A

Report

on

Environmental Audit

For

Ahmednagar Jilha Maratha Vidya Prasharak Samaj's

Shri Chhatrapati Shivaji Maharaj College of Engineering, Ahmednagar

Prepared by

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

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Director

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DISCLAIMER

Environmental audit Team has prepared this report for **Shri Chhatrapati Shivaji Maharaj College of Engineering, Ahmednagar** based on input data submitted by the representatives of College 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 recommendations are arrived following best judgments and no representation, warranty or undertaking, express or implied is made and no responsibility is accepted by Audit Team in this report or for any direct or consequential loss arising from any use of the information, statements or forecasts in the report.

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WATER MANAGEMENT OF EDUCATION INSTITUTES

Higher education institutions (HEIs) enjoy tremendous autonomy in terms of managing their natural resources. They are virtually independent and are internally regulated, while civilians, businesses, industries and others are subjected to, with close external monitoring and accountability. This opportunity of self-regulation available to them with their own heads of universities presiding over their internal resource management system as the final authority can be the springboard to water conservation. Water conservation needs to be ingrained in not only the consciousness but also practices of every citizen and system. HEIs have to make unremitting efforts through faculty, staff and students to make the Jal Shakti Abhiyan successful. Key Water challenges include Water Conservation, Water Quality Management, Watershed Management, Storm water Management and Wastewater Management

EXECUTIVE SUMMARY

Eco campus is a concept implemented in many educational institutions, all over the world to make them sustainable because of their mass resource utilization and waste discharge in to the environment. Waste minimization plans for the educational institute are now mandatory to maintain the cleanliness of the campus. To find out the environmental performance of the educational institutions and to analyze the possible solutions for converting the educational campus as eco-campus with water conservative plan, the conduction of Environmental auditing of institution is essential. The green auditing of 'Shri Chhatrapati Shivaji Maharaj College of Engineering, Ahmednagar' enables to assess the life style, action and its impact on the environment. This is the first attempt to conduct green auditing of this college campus. This audit was mainly focused on greening indicators like conservation of water in terms of install contour trenches and artificial ponds as per local capacity, terrain, gradient of land, quality of soil and water, vegetation, waste management practices and roof top rain water harvesting structures of the campus etc. Initially a questionnaire survey was conducted to know about the existing resources of the campus and resource consumption pattern of the students and staffs in the college. In order to assess the quality of water and soil, water and soil samples were collected from different locations of the college campus and analyzed for its parameters. Collected data was grouped, tabulated and analyzed. Finally a report pertaining environmental management plan with strength, weakness and suggestion on the environmental issue of campus are documented.

1. INTRODUCTION

Background

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's, Shri Chhatrapati Shivaji Maharaj College of Engineering, is affiliated by Savitribai Phule Pune University. The journey of Shri Chhatrapati Shivaji Maharaj College of Engineering began on year 2011 with a vision and mission of Shri Chhatrapati Shivaji Maharaj College of Engineering "to impart quality education through effective teaching learning methodologies".

Today, the college has four faculties – Civil Engineering, Mechanical Engineering, Electronics and Telecommunication Engineering and Computer Engineering. This is also certified by ISO 9001:2015. The campus has strength of 825 students and 47 teaching faculty. The campus includes a Main Block, Canteen, Lecture Rooms, a Central Library, Auditorium, Laboratories and Computer Labs. The major water source is Mula Dam. MIDC supplies water to Institutes. Electricity power needs for the entire campus is met through Off-grid solar power and MSEB.

Table 1.1 Key facts about the site

Name of the Institute	Shri Chhatrapati Shivaji Maharaj College of Engineering
Address	Survey No. 162 and 163, Nagar-Kalyan Road, Nepti, Ahmednagar (MH) - 414005
Campus Area	22 acres
Build up area	6500 sq.mts
Average Annual Rainfall	621 mm
Water Source	MIDC Supplies Water
Waste Treatment System	Septic Tanks
Average daily water consumption	~ 31.06KL
Average daily water supply	~ 15 Units
Average daily waste water	~ 28.70KL

Figure 1.1. Location of Shri Chhatrapati Shivaji Maharaj College of Engineering, Nepti

1.1 Environmental Policy of the College

Shri Chhatrapati Shivaji Maharaj College of Engineering is an environment and quality conscious college. It has taken initiative to protect its own environment with its Green Campus initiative and keeps pollution free campus. Environment development is its focal area with the educational policies implemented on the campus.

Being environment conscious administration, the management and the student of the college look after the environment carefully. Every year, during rainy season, tree plantation is carried out. All the avenues and roads within the College campus are therefore adorned with tall trees bearing emerald green leaves and beautiful flowers to create a homogenous feeling amongst everyone within the campus.

1.2 Role of Higher Education Institutions in Water Conservation

- Build consensus on the need for water conservation on campus with students, administration, faculty and other internal as well as external stakeholders
- Facilitate design of specific interventions for making the campus water sufficient and water efficient by following best available standards and accepted parameters
- Monitor the existing water management in the campus with participation and transparency

- Present a step-by-step guide for conserving water on the campus
- Generate case studies on best water conservation practices adopted on the campus and in the villages the campuses are engaged with. These instances can serve as models for other institutions and villages to adopt
- A core team consisting of the leadership of the institution along with key stakeholders may be formed. The team shall work as “Campus Jal Shakti Team”.
- The team that would be involved in all aspects of exploring, surveying, fact-finding, recording, planning, taking action and monitoring will also include all relevant stakeholders viz., citizens, student teams, their teachers, village leaders apart from administrative officials concerned in both campuses and villages
- Water Conservation Initiative can be a successful only if the Head of the Institution ignites the spirit of everybody in the organization. S/he needs to direct the departments, pay attention to the findings of student teams and ensure that their valuable suggestions are followed in letter and spirit by all students, faculty members as well as administrative, non-teaching and support staff. A motivated leader can bring a sea-change in the system and therefore s/he is the cornerstone of this campaign. An advisory committee may be constituted to guide the initiative.

