7.1.6 Quality audits on environment and energy regularly undertaken by the Institution and any awards received for such green campus initiatives:

1. **Green audit**
2. **Energy audit**
3. **Environment audit**
4. **Clean and green campus recognitions**
5. **Beyond the campus environmental promotion activities**

A. Any 4 or all of the above

B. Any 3 of the above

C. Any 2 of the above

D. Any 1of the above

E. None of the above

Dr. G. T. Thampi
PRINCIPAL
Thadomal Shahani Engineering College
Bandra (W), Mumbai-400 050.

GREEN AUDIT REPORT

Varshasookt Consultants

We cherish the drops of life!!!

Dr. G. T. Thampi
PRINCIPAL
Thadomal Shahani Engineering College
Bandra (W), Mumbai-400 050.

CONTENTS

ACKNOWLEDGEMENT

VARSHASOOKT CONSULTANTS Green Audit Team thanks the management of THADOMAL SHAHANI ENGINEERING COLLEGE for assigning this important work of Green Audit. Our special thanks are to:

- Honorable Principal G.T. Thampi.
- Teaching & Supporting Staff of Collage for giving us necessary inputs to carry out this very vital exercise of Environmental Audit. We are also thankful to other staff members who were actively involved while collecting the data and conducting field measurements.

The Green audit conducted by the THADOMAL SHAHANI ENGINEERING COLLEGE is an internal audit that aims towards looking after a healthy environment. Though nascent, the initiative is taken up to foster the concept of environmental sustainability. Sincere thanks to all for providing us necessary amenities and co-operation during the audit that helped in making the audit a success.

GREEN AUDIT

CERTIFICATE

This is to certify that a "Green Audit" for Thadomal Shahani College of Engineering, Linking Rd, TPS III, Bandra West, Mumbai, Maharashtra 400050, has been conducted in March 2021 to assess the green initiatives planning and efforts implemented in the college **campus like** Green Campus Management. Carbon Footprint, plantations, waste management and rainwater harvesting, conservation of energy. This green audit is also aimed to assess **impact of green** initiatives for maintenance of eco-friendly campus.

Place: Bandra

Date: 12th March 2021

Ms. Chitralekha Vaidya

(Lead Auditor)

1. EXECUTIVE SUMMARY

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

The purpose of the audit was to ensure that the practices followed in the campus are in accordance with the Green Policy adopted by the institution. The methodology included: preparation and filling up of questionnaire, physical inspection of the campus, observation and review of the documentation, interviewing key persons and data analysis, measurements and recommendations. It works on the several facets of 'Green Campus' including Water Conservation, Tree Plantation, Waste Management, Paperless Work, Alternative Energy and Mapping of Biodiversity. With this background, the specific objectives of the audit were to evaluate the adequacy of the management control framework of environment sustainability as well as the degree to which the Departments are in compliance with the applicable regulations, policies and standards. It can make a tremendous impact on student health and learning Institute operational costs and the environment. The criteria, methods and recommendations used in the audit were based on the identified risks.

VARSHASOOKT CONSULTANTS THANE

Dr. G. T. Thampi
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2. INTRODUCTION

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

1. Green Audit is a systematic approach.
2. Audit is conducted objectively.
3. Auditor obtains and evaluates evidence.
4. Evidence obtained and evaluated by the auditor concerns assertions about economic actions and events.
5. Auditor ascertains the degree of correspondence between assertions and established criteria.
6. Goal, or objective, of the audit is communicating the results to interested users.

About the college

Thadomal Shahani Engineering College (TSEC) is an engineering college in Mumbai, India. Founded in 1983, it is the first and the oldest private engineering institute affiliated with the University of Mumbai. TSEC was founded by the Hyderabad (Sind) National Collegiate Board (HSNC Board) in the year 1983. It is named after one of Mumbai's most respected philanthropists, Dada Kishinchand T. Shahani's father, Thadomal Shahani. The HSNC board is a charitable trust established by the Sindhi Community in 1922. With active support and encouragement from one of Bombay's influential Barrister H.G. Advani, the HSNC Board came into existence in 1949 at Bandra, Mumbai.

The Late Barrister became the Founder-President, whereas Vidyasagar Principal K.M. Kundnani was the Founder-Secretary and Founder-Principal of the first college started by the board was R.D National College. Since then the Board has been offering unique pre-degree study, undergraduate and post graduate degrees in a wide range of programs. It has produced professionals' par excellence in the fields of Arts, Science, Commerce, Management, Education, Law, Engineering, Technology and Para-Medical

Vision

- Contributing to evolving supply chain of human capital for National Economy
- Creating entrepreneurs and 'game changers' to support heightened level of economic activities underpinning ever increasing human aspiration
- Helping the Nation evolve as a total solution provider
- Value and wealth creation for the mankind

Mission

- Product and processes innovation
- Leveraging human cognitive and behavioural science for creating instructional content
- Pervasive and ubiquitous Information Communication Technologies for customized content for learning
- Acknowledge and facilitate various learning styles and learning abilities
- Migrating from teaching paradigm to learning paradigm
- Every day discourse shall inculcate research culture and further the cause of societal advancement
- Understand various markets and cultures
- Collaborative learning and emotional integrity
- Sensitizing about opportunities in Energy, Education, Environment and Health care sectors
- Extensively promoting computer aided design, analysis and manufacturing procedures

- Theoretical rigor to develop conceptual clarity
- Modelling and design of experiments to inculcate culture of investigation
- Helping foot print on Project management and collaborative human endeavour
- Interdisciplinary studies and exposure to functional areas

Other Facilities

- Library
- Seminar Hall
- Laboratory
- Canteen
- Wi-fi and 3G communication enabled campus
- Spacious student lounge

No. of Buildings	2
No. of Floors in Building-1	11
No. of Floors in Building-2	6

3. OBJECTIVE OF THE STUDY

The main objectives of the green audit are to promote the environment management and conservation in the Institute campus. The purpose of the audit is to identify. Quantify, describe and prioritize framework of environment sustainability in compliance with the applicable regulations, policiesand standards.

Green Audit can be defined as systematic identification, quantification, recording, reporting and analysis of components of environmental diversity. The „Green Audit" aims to analyze environmental practices within the Institute campus, which will have an impact on the eco-friendly ambience. It was initiated with the motive of inspecting the work conducted within the organizations whose exercises cancause risk to the health of inhabitants and the environment.

