळी
***Terminalia catappa* L.**	Combretaceae	बदाम
***Diospyros peregrina* Gürke**	Ebenaceae	टेंबुर्णी
***Phylanthus emblica* Gaertn.**	Euphorbiaceae	आवळा
***Tamarindus indica* L.**	Leguminaceae	चिंच
***Morus alba* L.**	Malvaceae	तुती
***Artocarpus heterphyllus* Lam.**	Moraceae	फणस
***Psidium guajava* L.**	Myrtaceae	पेरू

Syzygium cumini* var. *microcarpa	Myrtaceae	लेंडी जांभूळ
***Syzygium cumini* (L.) Skeels.**	Myrtaceae	जांभूळ
***Ziziphus jujuba* Mill.**	Rhamnaceae	बोरी
***Ziziphus mauritiana* Lam.**	Rhamnaceae	घटबोर
***Citrus limon* Osbeck Modernism.**	Rutaceae	लिंबू
***Limonia acidissima* L.**	Rutaceae	कवठ
***Muntingia calabura* L.**	Tiliaceae	चेरी

Medicinal Plants / औषधी झाडे

***Terminalia arjuna* Wight & Arn.**	Combretaceae	अर्जुन
***Terminalia bellirica* Roxb.**	Combretaceae	बेहडा
***Terminalia chebula* Retz.**	Combretaceae	हिरडा
***Putranjiva roxburghii* Wall.**	Euphorbiaceae	पूत्रंजीवा
***Pongamia pinnata* (L.) Pierre.**	Fabaceae	करंज
***Pterocarpus marsupium* Roxb.**	Fabaceae	बिजा
***Vitex nigundo* L.**	Lamiaceae	निरगुडी

***Bauhinia racamosa* Vahl.**	Leguminaceae	आपटा
***Lawsonia inermis* L.**	Lythracaeae	मेहंदी
***Ceiba pentadra* Gaertn.**	Malvaceae	सेमुल
***Firmiana colorata* Roxb.**	Malvaceae	कवशी
***Azadirachta indica* A. Juss.**	Meliaceae	कडुलिंब
***Melia azedirach* L.**	Meliaceae	लिंबारा
***Murraya koenigi* Sprengel.**	Rutaceae	कडीपत्ता
***Aegle marmelos* L. Correa**	Rutaceae	बेल
Sapindus mukorossi Gaertn.	Sapindaceae	रिठा
***Balanites aegyptiaca* L.**	Zygophyalaceae	हिंगणबेट
Other Important Plants / इतर झाडे		
***Buchanania cochinchinensis* Almeida**	Anacardiaceae	चारोळी
***Semecarpus anacardium* Buch.-Ham**	Anacardiaceae	बिब्बा
***Spondias pinnata* Kurz.**	Anacardiaceae	अंबाडा
***Bixa orellana* L.**	Bixaceae	शेंदरी
***Cordia sebestena* L.**	Boraginaceae	कोरडिया
***Anogeissus latifolia* Wall. ex Guill. & Perr.**	Combretaceae	धावडा
***Terminalia tomentosa* Willd.**	Combretaceae	ऐन
***Elaeocarpus ganitrus* L.f.**	Elaeocarpaceae	रुद्राक्ष
***Samanea saman* Merr.**	Fabaceae	रेनन्ट्री

***Barringtonia acutangula* Gaertn.**	Lecythidaceae	नेवर
***Adenanthera pavonia* L.**	Leguminaceae	रतनगुंज
***Albizzia lebbeck* (L.) Benth.**	Leguminaceae	शिरीष
***Bauhinia vahlii* Wight & Arn.**	Leguminaceae	कांचनवेल
***Aphanamixis polystachya* Parker**	Meliaceae	रोहितक
***Swietenia mahogani* Jacq.**	Meliaceae	मोहोगणी
***Ficus racemosa* L.**	Moraceae	उंबर
***Ficus benjamina* L.**	Moraceae	बेंजामिन वड
***Ficus religiosa* L.**	Moraceae	पिंपळ
Bambusa spp.	Poaceae	बांबू
***Schleichera oleosa* Oken.**	Sapindaceae	कुसुंब
***Holoptelea integrifolia* Planch.**	Ulmaceae	वावळ

Someshwar Science College COLLEGE CODE 827

Principal
Someshwar Science College,Someshwarnaga

Principal
Someshwar Science College,Someshwarnagar

The biodiversity of Shri Someshwar Shikshan Prasarak Mandal's Sharadchandra Group of Institute

Flora:

Fauna:

Then Principal Dr. R. G. Pawar planting a coconut tree in Somehwar Devrai

Principal
Someshwar Science College,Someshwarnagar

The Leader of Opposition Maharashtra State Legislature Assembly, Mr. Ajit Pawar, visited Someshwar Devrai

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Team AASHA planting a tree in Someshwar Devrai

Principal
Someshwar Science College,Someshwarnagar