Table 1.2 Departments

Departments:
Electronics and Tele Communication
Computer
Mechanical
Civil

Table 1.3 Total population

Current Population in Campus:				
Sr. No.	**No of students**	**No of Teachers**	**No of non-teaching staff**	**Total**
1	**825**	**47**	**31**	**903**

1.3 AUDITORS FOR WATER AUDIT

Sr.No.	**Name of Auditor**	**Designation**
1	Mr. Sujitkumar Pote	Environmental Engineer, Sarvashree Technogreen Private Limited, Ahmednagar
2	Mr. Lokesh Jawale	Civil Engineer, Sarvashree Technogreen Private Limited, Ahmednagar

2. OBJECTIVES OF ENVIRONMENTAL AUDIT

The main aim objectives of this environmental audit are to assess the environmental quality and themanagement strategies being implemented in Shri Chhatrapati Shivaji Maharaj College of Engineering. The specific objectives are:

1. Environmental education through systematic environmental management approach
2. Developing an environmental ethic and value systems in young people
3. To assess the quality of the water in the Shri Chhatrapati Shivaji Maharaj College of Engineering. campus
4. Financial savings through a reduction in resource use
5. Curriculum enrichment through practical experience
6. To monitor the water consumption pattern of the college
7. To quantify the liquid waste generation and management plans in the campus
8. To assess whether the measures implemented by Shri Chhatrapati Shivaji Maharaj College of Engineering have helped to reducethe wastage of water.
9. To impart environment management plans to the college
10. Providing a database for corrective actions and future plans
11. To assess whether extracurricular activities of the Institution support the collection, recovery, reuse and recycling of solid wastes
12. To identify the gap areas and suggest recommendations to improve the Green Campus status of the of Shri Chhatrapati Shivaji Maharaj College of Engineering.

3. METHODOLOGY

Key components of water source and assessment report with an environmental audit conducted at Shri Chhatrapati Shivaji Maharaj College of Engineering, Ahmednagar included:

i. Pre-audit planning

a) Preliminary literature review of concepts and methodologies related to an environmental audit.
b) Discussion with the management staff on various systems installed in the campus.
c) Awareness creation and interaction with the staff and student on the concept of environmental audit.
d) Walk through the entire campus to understand the nature of water source, water use and waste management systems in the campus.

ii. Data collection

a) Development of questionnaire format to identify all water using fixtures/ equipment and examine water use patterns for individual buildings in the campus.
b) Collection of secondary data from compilation of water bills, collecting records of pumps, water quality analysis reports etc.
c) Semi-structured interview with maintenance manager, technicians, plumber and housekeeping staff on current situation and the past trends in water consumption, waste management, waste generation etc.

iii. Data Processing and analysis

The existing trends and patterns in water usage and waste generation and management is analyzed in this step from the data collected from the previous step.

iv. Audit Recommendations and reporting:

Based on the understanding from the environmental audit, recommendations are given to improve the existing environmental performance of the campus and are documented in a report format

In order to perform water 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

i) Raw Water

ii) Drinking Water

iii) Laboratory Waste Water

iv) Sewage Water

v) Rain Strom Drain Water

4. ENVIRONMENTAL AUDIT

An environmental audit is a systematic review of a site to identify opportunities to improve its water use efficiency. The site may be a public water utility, facility (institutional or commercial properties like malls, office, schools etc.) or a household. Audit recommendations are developed based on surveys and assessments of water-using hardware, fixtures, equipment, landscaping, and management practices at the site. Environmental audit involves tracking, assessing and validating all components of flow from the site of withdrawal or treatment through the water distribution system and into the consumer's properties. Environmental auditing examines the major areas of water use, including human consumption, personal hygiene & sanitation, washing, cleaning, laundry, gardening etc. Environmental auditing is an on-going process and rarely stays consistent in a site or system over time. Therefore, in order to gauge progress from adopted water conservation and cutbacks, environmental audit should be performed on a regular basis. In addition, it provides convincing overview of the water use trends, effectiveness of conservation measures and potential cost and water savings.

5. WATER SUPPLY

Around 31.06 kilo litres of water is used in the campus daily. Source of water for the entire campus is Mula Dam. MIDC supplies water to the institute. Water is stored in the main tank of 2500 kilo liter and is pumped to tanks (Make – Sintex, 1KL capacity, Total Nos. 8) located on building terrace from where it is distributed to toilets and bathroom of the main block , Hostel. The tanks (Make – Sintex, 2KL capacity, Total Nos. 2) is located on building terrace from where it is distributed to Water Cooler/RO Plant of 150 L capacity for drinking purpose as well as for laboratory. The tanks (Make – Sintex, 500L capacity, Total Nos. 1) is located on canteen building terrace from where it is distributed to canteen. The other source of water used in the College is bore wells present in the campus.

Sources of Water:

- MIDC Water
- Bore Well
- No. of flow meters attached and their locations.: One near OHT

The details of the pump used for pumping the water in overhead tanks are as follows-

Table 5.1 Details of of water pump

Sr.No/	No. of Pumps	Power	Location
1	1	3HP	Main water tank
2	1	1.5HP	Bore Well

6. WATER MANAGEMENT

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

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

MIDC supplies water to the institutes. MIDC has variable charges as basis on supply of water with monthly water bill. Water added to this source to main water tank of 2500m^3. Water is also extracted to full the requirement. The main tank is installed with 03 HP pump and is operated for 01 hours daily. The duration of pump operation is measured for electricity consumption but the quantum of water extracted is not measured by the management of the college.

The organization does not have any automatic leak detection system and all the leakages are controlled by manual observation hence leak quantum water is another issue which shall be considered in designing the water conservation scheme.

No leakage of water from pipes is observed from pipes by auditor team but leakages in taps were observed in some urinals.

There are 120 Taps in the college premises from which the water is used for different use. There is no tap maintenance schedule with the maintenance department; the leakage problem will be solved by them only when they get any compliant.