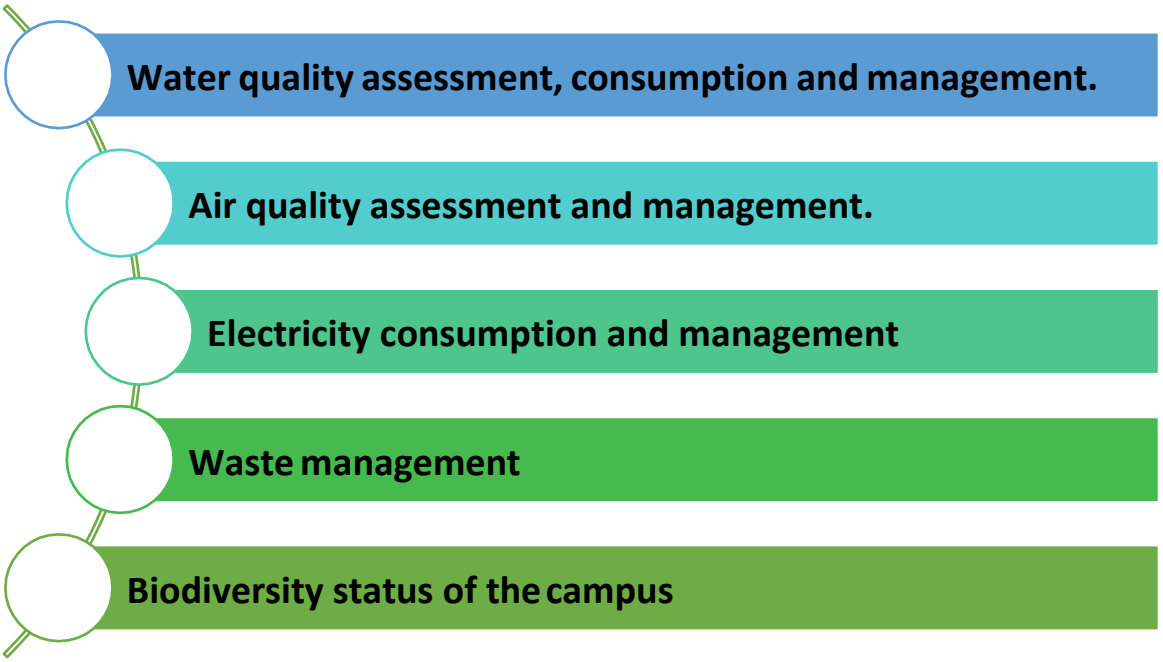
Later on, it is implemented as a measure to enhance a healthy environment to almost all the organizations. Through Green Audit, one gets a direction as how to improve the condition of environment and there are various factors that have determined the growth of carrying out Green Audit. Green audit is assigned to the criteria 7 of NAAC, National Assessment and Accreditation Council which is a self-governing organization of India which declares the institutions as Grade A, B or C according to the scores assigned during the accreditation.

The main objectives of carrying out green audit are

- To introduce and make aware students to real concern 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 bring out a present status report on environmental compliance.

4. METHODOLOGY

In order to perform green audit, the methodology included different techniques such as physicalinspection of the campuses, observation and review of the documentation, interviewing key persons and data analysis, measurements and recommendations. The study covered the following area to summarizethe present status of environment management in the campuses



The Green Audit taken up by the Thadomal Engineering College had been divided into three stages

5. THE PRE-AUDIT STAGE

In the pre-audit stage, meetings provide an opportunity to support the capacity and objectives of the audit and enable discussions on the feasibility associated with the audit. The meeting provides the first opportunity to meet the audit and deal with several practical knowledge and concerns. The meetingprovided the chance to gather information that the audit team can study before arriving on the site. The audit procedure and audit plan were handed over at this meeting and discussed in advance of the audit itself. In Thadomal Shahani Engineering College, the planning of audit processes was discussed in the pre-audit meeting. Audit team was also selected in this meeting with the help of staff and the Institute management. The audit protocol and audit plan were handed over at this meeting and discussed in advance of the audit itself. The Management of the Institute has shown the commitment towards the green auditing during the pre-audit meeting. They were ready to encourage all green activities. It was decided to promote all activities that are environment friendly such as awareness programs on the environment, campus planting more trees on the campus, etc., after the green auditing. The management of the Institute was willing toformulate policies based on green auditing report.

6. THE AUDIT STAGE

The Audit Stage encompasses of the team selection and the field works performed. Looking after the unique structure, location and ambiance of the Institute, the Green Audit Team focused on Material Issues pertaining to Institute which have the highest influence on the Green Attributes of the Institute. The Audit stage also focused on the Methodology adopted. Checklist approach is adopted for transparent evaluation of the topics and increase readability for independent reader. Discussions were made with the college management regarding their policies on environmental management. Future also discussed, the purpose of plans of the college were the green audit was to ensure that the practices followed in the campus in accordance with the Green Policy adopted by the institution.

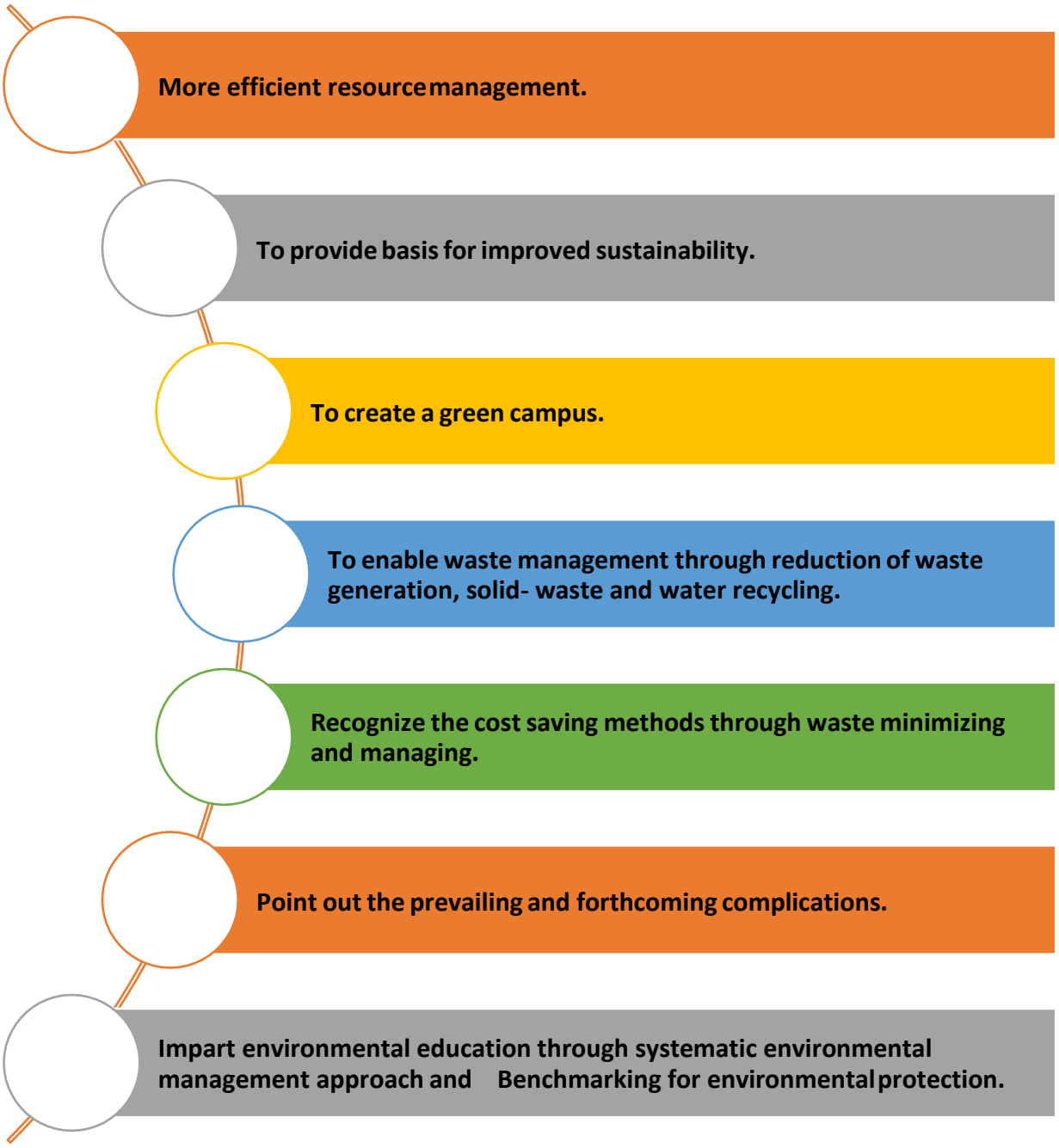
College and its premises were visited and analysed by the auditor to gather information. Campus trees were counted and identified. Canteen, library, office rooms and parking grounds were also visited to collect data. Number and type of vehicles used by the stakeholders were observed.