Table 6.1 Avg. consumption of water per day

Location/ Area	Avg. total consumption of water per day (in Liters)
1.College	25432
2. Gardening	2361
3. Labs	100
4. Canteen	3168

A) Availability of Water from source

The water bill for last 12 months is as given below:

Table 6.2 Water Bill for last 12 Months

	Apr 22	May 22	June 22	July 22	Aug 22	Sept 22	Oct 22	Nov 22	Dec 22	Jan 23	Feb 23	Mar 23
Bill in Rs.	6338	7430	6045	6728	6533	16848	10667	16342	8075	6962	7313	8093
Unit in Cu. Meter	325	381	310	345	335	864	547	838	414	357	375	415

*Availability of Water from source= 5506 Cub Meter =5506000 liter per year

*Availability of Water (Lit) from source = 5506000/365= 15085 liter per day

Table 6.3 Availability of Water from source Bore well

	Apr 2022	May 2022	June 2022	July 2022	Aug 2022	Sept 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023
Unit in Cu. Meter	435	447	485	487	645	784	478	698	584	748	856	745

*Availability of Water from source= 7392 Cub Meter =9392 000 liter per year

* Availability of Water (lit) from source 9392 000 /365= 20252 liter per day

B) Availability of water from Rain Water Harvesting

Rainwater is the main water from natural source. Every campus can harvest water depending upon the area on the campus. This could be both paved area and unpaved area. For the purpose of location specific groundwater recharge and for harvesting efficiency, paved water catches and provides higher quantity of water. Rainwater is also universal carrier of waste on its route. It is essential to keep the rainwater route clean to ensure free flow of clean water and better recharge of rainwater.

For this, the following calculations and data are required.

a. Area of the Campus Land: 22 Acre = 89030 sqm
b. Institution's Paved Area: 8500 sqm
c. Institution's Unpaved Area: 80530 sqm

Annual Rainfall in Metres (Rainfall in MM/1000) = Area of the Institution's Land x Annual rainfall in metres

Rainwater that can be harvested in an area can be arrived at by the following calculations:

i. Paved area x Volume of Rainfall X 0.85(run off coefficient) = 8500 X 621 X 0.85 = 4487 m^3

ii. Unpaved area x Volume of rainfall x Runoff coefficient (Runoff coefficient for unpaved area = 0.35)

= 80530 X 621 X 0.35 = 17503 m^3

X. Rainwater that can be harvested: Quantity of rainwater harvested is: i + ii = 21990 (m^3 per annum).

Earlier the rainwater storage tank was used for low quality uses like watering plants etc. But, presently storage has been replaced and all the water is recharged into the ground.

Waste Water System At College

The source waste water is categorized in two types (i) Laboratory Waste Water which can be said asEffluent and (ii) Domestic Waste Water i.e. Sewage Water.

The effluent produced in this college is about liters per week per laboratory and there are two such laboratories producing effluent is first year Chemistry Laboratory and the Environment Laboratory in Civil Engineering department. The effluent produced is released to the common drainage without any treatment which is damaging to the environment and have very big concerned with ground water contamination.

The Sewage water mainly comes from Toilets of college and hostel. The sewage is released to septic tank and sock pit.

Major Observations in regard of Water Usages and Conservation Plan

1) At present waste water after treatment is not recycled or reused in any form in the college premises

2) Drip irrigation and sprinklers are used for watering the garden. The garden is also watered with water pipe, one times a day for 02 hours each time.

3) The roof top rain water is drained by storm water drain and released to artificial pond and terrain of the college campus.

4) Campus farming

The college has started a novel venture of cultivation of fruit trees in a 30 cent area of the campus.

5) Routine Green Practices

Every year college celebrates World Environment Day, World Water Day and Ozone Day in the campus. The main focus of these programs was to provide awareness to the students about the importance of the environment, its conservation and sustainable use of environmental resources. The programs are conducted through seminars, poster presentation, quiz competition debates etc.

7. CALCULATION OF WATER CONSUMPTION PATTERN

Water use diagram

The various blocks of Shri Chhatrapati Shivaji Maharaj College of Engineering, Ahmednagar such as main block, work shop, hostel and canteen were surveyed in this study with the questionnairedeveloped based on literature review and observations and discussions during the pre-auditphase Figure 7.1 shows the water usage by various activities of college campus based on the survey. It can be seen that toilet flushing (35%), wash basin (37%), Gardening (5%), cooking (3%), cleaning (17%) and drinking (3%) are the activities that dominates water usage.

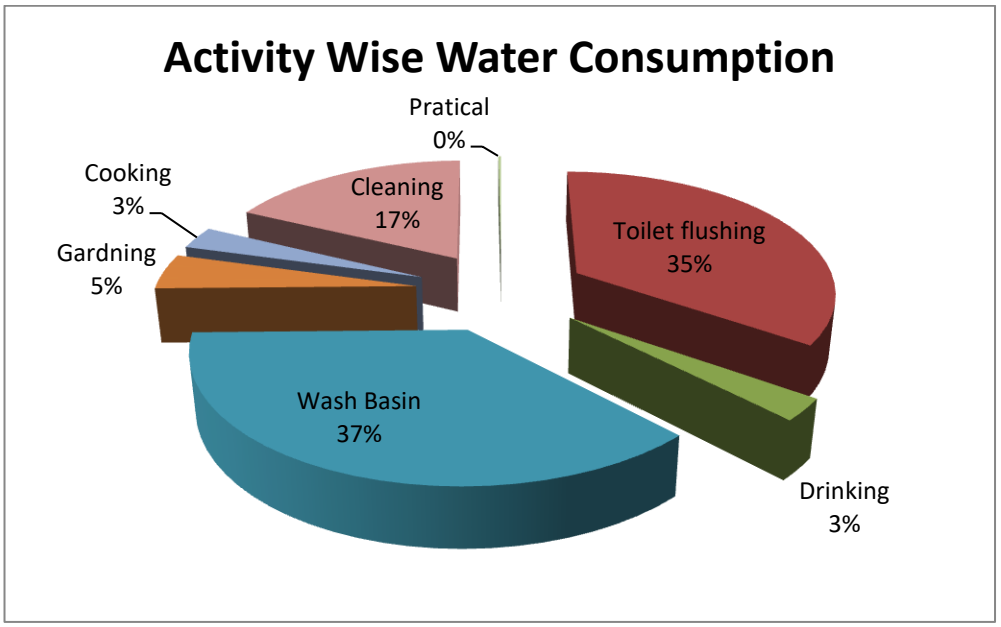

Fig. 7.1 Activity Wise Water Consumption

A) Calculation for water consumption per day for laboratory

Table7.1 Water Consumption for laboratory

Sr. No.	Location	Practical per year	Batches	Water use per Practical in liter	Water consumption in liter per year	Water consumption in liter per month	Water consumption in liter per day
1	Chemistry Lab	10	8	100	8000	667	22
2	Environmental Lab	10	4	200	8000	667	22
3	Geotech Lab	10	4	250	10000	833	28
4	Fluid Mechanics Lab	10	2	250	5000	417	14
5	Hydraulics lab	10	2	250	5000	417	14
Total (A)					**36000**	**3000**	**100**

b) Calculation for block wise water consumption per day

Table7.2 Block wise Water Consumption

Sr. No.	Location	Student / Staff	Water Consumption LPD	Working Day per year	Total water consumption in liter per year	Total water consumption in liter per day
1	**Canteen**	150	30*	257	1156500	3168
2	**College building**	903	40*	257	92828440	25432
Total (B)					**10439340**	**28601**

*rates per capita per day by Indian Standard Code of Basic Requirements for Water Supply, Drainage and Sanitation

c) Calculation for water demand of landscape per day

The SLIDE equation for estimating the water demand of an established landscape is:

Water Demand (gal.) = PF X LA X 0.623

Where, PF = Plant factor for given plant type categories

LA = Landscape Area in sq. feet

0.623= Convert ET0 inches of water to volume in galleon

Furthermore, SLIDE recognizes the research findings that:

- Landscape plants are usually capable of using more water than they need in order to provide acceptable performance and function.
- The ETo × PF concept has limited accuracy in landscapes due to the biological physical complexities of these systems, and adding other ETo-adjustment factors to an equation does little to improve its accuracy.
- Most species tolerate moderate managed drought and can provide acceptable performance over a range of PF's.

Water Demand (gal.) = 0.7 X 435600 X 0.623 = 189965 gallon

Water Demand (lit) = 189965 X 3.79 = 719968 liter per annum for land scape

Water demand (lit) = 719968/305 = 2361 lit per day.

Assumption, Mixed Plantings (mixed landscape beds): Perennials have highest PF, so PF = 0.7.

Subtract rainfall days from annual water demand.

Total Water consumption per day = A+ B+C

= 100+28601+2361

= 31062lit

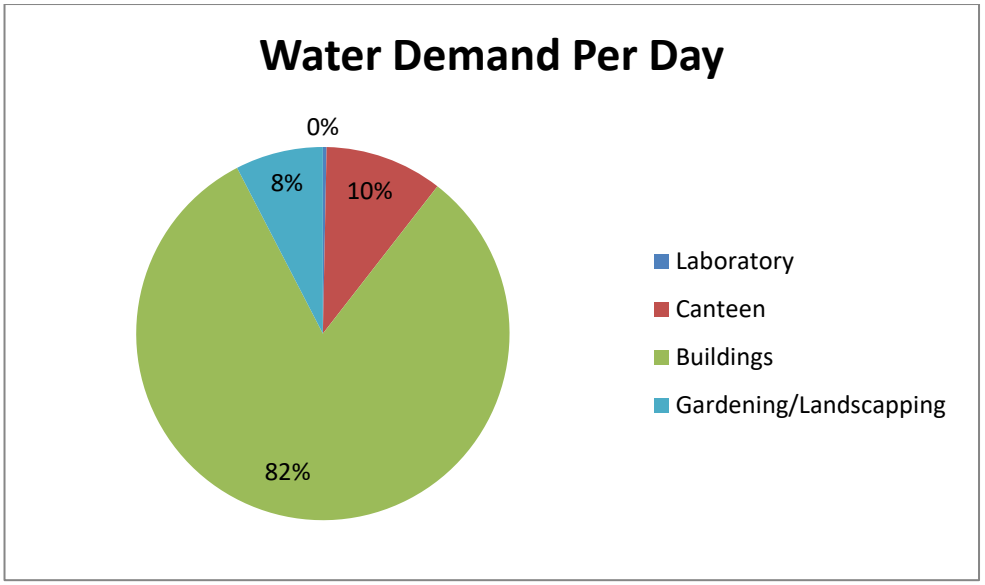

Fig 7.2 Block wise total water consumption (31062 Litre/day) (in percentage)

Percentage of Water Drawn

Quantity of water drawn from a particular source

= ……..X100

Total quantity of water used for a specific purpose

= (15085 / 31062) X 100

= 48.56%

Conclusion: 46% water drawn from Mula dam through pipeline of MIDC for daily use of Institute.

Table 7.3: Total Water Supply and Use at College

S. No	Heads	Water use (in litres)
1.	Average daily water supply, to the overhead tanks from the underground tank	35337
2.	Total calculated water consumption from the environmental audit	31062
3.	Difference between water consumption fromoverhead tanks and actual water use for various purposes	4275

8. AUDITING FOR WASTE MANAGEMENT

Pollution from waste is aesthetically unpleasing and results in large amounts of litter in our communities which can cause health problems. Plastic bags and discarded ropes and strings can be very dangerous to birds and other animals. This indicator addresses waste production and disposal, plastic waste, paper waste, food waste, andrecycling. Solid waste can be divided into two categories: general waste and hazardous waste. General wastes include what is usually thrown away in homes andschools such as garbage, paper, tins and glass bottles. Hazardous waste is waste thatis likely to be a threat to health or the environment like cleaning chemicals and petrol. Unscientific landfills may contain harmful contaminants that leach into soil and water supplies, and produce greenhouse gases contributing to global climate change.

Furthermore, solid waste covering Bio Degradable, Non Bio Degradable and Hazardous Wastes. There wastes are either in to recycling or reuse or combination ofboth. Thus, the minimization of solid waste is essential to a sustainable University. The auditor diagnoses the prevailing waste disposal policies and suggests the best way to combat the problems. It is therefore essential that any environmentally responsible institution examine its waste processing practices.