7. THE POST AUDIT STAGE

The base of any green audit is that its findings are supported by documents and verifiable information. The audit process seeks, on a sampled basis, to track past actions, activities, events, and procedures to ensure that they are carried out according to systems requirements and in the correct manner. Green audits form a part of a process. Although they are individual events, the real value of green audits is the fact that they are carried out, at defined intervals, and their results can illustrate improvement or change over time. Although green audits are carried out using policies, procedures, documented systems and objectives as a test, there is always an element of subjectivity in an audit. The post-audit stage ensures formulation of Draft findings and sent to management response. Since the audit is done internally, it was important to ensure management approval for the draft. After getting draft approval, the audit team went for final report formulation.

8. AUDIT GOALS OF THE INSTITUTE

The Institute, has created green monitoring team that aimed at performing the green audit of theinstitution. The main objectives of the audit are



9. AUDIT FRAMEWORK AND DETAILED FINDINGS

The following audit framework is used for conducting Green Audit in 2021. The framework also liststhe findings and observations for every criterion.

Control objective	Control(s)	Audit Observation
• **WATER MANAGEMENT**	• Repair sources of water leakage, such as dripping taps.	• Regular checking and maintenance of pipelines are done to control Water wastage.
	• Encourage to decrease excess water usage.	• Though water is used nominal in the Institute, but to ensure a further minimal rate, placards and warnings are not set up in the Institute premise. That must be adopted at every water delivery Point.
	• Install water recycling mechanism.	• There is no such water recycling mechanism adopted by the college.
	• Minimize wastage of water and use of electricity during water filtration process, if used, such as Aqua guard filter	• Institute has Aqua guard filter on each floor which gives safe drinking water.
	• Rainwater Harvesting project execution	• Though Rainwater is collected through underground pipelines, it is recharged to ground water, and it is use for garden purpose.
• **WASTE MANAGEMENT**	• Compost, or cause to be composted, all organic	• The Institute has no waste management in college, the municipal collects the waste. Hence, automatic waste composting is strongly

		recommendation for better waste Management.
	• Make full use of all recycling facilities	• Institute does not have any such recycling device to carry on the procedure. Primary segregation is carried out and partly paper, plastic and E waste is sold or shared to local kabadiwalas or few NGOs.
	• Waste, green waste and non-recycled collected from gardens, offices and rooms.	• Compost plant that ensures proper treatment of all organic wastes. However, it is absolutely primary processing. Better and scientific Treatment is expected.
	• Recycle or safely dispose of dry wastes, computers and electrical appliances.	• Recycle or safely dispose of dry wastes, computers and electrical appliances is done at primary level is done. E waste is not given to any authorized E waste recyclers.
	• Provide sufficient, accessible and well-publicized collection points for recyclable waste, with responsibility for recycling clearly allocated	• The Institute has set up separate two bins on each floor to ensure proper segregation and collection of the various wastes. The responsibility of recyclable waste is however still not taken up by the Institute
	• Dispose all waste, whether solid or otherwise, in a scientific manner and ensure that it is not released directly to the environment	• Yes, the Institute is trying to dispose all wastes, whether solid orotherwise, in a scientific manner and ensure that it is not released directly to the environment; however, there is a lot of scope for improvement in current waste handling methods.

• **GREEN CAMPUS**	• Encourage the faculties and students to plant trees in the garden.	• Encourage the faculties and students to plant trees in the garden. Existing plantation is not marked properly. However, more plantation can be adopted with more native trees.
	• Establish a Garden in the campus	• Institute already has a well-Maintained garden.
	• Disposal of the chemical waste generated from the laboratories in a scientific manner	• There is no as such treatment is given to the laboratories waste generated.
	• Minimize the use of fertilizers and Pesticides in Institute ground & garden.	• Moderate amounts of bio-fertilizers are used in the Institute.
• **ENERGY MANAGEMENT**	• Look in to the possibility of on-site micro-generation of renewable electricity.	• Institute has installed Solar wall Lights.
	• Give preference to the most energy efficient and environmentally sound appliances available, this includes only using energy-saving light bulbs	• The Institute is using LED lights as much as practicable as well as CFL.
	• Ensure that all cleaning products used by Institute staff have a minimal detrimental impact on the environment, i.e. are biodegradable and non-toxic	• Negligible amounts of washing liquids are used in the Institute and all the toilet cleaners are eco-friendly

Fig.1 Solar Wall Lights

Green Campus:

Total number of plants in the campus- 26

- **New Building**

Particulars	Quantity
Almond	1
Java Plum	1
Mango	2
Ashoka	1
Goose Berry	1
Chikoo	1
Peepal	1
Curry Patta	1
TOTAL	**09**

- **Old Building**

Particulars	Quantity
Almond	2
Peepal	1
Coconut	3
Java Plum	1
Mango	2
Ashoka	8
TOTAL	**17**

Water Management

The source of water used in the college are municipal water supply.

Sr.No.	Parameters	Response
1	No of wells	Nil
2	No of water tanks	8
3	Any wastage/why	Nil
4	Water used for gardening	1000 cu.mt.
5	Waste water sources	Canteen, washrooms
6	Rain water harvest available?	Yes
7	Any leaky taps?	Nil
8	Amount of water lost per day	Nil

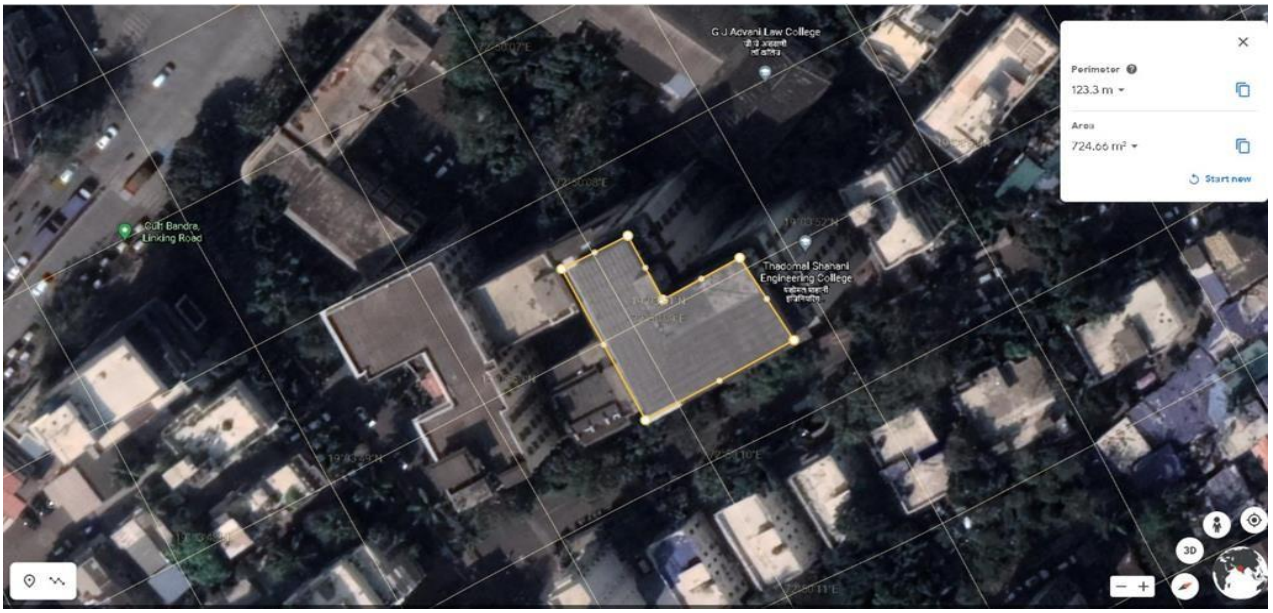
Waste management

Waste management is important for an eco-friendly campus. In a college, different types of wastes are generated, its collection and management are very challenging. The following data provide the details of the waste generated and the disposal method adopted by the college.