College students, staff, and faculty often lead busy lives and value convenience; as they go about their day rushing between activities and classes, the purchase of single-use products is often the most convenient choice. The consequence of this convenience comes in the form of high quantities of waste. In an era where societies around the world are becoming more conscious of the issues surrounding waste, students, faculty, and staff must be properly educated on proper waste management practices. Although the introduction of more recycling bins on campus may help increase recycling rates, a study noted that any recycling or waste management system depends not only on technical factors and availability, but also the motivation of the users to participate in the process. It can be understood that waste management education is essential in reducing waste, increasing diversion rates and encouraging environmentally friendly behavior.

OBJECTIVES:

The main objective of the solid waste management system in the campus is to promote the Environment Management and Conservation in the College Campus. The purpose of the current available system is

1. To identify, quantify, describe and prioritize framework of Environment Sustainability in compliance with the applicable regulations, policies and standards.
2. To introduce and aware students to real concerns of environment and its sustainability

3. 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.
4. 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.
5. To bring out a status report on environmental compliance.

Waste Generation

S. No	Description	Apr 22	May 22	Jun 22	Jul 22	Sep 22	Oct 22	Nov 22	Dec 22	Jan 23	Feb 23	Mar 23
1	Bio Degradable-Other than Food (inkgs)	18	15	13	13	17	13	12	12	12	13	13
2	Bio Degradable - Food Waste (inkgs)	15	14	13	12	12	19	18	16	17	12	14
3	Non Bio Degradable (in kgs)	12	13	11	11	12	10	17	18	11	9	9
4	Hazardous Waste (in litres)	25	24	45	24	20	25	17	16	15	17	19

S. No	Description	Apr 22	May 22	Jun 22	Jul 22	Sep 22	Oct 22	Nov 22	Dec 22	Jan 23	Feb 23	Mar 23
5	E-Waste (in Kgs)	-	-	95	-	-	-	-	-	-	-	-

Areas of Improvement:

- Environment Policy to be adopted by the College Campus.
- Water Meter should be installed and maintain the inventory of ground water extraction resource bore well.
- Stack height of DG set should be as per DG Rules
- Storage of chemicals like; paints, gums resins, oils, lubricants, acids etc. in designated place and safety/warning signs should be displayed.
- Internal inspection system should be developed for various aspects of environment available in campus
- Waste Management plan should be prepared for the campus.
- Display of environment awareness posters should be there in the prominent areas of campus.

9. ENVIRONNEMENTAL MONITORING

Environmental Awareness Course (EVS): Environmental Studies Courses (Audit Course-I and Audit Course-II) introduced by Savitribai Phule Pune University, Pune for first year students for all faculties. Under thiscourse students learn to be environmental friendly. They are made aware of

1) Renewable and Non-renewable energy sources
2) Energy conservation.

9.1 **Air Monitoring:**

Air quality in the academic institute is very important for health of the students, faculty and staff of the institute. The air pollution sources in the college campus are wind storm, pollen grains, natural dust, vehicular emissions, generators, fires and laboratory fumes etc.

9.2 **Noise Environment:**

The noise levels measurements were carried out using Noise level meter. The noise levelsurvey was carried out at seven locations, at outside as well inside thestudy area. The Noise levels monitored in the college campus as well as inside the classroom and found the noise level within the permissible limit.

Sr.No	Location	Minimum Reading In dB	Maximum Reading In dB	Limits
1.	Near Main Gate	27.4	27.7	75
2.	Near Back Gate	28.0	28.1	75
3.	Inside Class room	27.7	28.5	75
4.	Outside Classroom	28.5	28.5	75
5.	Inside Library	28.2	28.5	75
6.	Inside lab	28.4	28.7	75
7.	Garden	27.5	27.7	75

9.3 Ventilation Study:

Sr.No	Location	Reading In m/s	Limits
1.	Inside Class room	1.2	>0.5
2.	Inside Library	1.2	>0.5
3.	Inside Engg lab	0.9	>0.5
4.	Inside Workshop	1.3	>0.5

9.4 Illumination Study:

The Illumination measurements were carried out using Luxmeter at five locationsinside the study area and light intensity found adequate in monitored area.

Sr.No	Location	Reading In Lux	Limits
1.	Inside Class room	240	>100
2.	Inside Library	250	>100
3.	Inside Engg lab	210	>100
4.	Workshop Premises	310	>100

10. ENERGY USE AND CONSERVATION

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

OBSERVATIONS:

10.1 APPLIANCES/LIGHTING LOAD

Sr No.	Location	Name of Appliance	Power Rating (Watt)	Quantity	Power Consumption (Watt)	Usage per Day Hr	Power Consumption/ day (Watt)
1	Principal Office	Fan	80	2	160	2	320
		CFL	40	1	40	2	80
		LED	9	10	90	2	180
		PC	60	1	60	2	120
		Printer HP1020	150	1	150	0.5	75
		LED TV 43Inch	40	1	40	1	40
		AC 1 Tonn	1750	2	3500	1	3500
		CCTV	5	1	5	24	120
		Modem	5	1	5	3	15
2	Principal Office Entrance	Fan	80	1	80	2	160
		FTL	40	1	40	2	80
		LED	40	2	80	1	80
3	Main Corridor	Electronic Bell	5	1	5	2	10
		Speaker	50	1	50	0.5	25
		Router	100	1	100	3	300
		D-Link	5	1	5	3	15
		CCTV	5	2	10	24	240
		FTL	40	1	40	2	80
4	Conference Room	FTL	40	2	80	2	160
		Fan	80	2	160	2	320
		Projector	180	1	180	0.5	90
		AC 1 Tonn	1750	1	1750	2	3500
5	Administration Office	FTL	40	4	160	1	160
		LED	18	2	36	2	72
		Fan	80	4	320	2	640
		PC	80	7	560	0.5	280
		Printer	150	4	600	0.5	300
		CCTV	5	2	10	24	240
		Thumb Machine	15	1	15	0.5	7.5
6	Ground Floor	D link	5	5	25	3	75