Types of waste	Particulars	Disposal method
E-Waste	Computers, electrical and electronic parts	Pick up by municipal corporation
Plastic waste	Pen, Refill, Plastic water bottles and other plastic containers, wrappers etc.	Pick up by municipal corporation
Solid wastes	Damaged furniture, paper waste, paper plates	Pick up by municipal corporation
Waste water	Washing, urinals, bathrooms	Municipal sewer line
Food waste	Food waste from canteen	Pick up by municipal corporation

10. THADOMAL ENGINEERING COLLEGE LOCATION

- **New Building**



- **Old Building**

11. SUGGESTIONS AND RECOMMENDATIONS

A few recommendations are added to curb the menace of all management using eco-friendly and scientific techniques. This may lead to the prosperous future in context of green campus and thus sustainable environment and community development. It has been shown frequently that the practical suggestions, alternatives, and observations that have resulted from audits have added positive value to management of the campus.

CRITERIA WISE RECOMMENDATIONS

Green Campus

- All trees in the campus should be named scientifically and name should be placed on each tree.
- Not just celebrating environment day but making it a daily habit.
- Beautify the college building with indoor plants.
- Providing funds to the any Nature Club for making campus greener.
- Encouraging students not just through words, but through action for making the campus green.
- Conducting competitions among departments for making students, teaching-non teachingstaffs more interested in making the campus greener.
- In order to increase the carbon credit and greenery of the campus, it is recommended to plant more indigenous and Fruit and medicinal plants species inside the campus like Guava, Amla, Kaju, Tulsi, Alovera and Ashvagandha.

Water management

- The college should arrange awareness programs for water conservation. The campaign should be on proper monitoring of water consumption patterns in the campus and can alsoconduct water quality monitoring during specific intervals.
- Install display boards to control over exploitation of water.

Energy management

- The energy audit recommends to avoid the use of more energy consuming electrical appliances and to replace with more environment friendly and energy efficient appliances(for example five stars rated Air conditioner) in the college. The potential of renewable energy sources has to be explored. As the college has a very large roof area for installing solar panels so that it can be effectively used for generating power.
- It is recommended to install the following solar powered appliances in the campus;
- Solar powered water heater and cooker in the college canteen.
- Solar powered street lights and LED display boar.
- Observe a power saving day every year
- Conduct more save energy awareness programs for students and staff.
- Use energy efficient light-emitting diode (LED) bulbs instead of incandescent and CFL bulbs
- Maintain appliances and replace old appliances.
- Use computers and electronic equipment in power saving mode.

Waste management

- Try to avoid the use of plastic in the campus, and to encourage the use of biodegradable materials as alternatives. Ban on single use plastic such as carry bags, food packaging, bottles, straws, containers, cups and cutlery. Instead use steel plates. Avoid using paper cups and plate too.
- Leaf litter from the campus can be effectively used for aerobic/ vermi composting, so that the composted material can also be used as good manure.
- Recycle the paper waste instead of incinerate or burning.
- Practice of waste segregation to be initiated.
- Establish a functional bio gas plant.

Carbon footprint

- Increase a system of car-pooling among the staff to reduce the number of four wheelers coming to the college.
- Introduce college bus services to the students and staff members.
- Encourage students and staff member to use public transport as possible.
- Establish a more efficient cooking system to save gas.
- College observe “no own vehicle day” every month. The any day of every month must be dedicated for it. Teachers and students are not allowed to take their private vehicles on that day and are supposed to reach college via public transportation methods. The no own vehicle day is widely accepted among students and teachers and is hugely appreciated by the community.
- College also can promote car and bike pooling system. Teachers/ students coming from the same area share their vehicles to reach the college. This also reduces the number of private vehicles used in the college campus

12. CONCLUSION

The green audit assists in the process of testing performance in the environmental arena and is fast becoming an indispensable aid to decision making in a college. The green audit reports assist in the process of attaining an eco-friendly approach to the sustainable development of the college. A green audit report is a very powerful and valuable communications tool to use when working with various students who need to be convinced that things are running smoothly and systems and procedures are coping with natural changes and modifications that occur. The audit has identified several observations for making the campus premise more environment friendly. The recommendations are also mentioned with observations for campus team to initiate action. The audit team opines that the overall site is maintained well from environmental perspective, certain changes if implemented the college will be benefited by various environmental ways.

The audit was conducted to check following aspects

- More efficient resource management.
- Provide basis for improved sustainability.
- Creating a green campus.
- Enable waste management through reduction of waste generation, solid- waste and water recycling
- Recognition of the cost saving methods through waste minimizing and managing.
- Point out the prevailing and forthcoming complications.
- Impart environmental education through systematic environmental management approach and Benchmarking for environmental protection.

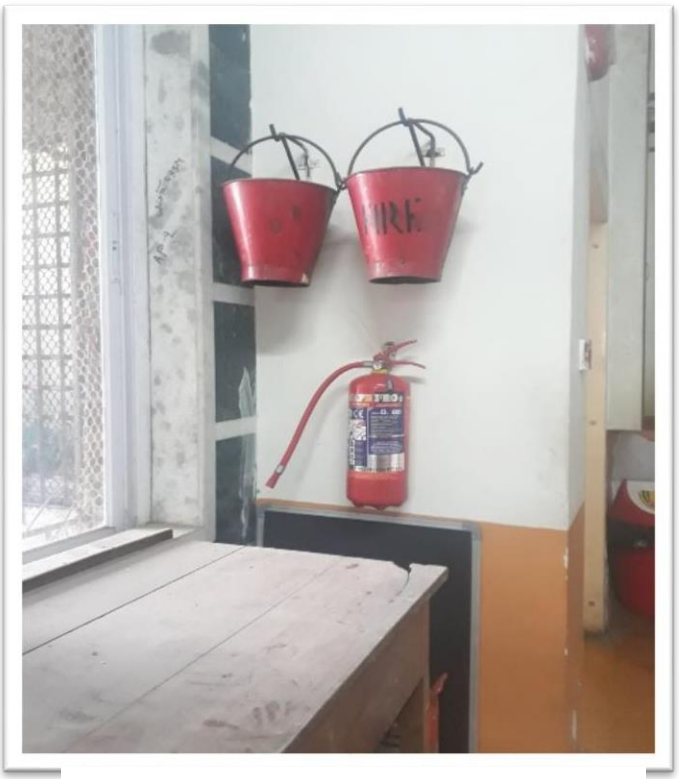
Allow targets are fairly achieved in executed green audit report.

Amenities at College

- **Entrance of Old Building**

- **Dustbins in backyard of College, which pick up by BMC**

- **Parking area in the campus**



- **Fire extinguisher on each Floor**

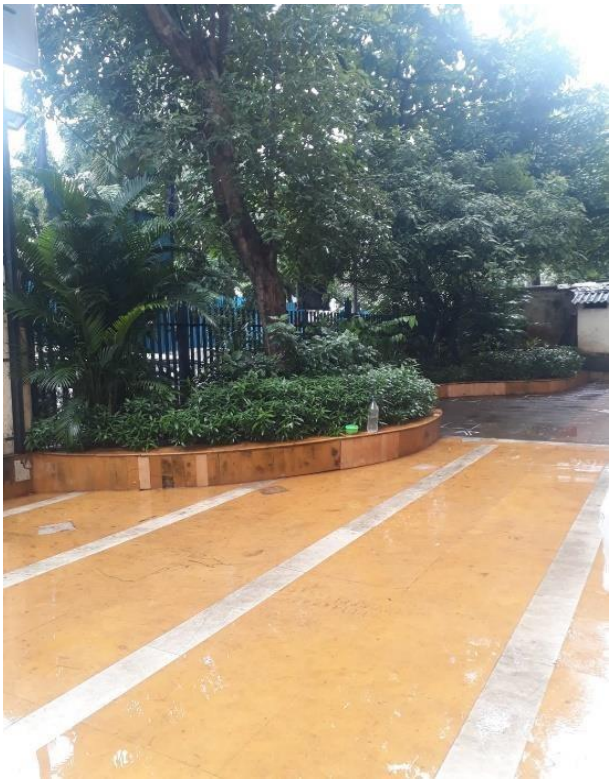
- **Two Separate Dustbins on each floor**

- **Electrical room in the college**

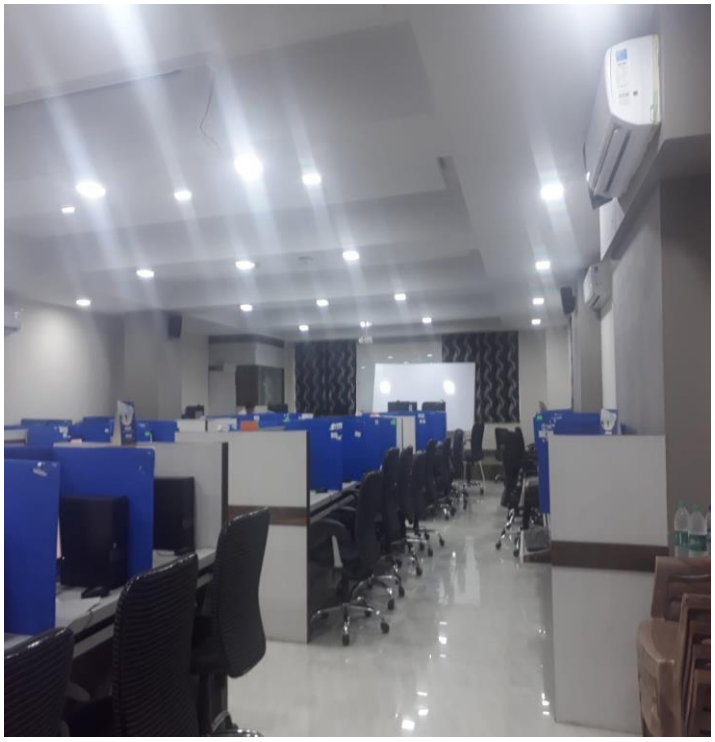
- **Aqua gaurd filter on each floor**

- **Library in the college**

- **Fire Hose Box to extinguish fire in the campus**



- **Planted trees in campus**



- **Computer Lab**

- **Biotech Laboratory**

Energy Audit Report

of

THADOMAL SHAHANI ENGINEERING COLLEGE, BANDRA WEST, MUMBAI

Prepared

By

Dr. Santosh D Dalvi
BEE Certified Energy Auditor
Certification No: CEA- 12141

March 2021

Dr. G. T. Thampi
PRINCIPAL
Thadomal Shahani Engineering College
Bandra (W), Mumbai-400 050.

Lokmanya Tilak Jankalyan Shikshan Sansthaa's
LOKMANYA TILAK COLLEGE OF ENGINEERING
Approved by AICTE vide letter No. F-740-89-295 (E)/RC/94 Dt. 26-07-1994
Affiliated to University of Mumbai & Recognised by Govt. of Maharashtra

Shri. Satish Chaturvedi
Chairman

Dr. Vivek Sunnapwar
Principal

LTCE/Gen/2021/

Date: 18/03/2021

ENERGY AUDIT COMPLETION CERTIFICATE

This is to certify that Energy Audit has been carried out in the campus and buildings of Thadomal Shahani Engineering College, Bandra West , Mumbai as per the guidelines laid down in The Energy Conservation Act, 2001, in the month of March 2021.

Name of the Installation	Thadomal Shahani Engineering College, Bandra West, Mumbai-400050
Details of Facilities Audited	Laboratories, Classrooms, Library, Seminar halls of New and Old Building
Date of Energy Audit	15/03/2021
Name of Certified Energy Auditor	Dr. S D Dalvi
Certification Number	CEA- 12141
Validity of the Certificate	14/03/2022

Dr. S D Dalvi
Certified Energy Auditor

Dr. Vivek Sunnapwar
Principal

Sector-4,Koparkhairane,Navi Mumbai,MH -400 709, INDIA. T : +91 22 2754 1005/6, F : +91 22 2754 7793, W : www.ltce.ltjss.net

Dr. G. T. Thampi
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Contents

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Executive Summary-Energy Audit

Energy Saving Potential

Sr No	Area & Proposed Action for Energy Efficiency Improvement	Savings Potential	Investment	Payback Period
		Rs/month	Rs	Months
1	Maintaining Power factor to unity and other incentives/discounts	14096	NIL	Immediate
2	Replacing magnetic ballast with electronic ballasts for tube lights and lamps	1581	81200	51
3	Improving & maintaining performance of air conditioners at optimal levels (Sampled)	362	Negligible	Immediate
4	Replacing tube lights (TL) by LED lamps	7714	133600	18
5	Replacing ordinary ceiling fans by energy efficient Fans	3683	985000	23

Dr. G. T. Thampi
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Chapter-I

Introduction

1.1 Background of the study:

The fundamental purpose of the energy audit is not only to identify the potential saving areas but also to establish energy monitoring and control system to reap the gains on sustainable basis. It is with this purpose that Thadomal Shahani Engineering College (TSEC), Bandra (West), Mumbai, Maharashtra, assigned Dr. S D Dalvi, CEA-12141 Energy Auditor to carry out Energy Audit. It was really tough time to carry out study in Covid-19 Pandemic, But the TSEC management made it success.

This energy audit report presents the analysis of the data collected, observations made at the facility and is governed by the objectives, scope of work, methodology etc. discussed in the ensuing paragraphs.

Objective:

The basic objectives of the Energy Audit Study are to,

- Identify key result areas for energy saving along with their broad Cost Benefit Analysis.
- Suggest energy monitoring and control mechanism to realize the savings on the sustainable basis.

Methodology:

Prior to start of the Audit session, submitted a list of data required along with the execution plan.

Then deputed a team of Project Engineers for this task. The visit was undertaken in the First week of March 2021. The field training was given to the engineers

about data collection. The team was trained about operation and handling of the instruments used in the energy auditing, in Covid-19 Pandemic situation.

The prime objectives of these visits were:

- To hold discussions with Principal, to understand Energy consumption pattern, to get acquainted with the efforts already put in for energy conservation
- To collect historic data regarding energy consumption and maintenance practices.
- To undertake requisite field trials and to make observation.

Team:

The team members of the audit study.

1. Dr S D Dalvi, Certified Energy Auditor (CEA-12141)

2. Mr Swapnil D Mhatre, Project Engineer

3. Mr Shubham J Birambole, Project Engineer

4. Mr Nikhil C Varsolkar, Project Engineer

Instruments

The following instruments were utilized for measurement during the energy audit study.