	Corridor	Incandescent Bulb	60	5	300	3	900
		LED Bulb	50	4	200	2	400
		Display	20	1	20	3	60
		CCTV	5	1	5	24	120
		FTL	40	6	240	1	240
		Router	150	2	300	2	600
7	Room No. 038	FTL	40	1	40	1	40
		Fan	80	1	80	2	160
		PC	80	1	80	1	80
		Printer	150	1	150	0.5	75
8	Gymnasium	FTL	40	3	120	1	120
		Fan	80	3	240	2	480
9	Sport Section	LED	9	1	9	2	18
		Fan	80	3	240	2	480
		PC	80	2	160	1	160
		Printer	150	2	300	0.5	150
10	IQAC Cell	FTL	40	1	40	2	80
		LED	9	4	36	2	72
		Fan	80	3	240	2	480
		PC	80	5	400	1	400
		Printer	150	2	300	0.5	150
		Scanner	150	1	150	2	300
		Projector	150	1	150	0.5	75
11	Geotechnical Laboratory	Fan	80	3	240	2	480
12	CE HOD Cabin	FTL	40	1	40	2	80
		PC	80	1	80	3	240
		Printer	150	1	150	0.5	75
13	Fluid Mechanics	Incandescent Bulb	60	1	60	0	0
		Fan	80	3	240	2	480
14	Transportation Lab	FTL	40	3	120	1	120
		Fan	80	2	160	2	320
15	Concrete Technology Laboratory	FTL	40	1	40	1	40
		Incandescent Bulb	60	2	120	1	120
		Fan	80	3	240	2	480
16	Project Lab, Room No. 109	Fan	80	2	160	2	320
		FTL	40	2	80	1	80
17	Strength of Material	LED	18	1	18	2	36
		Fan	80	3	240	2	480
		PC	80	1	80	1	80
18	CAD Laboratory	LED	9	1	9	2	18
		Fan	80	3	240	2	480
		PC LCD	80	16	1280	1	1280
		Printer	150	2	300	0.5	150

		Laptop	80	1	80	3	240
		Projector	150	1	150	0.5	75
19	Environmental Laboratory	FTL	40	2	80	1	80
		Fan	80	1	80	2	160
20	Geology Laboratory	Fan	80	1	80	2	160
		Laptop	80	1	80	2	160
21	Classroom 106 to 113	Fan	80	32	2560	2	5120
		CCTV	5	8	40	24	960
22	MQC Laboratory	Fan	80	2	160	2	320
23	Fluid Mechanics	Fan	80	1	80	2	160
		Advance Hydraulic pump, 1HP/0.75w	0.75	1	0.75	2	1.5
		Fan	80	3	240	2	480
		FTL	40	1	40	1	40
24	IC Engine Laboratory	Fan	80	4	320	2	640
26	Theory of Machine Lab	Fan	80	2	160	2	320
		PC	80	1	80	1	80
27	Girls Common Room	Fan	80	2	160	3	480
		FTL	40	1	40	1	40
28	Applied Thermodynamics	Fan	80	3	240	2	480
30	Basic Electronics Lab	Fan	80	2	160	2	320
31	Digital System Laboratory	Fan	80	1	80	2	160
32	Electronic and Communication Lab 1	Fan	80	1	80	2	160
34	Embedded & VLSL Lab	FTL	40	2	80	1	80
		DLink Switch	5	1	5	2	10
		PC	80	8	640	1	640
		Fan	80	1	80	2	160
35	Computer Lab E&TC	FTL	40	2	80	1	80
		Fan	80	3	240	2	480
		PC	80	8	640	1	640
37	Classroom No.139,143,144,145 ,146	Fan	80	20	1600	2	3200
		FTL	40	8	320	1	320
		PC	80	4	320	1	320
		CCTV	5	5	25	24	600

38	Physics	FTL	40	2	80	2	160
		Fan	80	3	240	2	480
39	Electronics and Telecommunication Lab	DTH Set Top	15	1	15	3	45
		Power Supply	15	1	15	3	45
		Fan	80	3	240	2	480
40	Room No. 135, 137	Fan	80	2	160	2	320
		PC	80	1	80	1	80
41	Computer Center	Fan	80	6	480	2	960
		PC	80	40	3200	4	12800
		CCTV	5	4	20	24	480
		D-Link Switch	5	4	20	2	40
42	Room No. 122	Fan	80	1	80	2	160
		PC	80	6	480	1	480
43	Room No. 122	FTL	40	1	40	2	80
		Fan	80	1	80	2	160
		PC	80	4	320	1	320
44	Hardware Lab	Fan	80	1	80	2	160
		FTL	40	1	40	2	80
		PC	80	1	80	1	80
		BSNL Internet Router, Batteries 12v, 42Ah	10	3	30	3	90
		Modem	5	1	5	3	15
45	Network Lab	Fan	80	3	240	2	480
		PC	80	4	320	1	320
46	Programming Lab	Fan	80	3	240	2	480
		PC	80	18	1440	1	1440
		D-Link Switch	5	1	5	2	10
		CCTV	5	1	5	24	120
47	Computer Graphics lab	PC	80	19	1520	1	1520
		Fan	80	4	320	2	640
		FTL	40	1	40	2	80
		D-Link Switch Connector	5	1	5	2	10
		CCTV	5	1	5	24	120
48	Network Lab	FTL	40	3	120	1	120
		PC	80	22	1760	4	7040
		D-Link Switch Connector	5	1	5	2	10

		CCTV	5	1	5	24	120
49	Project Lab 1	FTL	40	2	80	1	80
		Fan	80	3	240	2	480
		CCTV	5	2	10	24	240
		PC	80	18	1440	4	5760
		D-Link Switch Connector	5	1	5	2	10
50	Project Lab 2	FTL	40	1	40	1	40
		Fan	80	4	320	2	640
		CCTV	5	2	10	24	240
		PC	80	28	2240	0.5	1120
		D-Link Switch Connector	5	1	5	2	10
51	Server Room	PC	80	2	160	1	160
		Fan	80	1	80	2	160
		FTL	40	1	40	1	40
		CCTV	5	1	5	24	120
		Power Supply 3.9A, 150-235v,50-60Hz	15	1	15	3	45
52	Yoga Meditation Hall	FTL	40	6	240	1	240
53	First Floor Corridor	CCTV	5	8	40	24	960
		Display Board	80	1	80	1	80
54	Library	Xerox Machine	500	2	1000	1	1000
		Fan	80	10	800	2	1600
		FTL	40	2	80	1	80
		PC	80	8	640	1	640
		Printer	150	1	150	0.5	75
		CCTV	5	3	15	24	360
55	Tutorial Room	Router	100	1	100	3	300
		FTL	40	1	40	1	40
56	UPS Room	UPS Inverter 7.5KVA	750	2	1500	3	4500
		Batteries 160 A	150	16	2400	24	57600
		Batteries 150 A	150	16	2400	24	57600
58	Water Cooler/RO/	150 Lit	150	2	300	2	600

59	**Canteen**	Referigerator ; 200 liter	430	1	430	24	10320
		FTL	40	6	240	3	720
		Fan	80	4	320	2	640
		Cooler Water	800	1	800	3	2400
60	**Porch**	FTL	40	1	40	3	120
		CCTV	5	2	10	24	240
61	**Campus**	Outdoor Flood LED	200	4	800	5	4000
		Pole Light LED	100	15	1500	5	7500
62	**Entry Security Cabin**	FTL	40	2	80	3	240
		Fan	80	2	160	2	320
63	**Main Gate**	CCTV	5	2	10	24	240
		Outdoor Flood LED	150	1	150	10	1500
64	**Second Floor Premises**	FTL	40	15	600	8	4800
		Fan	80	15	1200	6	7200
		LED Bulb	12	3	36	8	288
		Outdoor FTL	40	4	160	8	1280
	Toilet	LED Bulb	9	4	36	8	288
	Wash room	LED Bulb	9	4	36	8	288
					Total Load	**Daily (Watt)**	**246679**
						Daily Kw	**246.68**
						Monthly Kw	**6413.65**
						Yearly Kw	**76963.8**

10.2 TOTAL LOAD YEARLY

Sr No.	Location	Name of Appliance	Power Rating (Watt)	Qty	Power Consumption (Watt)	Usage per Year (HR)	Power Consumption/day (Watt)
1	Concrete Technology Lab	Sieve Shaker;0.5HP/0.37kw	370	1	370	18	6660
		Direct Share Testing M/c; 50Hz	300	1	300	18	5400
		Compression Testing machine	500	1	500	18	9000
		Oven;1.5kw	1500	1	1500	18	27000
		Vane Share Testing Machine	35	1	35	18	630
		Infrared Moisture Balance	300	1	300	18	5400
		Weighnig Machine 1kg	300	1	300	5	1500
2	Hydraulics Lab	Venturi/ Orifice meter Motor;0.25HP	186	2	372	2	744
		Bernollies Theorem Motor;0.25HP	186	1	186	2	372
		Multitube Manometer Speed Controller;3PH, 380v	150	1	150	2	300
		Tilting Fumes;1.5Hp/1.1Kw	1100	1	1100	2	2200
		Centrifugal Pump; 440v	500	1	500	2	1000
		Energy Regulator;230v	300	1	300	2	600
3	Geo Technical Laboratory	Marshall Stability Test	150	1	150	2	300
		Los Angel Test	0.75	1	0.75	2	1.5
		Ductility Test	500	1	500	2	1000
		Ring and Ball Testing Machine;2HP	1500	1	1500	2	3000
		Stipping Valve Test Apparatus; 230v	150	1	150	2	300
4	Concrete Technology Laboratory	Weighing Machine 100kg	150	1	150	2	300
		Compression Testing machine,220v	600	1	600	2	1200
		Vibrating Machine;0.8HP	597	1	597	2	1194
		Vibrating Machine; 0.75HP	560	1	560	2	1120
5	Strength of Material Laboratory	Tile Abrasion Testing Machine; 0.37kw	370	1	370	2	740
		Torsion Testing, 1Hp	750	1	750	2	1500
		UTM 100 KN	1000	1	1000	2	2000
6		Flocculator; 0.5HP	375	1	375	2	750
		Conductivity Meter, 230v	300	1	300	2	600

	Environmental Laboratory	COD, 1kw	1000	1	1000	2	2000
		Soxhlet Extraction Heater, 220v	300	1	300	2	600
		Flame Photometer, 220v	300	1	300	2	600
		Compressor, 220v	300	1	300	2	600
		Weighing balance, 220v	300	1	300	2	600
		Microbial Colony Counter, 220v	300	1	300	2	600
		Oven Furnace, 2.5Kw	2500	1	2500	2	5000
		BOD Incubator, 0.75kw	750	1	750	2	1500
		High Volume Sampler, 0.75kw	750	1	750	2	1500
7	MQC & I.C Engine Lab	Reciprocating Pump Test, 0.5HP	375	1	375	2	750
8	Fluid Mechanics	Pnumatic Trainer , 1HP	750	1	750	2	1500
		Gear Pump Rig	0.75	1	0.75	2	1.5
		Centrifugal Pump, 1HP/0.75w	0.75	1	0.75	2	1.5
		Impact Jet Apparatus, 0.5HP	375	1	375	2	750
		Turbo Kirloskar Pump, 3.7kw/5HP	3700	1	3700	2	7400
		Turbine Test Rig, 15HP	11190	1	11190	2	22380
9	Heat Transfer Lab	Incandescent Bulb	60	1	60	2	120
		Emmisivity Measurement Apparatus	300	1	300	2	600
		Flux Meter	300	1	300	2	600
		Pin Fin Appartus, 0.5HP	375	1	375	2	750
		Thermal Conductivity Meter	300	1	300	2	600
10	Tom Lab	Cam Analysis	500	1	500	2	1000
		Epicyclic Gear Train, 0.5HP	375	1	375	2	750
11	Girls Common Room	CFL	40	2	80	2	160
		Weighing Machine220gm	300	1	300	2	600
		Weighing Machine120gm	300	1	300	2	600
13	Basic Electronic Lab	Dimmer, 8AMPS	180	1	180	2	360
		Dc Shunt, 50Hz	50	1	50	2	100
		3PH Induction Motor	750	1	750	2	1500
		Slip Rig	300	1	300	2	600