1. Power meter
2. Hygro-temperature meter
3. Anemometers
4. AC power meter
5. Lux meter

Acknowledgment:

We wish to record our gratitude to the management of TSEC for awarding this assignment. We extend our thanks to the Principal, Dr. G T Thampi for initiating the work. We are also thankful to the maintenance team for extending all possible help and co-operation from their side.

Dr. G. T. Thampi
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Bandra (W), Mumbai-400 050.

Chapter-II

Consumption Pattern

2.1 Brief Description & Consumption data:

Present Scenario:

- The average monthly consumption is around 9,061 kWh.
- The monthly maximum consumption in AY 2020-21 is observed as 25,617 kWh.
- The calculated cost of power is Rs 10.43/- per kWh in AY 20-21 for LT I (B) electricity meters.

As can be seen the major consumption is of

- Air conditioners
- Ceiling fans
- Computers
- Illumination

The other unaccounted consumptions are of elevators, centrifugal pumps,

printers, scanners, ups etc.

2.2 Electricity Bills:

The electricity is supplied through LT connection; TSEC has installed Seven LT I (B) electricity meters. TSEC has installed five LT II (C) electricity meters. This tariff category is applicable for electricity used at Low/Medium voltage in non-residential, non-industrial and/or commercial premises for commercial consumption meant for operating various appliances used for purposes such as

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lighting, heating, cooling, cooking, washing/cleaning, entertainment/ leisure and water pumping in.

The statistics of electricity consumption for month of February 2021is tabulated and shown in the graph.

The analysis of LT II (C) electricity meters is shown in table.

Category		LT II (C)				
Meter No		L1003438	L1003439	L1003440	L1004492	L1004495
MF		20	40	80	40	20
consumption	KWH	1111	131	1845	218	1728
Maximum Consumption	kWH	568	5470	6057	960	2799
Month and Year		Sep-20	Oct-20	Oct-20	Feb-21	Mar-21
Power factor		0.335	0.894	0.85	0.971	0.428
TOD 9-12 hrs charges	Rs	156.5	7	278	36.5	147
TOD 12-22 hrs charges	Rs	3	13	98	5	324
TOD 22-06 hrs charges	Rs	*3*	18	*135.75*	0	*293.25*
Prompt Payment Discount	Rs	0	0	0	0	0
Digital Payment Discount	Rs	0	0	0	0	0
Delayed Payment Charges	Rs	243.35	143.51	495.02	108.31	518.04
PF Panalty/Incentives	Rs	3639.08	93.74	1546.55	*71.59*	6762.22
Energy Charges	Rs	19467.74	11481.11	39601.45	8664.5	41443.31
Bill Amount	Rs	19711.15	11627.69	40100.73	8774.69	41962.66

The analysis of LT I (B) electricity meters are shown in table.

Category		LTI (B)						
Meter No		7735461	7735462	7780668	7602803	7882202	7541328	7881869
consumption	KWH	73	31	98	1339	139	1289	1059
Maximum Consumption	kWH	124	72	563	2239	1416	3218	2131
Month and Year		Feb-20	Jan-20	Jan-20	Feb-20	Feb-20	Jan-20	Jan-20
Prompt Payment Discount	Rs	0	0	0	0	10.47	0	0
Digital Payment	Rs	0	0	0	0	0	0	0

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Discount								
Delayed Payment Charges	Rs	na	na	Na	na	Na	na	na
PF Panalty/Incentives	Rs	Na	na	Na	na	Na	na	na
Energy Charges	Rs	888.12	332.65	700.62	13427.24	1663.61	12876.58	10995.97
Bill Amount	Rs	897.97	342.43	708.78	13521.97	1663.61	12882.35	11046.99

2.3 Energy Saving Analysis:

The observations are as below.

1. Power factor penalty of Rs. 11970 per month* is levied which can be saved and converted into incentives by maintaining power factor near to unity.
The improvement in power factor also reduces maximum demand and proportionally saves on demand charges. The power factor has been maintained at unity.
2. Delayed payment charges of Rs. 1508.23 per month* may be saved.
3. TOD charges of Rs. 1068 and incentives of Rs. 450 are levied in current month.
4. The prompt payment discount and digital payment discount are not observed in the electricity bills.

2.4 Important Information from Electricity Distributor:

The electricity distributor of TSEC is Adani Electricity Mumbai Limited. The tariff for LT I (B) meter is shown in the table.

Tariff w.e.f. 1 April, 2021 to 31 March, 2022 (LT I B)

Consumption Slab (kWh)	Fixed Charge / Demand Charge[$$]	Wheeling Charge (Rs/kWh)	Energy Charge (Rs/kWh)
0-100 units	75	1.46	3.05
100-300 units	115	1.46	5.00
301-500 units	115	1.46	6.65
Above 500 units	140	1.46	7.80

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The tariff for LT II (C) meter is shown in the table.

Tariff w.e.f. 1 April, 2021 to 31 March, 2022 (LT II C)

Consumption Slab (kWh)	Fixed Charge / Demand Charge	Wheeling Charge (Rs/kWh)	Energy Charge (Rs/kWh)
(A) 0-20 kW	Rs. 405 per month	1.46	5.65
(B) >20 kW and ≤ 50 kW	Rs. 335 per kVA month	1.46	6.05
(C) > 50 kW	Rs. 335 per kVA month	1.46	6.60
TOD Tariffs (in addition to above base Tariff)			
0600 to 0900 hours			0.00
0900 to 1200 hours			0.50
1200 to 1800 hours			0.00
1800 to 2200 hours			1.00
2200 to 0600 hours			-0.75

Power factor incentives

Whenever the average Power Factor is more than 0.95 (lag or lead) and upto 1, an incentive shall be given at the rate of the following percentages of the amount of the monthly electricity bill. The details are shown in the table.

Sl.	Range of Power Factor	Power Factor Level	Incentive
1	0.951 to 0.954	0.95	0.0%
2	0.955 to 0.964	0.96	0.5%
3	0.965 to 0.974	0.97	1.0%
4	0.975 to 0.984	0.98	1.5%
5	0.985 to 0.994	0.99	2.5%
6	0.995 to 1.000	1.00	3.5%

Power factor penalty

Whenever the average PF is less than 0.9 (lag or lead), penal charges shall be levied at the rate of the following percentages of the amount of the monthly electricity bill. The details are shown in the table.

Sl.	Range of Power Factor	Power Factor Level	Penalty
1	0.895 to 0.900	0.90	0.0%
2	0.885 to 0.894	0.89	1.0%
3	0.875 to 0.884	0.88	1.5%
4	0.865 to 0.874	0.87	2.0%
5	0.855 to 0.864	0.86	2.5%
6	0.845 to 0.854	0.85	3.0%
7	0.835 to 0.844	0.84	3.5%
8	0.825 to 0.834	0.83	4.0%
9	0.815 to 0.824	0.82	4.5%
10	0.805 to 0.814	0.81	5.0%
…	…	…	…

Chapter-III

Computers

3.1 Brief Description:

In new building there were 876 computers and in old building 65 computers counted as observed. There were printers and scanners in both the buidings.

General Suggestions:

1. An efficient power management system may be incorporated to

a. Switch off the display if not in use.

b. Put the computer in Sleep mode / switching off the machines, if not used for prolonged period.

2. Optimize brightness of the screen.

3. Discourage use of screen savers, which has similar power consumption

Chapter-IV

Air Conditioning System

4.1 Brief Description:

Air conditioning system is basically provided to maintain comfortable ambience inside the premises by maintaining the temperature (and relative humidity, at times) at appropriate levels. The performance of human being is optimal at the temperature of 24 ± 2 ^{o}C and at relative humidity (RH) of 60 ± 5%.