		Squirrel Cage I.M 1 hp	750	1	750	2	1500
		DC Motor, 2HP	1500	1	1500	2	3000
14	Wave Theory and Antenna Lab	RF Motor 10 - 600MHZ	300	1	300	2	600
		Oscillator 50Oh,10-600MHz	300	1	300	2	600
		Communication System Trainer	300	1	300	2	600
15	Basic Electronic Lab	Frequency contrller 50Hz	300	1	300	2	600
		Osciloscope	300	1	300	2	600
16	Classromms	Internet Connector Switch	50	5	250	2	500
17	Physics	Digital Gauss Meter; 200v	300	1	300	2	600
		Hall Effect Set up;200v	300	1	300	2	600
		Ultasonic Interferometer, 200v	300	2	600	2	1200
		Regulator Power Supply;	300	1	300	2	600
18	Electronics & Communication Engineering Lab	CRT TV 220v	100	3	300	2	600
		HDTV Trainer	300	1	300	2	600
		Dipcot	300	1	300	2	600
		PhotoeTech	300	1	300	2	600
		VSWR Meter	300	1	300	2	600
19	Hardware Lab	Catalyst	300	1	300	2	600
20	Yoga Meditation Hall	Incandescent Bulb	60	3	180	2	360
21	First Floor Corridor	Incandescent Bulb	60	10	600	2	1200
		Incandescent Bulb	60	1	60	2	120
22	Workshop	Lath Machine, 3HP	1500	8	12000	2	24000
		Surface planning M/C Motor, 3HP	1500	1	1500	2	3000
		R. Drilling M/C, 3PH, 0.75kw	750	1	750	2	1500
		R. Drilling M/C, 3PH, 0.37kw	750	1	750	2	1500
		Power Hexa M/C,1HP	750	1	750	2	1500
		Grinding M/C, 1.5HP	750	1	750	2	1500
		Drill M/C, 1.5 HP	750	1	750	2	1500
		welding M/C	300	1	300	2	600
		Cutter Machine	300	1	300	2	600
		Lath Machine, 2HP	750	2	1500	2	3000
					Total	**Yearly**	**183914.50**
						Monthly	**15326.21**
						Daily	**589.47**

Calculations:

1. **Total Calculated Load = Yearly Daily load + Yearly Equipment's load**
   A = 76,964+184 =77,148 units
2. **Solar Power Generated= B= 34781 units approx...**
3. **Difference of Load calculated and Solar power generated**
   =C= 77,148- 34,781=42,367 units
4. **Yearly approximate units consumed =Electric Unit Consumed + Solar Energy Generated+ Offset Grid Export Unit**
   =18,163 + 34,781 +8,977= 61,921 units
5. **Difference of Total Calculated Load and Yearly Load Consumed**
   =D=77,148-61, 921=15,227 units

General Observations based on Electricity Bill:

1. For College Campus the Contract Demand (CD) is 39.5 kVA and minimum billing Demand is less than 50% of the Contract Demand, Maximum Demand recorded whichever is higher. Since, the MD recorded is less than 18kVA.
2. The average electricity cost is Rs.16.28 considering the last twelve months average units and bill.
3. Average monthly Power Factor is maintained near P.F. 0.98.
4. Power factor is affected during June 2022 is 0.96, which need to improve power factor up to 0.9.

11. RECOMMENDATIONS

Management of College may consider on top priority:-

1) To establish and implement the Water Conservation and Management Plan as per Environment Protection Act 1986
2) The water Conservation Awareness Program to be conducted on World Water Day on 22nd March every year
3) To eliminate the spillage and over usage of water in washbasins, urinals and toiler push tapsare highly recommended.
4) Automatic Leak detection systems for conservation of water.
5) Rain Water Harvesting as per the guidelines of Central Ground Water Board shall be done.
6) 80 % of total quantum of ground water extracted shall be recharged to ground either byArtificial Recharge Structures within the college premises
7) Special Internal Environmental audit to be conducted quarterly and should be headed by HOD CivilDepartment
8) Reuse of Sewage Treated water for flushing in toilets is highly recommended.

RECOMMENDATIONS:

1. Initiate Green Campus Award.
2. In order to prevent wastage of light, will be use sensor based lights in washrooms, classrooms, Laboratory etc.
3. To eliminate the spillage and over usage of water in washbasins, urinals and toiler push taps are highly recommended Incinerator may be establishing in the washroom of hostels for discarding sanitary pads.
4. Increase recycling education on campus.
5. The environmental committee must organize more programs of sustainable environment policy for staff and students.
6. To be awareness or implement 3R (Reduce, Reuse and Recycle)
7. To be conduct quarterly Internal Water Audit and should be headed by HOD Civil Department.

9) To be Composting of bio degradable waste scientifically.
10) To be maintain plumbing scheduling of inspection of water loss and leakages.
11) To be use PLC, Float Level sensor based overflow protection system to avoid water loss for overhead Tanks.

ANNEXURE 1: WATER EFFICIENCY CHECKLIST

Water Efficiency & Wastewater Management

Sr. No.	Design Feature	Status	Remarks (If any)
1	Aerators to water taps	X	
2	Automatic toilet faucets	X	
3	Dual flush toilet with cistern	X	
4	Efficient plumbing system from maintenance & operation point		
5	Use of low flow/ flow control water equipment or gadget	X	
6	Water free urinals (No flush urinals/Zero flush urinals/Water less urinals/air based flushing system these save water used in toilet)	X	
7	Drip irrigation (This refers to plant watering system)	X	
8	Water distribution diagram/water network/Water balance diagram	X	This would be useful for monitoring & reducing water consumption.
9	Filtration Unit for treated sewage recycle	X	This will be useful for recycling water after treatment.
10	Rainwater harvesting		
11	Display of signboards at appropriate places forwater conservation	X	
12	Use of storage tank water in the toilet for flushing		We should discourage use of potable water

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AUDIT CERTIFICATE

This is to certify that **Shri Chhatrapati Shivaji Maharaj College of Engineering, Ahmednagar** has successfully undergone an **"Environmental Audit 2022-2023"** to access the eco-friendly initiatives planning and efforts practiced in college campus were found satisfactory.

The efforts taken by the management and the faculty towards environment and sustainability are appreciated.

Place: Ahmednagar
Date: 15th May 2023

SARVASHREE TECHNOGREEN PVT. LTD. U74999 PN2020 PTC192445

Susheel Pote
Director

Anil Dube
Certified Energy Auditor
EA-4973