The warmer and humid air from the premises is drawn and fed to the Air Conditioning System by a circulating fan. This air is chilled in an evaporator by vaporizing the refrigerant and is distributed throughout the conditioned area. The refrigerant is pressurized by a compressor and subsequently s cooled and condensed by an air cooled condenser. The compressor and condenser are placed in an outdoor unit, located on the external side of the premise. While the circulating fan and evaporator is placed in an indoor unit located inside the premises.

4.2 Performance Evaluation:

The Air Conditioning effect (TR) and specific power consumption can be computed as under

AC Effect (TR) = Air flow rate x Specific gravity of air x (Enthalpy of supply air - Enthalpy of return air) / 3000

Specific Power (kWh/TR) = Power Consumption / AC Effect

The performance as well as chilling (or Air Conditioning) effect delivered by the air conditioner (represented as TR - Ton of Refrigeration) is computed by measuring

- Air Velocity along with the cross-sectional area of flow to determine flow rate and subsequently mass flow rate.
- Temperature and relative humidity of the air at the inlet of the evaporator coil to determine enthalpy of the air.
- Temperature and relative humidity of the air at the outlet of the evaporator coil to determine enthalpy of the air.
- Power drawn by the air conditioning unit

The chilling effect can be computed as under,

1. Flow Rate of Air (kg/hr)

= Average Air velocity (M/s) x Cross sectional area of the air flow (Sq M) X Specific gravity of air

2. Chilling or Air Conditioning Effect (TR)

= Air flow rate (kg/hr) x Enthalpy difference between the air at inlet and outlet of the evaporator coil (kJ/kg) / (4.18 x 3024)

3. Chilling or Air Conditioning Effect (kW)

= Air flow rate (kg/hr) x Enthalpy difference between the air at inlet and outlet of the evaporator coil (kJ/kg) / 3600

= 3.5112 x Chilling Effect (TR)

4. Specific Power Consumption (kWh/TR) =

Power consumption (kW) / Air Chilling Effect (TR)

Energy Efficiency Ratio - EER (W of cooling / W of input power)

= Power consumption (kW) / Air Chilling Effect (kW)

= 3.5112 / Specific Power consumption (kW/TR)

The data collected only at the sampled and accessible air conditioners, based on structural observations like filter condition, insulation damage etc. and analyzed is tabulated below.

Assuming,

daily operation hours= 5

No of functioning days per year= 200

No of functioning days per month= 22

Average cost of electricity = Rs. 5/kWh

Sr No	LOCATION	Make	TYPE OF A/C Split/window	CAPACITY	POWER	Average Velocity	FLOW
				TR	kW	MPS	M^3/hr
TSEC OLD BUILDING							
1	202	Voltas	Window	1.5	1.71	1.9	465.1
2	203	Blue star	Window	1.5	1.83	1.8	440.6
3	503	Voltas	Split	2	1.88	3.3	950.4
TSEC NEW BUILDING							
4	702	Voltas (2)	Split	2	1.88	1.6	460.8
5	704	Voltas	Split	2	2.85	2.8	806.4
6	802	Voltas	Split	2	2.89	2.6	748.8
7	804	Voltas (2)	Split	2	1.67	1.6	460.8

Sr No	AHU Inlet			AHU Outlet			AC Load	SPC	Savings	
	Temp	RH	Enthalpy	Temp	RH	Enthalpy				
	°C	%	KJ/Kg	°C	%	KJ/Kg	TR	kW/TR	kwh	Rs
TSEC OLD BUILDING										
1	30.5	70.5	80.72	20.6	72.6	50.65	1.34	1.27	0.4	366
2	29.4	72.2	80.7	20	78	49.04	1.34	1.37	0.8	830
3	28.7	80.5	80.16	24.9	77.7	64.24	1.45	1.29	0.5	469
TSEC NEW BUILDING										
4	29.2	69.3	74.67	27.2	68.4	78.96	1.50	1.25	0.3	267
5	26.4	75.3	75.48	18.2	70.9	48.41	2.10	1.36	0.8	798
6	26.5	75.4	75.48	18.2	70.9	48.4	1.95	1.48	1.4	1421
7	27	70.2	67.34	23.5	78.6	59.99	1.35	1.24	0.2	185

Opportunity for Conservation of energy:

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Performance improvement:

The specific power consumption of sampled air conditioning units is higher than the general norm of 1.2 KWH/TR or EER of around 3.0.

The saving potential works out to about 4-6% in the overall consumption of the air conditioners as can be seen from the table above.

The performance of air condition can deteriorate due to

- Lower suction pressure and consequently temperature due to constrains on the evaporator. Generally, 1 ^{o}C drop in condensing temperature increases the specific power consumption by 4 to 5%. The constraints on the evaporator include

o Clogging of the filters

o Choking of fins o Damages to the fins

o Deposition of dust on the external surface of the coil

o Scaling on the internal or external surface of the coil

o Depositions inside the coil o Inadequate surface areas due to improper design

- Higher discharge pressure and consequently temperature due to constrains on the condenser. Generally, 1 ^{o}C rise in condensing temperature increases the specific power consumption by 3 to 4%. The constraints on the condenser include

o Clogging of the fins o Damages to the fins

o Deposition of dust on the external surface of the coil

o Scaling on the internal or external surface of the coil

o Depositions inside the coil o Inadequate surface areas due to improper design

- Deteriorations in the fan (for the indoor as well outdoor unit) performance

o Damages to the fan blade o Deposition of dust on the fan surface o Damages to bearings, shaft, etc.

o Inadequate capacity due to improper design

- Improper location of the outdoor unit

o Direct exposure to sunlight o Inaccessible to maintenance / servicing o Restriction on cooling air circulation

- Improper quantity of refrigerant.
- Mechanical constrains on the refrigeration compressor

O Damages to bearings, shaft, etc.

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O Increases in internal clearances

o Drop in volumetric efficiency

The saving potential can be worked out based on specific power consumption of 1.2 kWh/TR (Energy Efficiency Ratio - EER of 2.93); as detailed above.

The expected saving is about 4.4 kWh, considering an operating period of 5 hours a day for 22 days per month.

The savings work out to Rs 4,336/- per year for sampled air conditioners.

There are no capital investment and the payback period shall be attractive.

Chapter-V

Illumination

5.1 Brief Description:

The detail list of light fitting is as under.

Most fittings in new buildings are fitted with electronic ballast and at very few locations magnetic ballast fittings are used.

The fittings in the old buildings are fitted with magnetic ballast, except few locations, are provided with electronic ballast.

SN	Location	(hrs/day and day/month) Opn		Length	Width	Height	Area	RI	Ballast Type	Type of Fitting			Intensity	Power Intensity		Desired Parameters		Installed Load Efficacy Ratio	Desired Parameters (ILER = 75%)		Energy Loss (-ve indicates gain due to solar)		Saving Potential Diversity Factor 75% & Power @ Rs. 5/kWh
				M	M	M	M2								Average	Actual	Desired		Power Intensity	Power			
										F	W	R	Watts	W/M2		Lux/W/M2			W/M2	W	W	%	kWh/M
	TSEC Old Building																						
1	Ground Floor	4	22	7	7	3.5	49	1.00	M	13	13	36	468	9.55	109	11.41	36	32%	4.04	197.8	270.2	58%	17.8
2	H-101	10	30	6.15	4.56	2.77	28.044	0.95	M	2	2	40	80	2.852660106	171.43	60.09	36	167%	6.35	178.1	-98.1	-123%	-22.1
3	101	4	22	9	7	3.5	63	1.13	M	5	3	36	108	1.71428	94.28	55.00	40	137%	3.14	198.0	-90.0	-83%	-5.9
4	102	4	22	9	7	3.5	63	1.13	M	5	4	36	144	2.28	130	57.02	40	143%	4.33	273.0	-129.0	-90%	-8.5
5	103	4	22	9	7	3.5	63	1.13	M	6	4	36	144	2.28	125.71	55.14	40	138%	4.19	264.0	-120.0	-83%	-7.9
6	104	4	22	8	6	3.5	48	0.98	M	6	5	36	180	3.75	132.85	35.43	36	98%	4.92	236.2	-56.2	-31%	-3.7
7	105	4	22	9	7	3.5	63	1.13	M	6	6	36	216	3.41	248.57	72.89	40	182%	8.29	522.0	-306.0	-142%	-20.2
8	106	4	22	8	7	3.5	56	1.07	M	6	6	36	216	3.85	87.14	22.63	40	57%	2.90	162.7	53.3	25%	3.5
9	107	4	22	8	6	3.5	48	0.98	M	5	5	36	180	3.75	109.28	29.14	36	81%	4.05	194.3	-14.3	-8%	-0.9
10	108	4	22	7	6	3.5	42	0.92	M	4	4	36	144	3.42	93.33	27.29	36	76%	3.46	145.2	-1.2	-1%	-0.1
11	109	4	22	7	6	3.5	42	0.92	M	4	4	36	144	3.42	126.67	37.04	36	103%	4.69	197.0	-53.0	-37%	-3.5
12	202	4	22	4	4	3.5	16	0.57	M	4	3	36	108	6.75	105.71	15.66	36	44%	3.92	62.6	45.4	42%	3.0
13	203	4	22	8	5	3.5	40	0.88	M	6	4	36	144	3.6	70	19.44	36	54%	2.59	103.7	40.3	28%	2.7

14	204	4	22	8	4	3.5	32	0.76	M	4	4	36	144	4.5	60	13.33	36	37%	2.22	71.1	72.9	51%	4.8
15	206	4	22	10	6	3.5	60	1.07	M	4	3	36	108	1.8	127.14	70.63	40	177%	4.24	254.3	-146.3	-135%	-9.7
16	207	4	22	10	6	3.5	60	1.07	M	5	4	36	144	2.4	107.14	44.64	40	112%	3.57	214.3	-70.3	-49%	-4.6
17	301	4	22	4	3.5	3.5	14	0.53	M	2	1	36	36	2.5	195.71	78.28	36	217%	7.25	101.5	-65.5	-182%	-4.3
18	302	4	22	3.5	4	3.5	14	0.53	M	2	2	36	72	5.14	94.28	18.34	36	51%	3.49	48.9	23.1	32%	1.5
19	304	4	22	10	6	3.5	60	1.07	M	6	6	36	216	3.6	11.42	3.17	40	8%	0.38	22.8	193.2	89%	12.7
20	305	4	22	10	4	3.5	40	0.82	M	6	6	36	216	5.4	277.14	51.32	36	143%	10.26	410.6	-194.6	-90%	-12.8
21	306	4	22	8	5	3.5	40	0.88	M	7	5	36	180	4.5	122.85	27.30	36	76%	4.55	182.0	-2.0	-1%	-0.1
22	307	4	22	8	5	3.5	40	0.88	M	5	3	36	108	2.7	134.28	49.73	36	138%	4.97	198.9	-90.9	-84%	-6.0
23	308	4	22	7	6	3.5	42	0.92	M	4	4	36	144	3.4	135.71	39.91	36	111%	5.03	211.1	-67.1	-47%	-4.4
24	401	4	22	5	3	3.5	15	0.54	M	3	3	36	108	7.2	225.71	31.35	36	87%	8.36	125.4	-17.4	-16%	-1.1
25	402	4	22	10	7	3.5	70	1.18	M	3	3	36	108	1.54	64.28	41.74	40	104%	2.14	150.0	-42.0	-39%	-2.8
26	408	4	22	7	6	3.5	42	0.92	M	4	4	36	144	3.42	172.85	50.54	36	140%	6.40	268.9	-124.9	-87%	-8.2
27	409	4	22	1.5	1.5	3.5	2.25	0.21	M	1	1	36	36	16	225	14.06	36	39%	8.33	18.8	17.3	48%	1.1
28	501	4	22	4	3.5	3.5	14	0.53	M	2	2	36	72	5.14	62.85	12.23	36	34%	2.33	32.6	39.4	55%	2.6
29	502	4	22	3.5	4	3.5	14	0.53	M	2	2	36	72	5.14	62.85	12.23	36	34%	2.33	32.6	39.4	55%	2.6
30	503	4	22	12	5	3.5	50	1.01	M	8	7	36	252	5.04	63.85	12.67	40	32%	2.13	106.4	145.6	58%	9.6
31	504	4	22	15	15	3.5	225	2.14	M	24	14	36	504	2.24	86.42	38.58	46	84%	2.50	563.6	-59.6	-12%	-3.9
32	505	4	22	12	5	3.5	60	1.01	M	6	6	36	216	3.6	202.85	56.35	40	141%	6.76	405.7	-189.7	-88%	-12.5

33	506	4	22	12	5	3.5	60	1.01	M	7	7	36	252	4.2	471.42	112.24	40	281%	15.71	942.8	-690.8	-274%	-45.6
34	507	4	22	7	6	3.5	42	0.92	M	4	4	36	144	3.42	407.14	119.05	36	331%	15.08	633.3	-489.3	-340%	-32.3
35	509	4	22	1.5	1.5	3.5	14	0.21	M	1	0	36	36	3.42	407.14	119.05	36	331%	15.08	211.1	-175.1	-486%	-11.6
36	601	4	22	3	3	3.5	9	0.43	M	2	2	36	-72	3.42	683.33	199.80	36	555%	25.31	227.8	-299.8	416%	-19.8
37	602	4	22	12	4.5	3.5	54	0.94	M	8	8	36	288	5.3	77.57	14.64	36	41%	2.87	155.1	132.9	46%	8.8
38	603	4	22	7	4	3.5	28	0.73	M	8	7	36	252	9	302.71	33.63	36	93%	11.21	313.9	-61.9	-25%	-4.1
39	604	4	22	7	8	3.5	56	1.07	M	12	12	36	432	7.7	252.85	32.84	40	82%	8.43	472.0	-40.0	-9%	-2.6
40	605	4	22	7.5	4.5	3.5	29	0.80	M	7	7	36	252	8.68	86.42	9.96	36	28%	3.20	92.8	159.2	63%	10.5
41	606	4	22	7.5	4.5	3.5	29	0.80	M	7	7	36	252	8.68	324.28	37.36	36	104%	12.01	348.3	-96.3	-38%	-6.4
42	608	4	22	4	5	3.5	20	0.63	M	6	6	36	216	10.8	174.28	16.14	36	45%	6.45	129.1	86.9	40%	5.7
	TSEC New Building																						
43	OFFICE	6	22	6	6	4.5	36	0.67	E	1	1	22	22	0.61	90	147.54	36	410%	3.33	120.0	-98.0	-445%	-9.7
44	TPO Room	4	22	6	6	4.5	36	0.67	M	3	3	22	66	0.54	140	259.26	36	720%	5.19	186.7	-120.7	-183%	-8.0
45	201	6	22	8	7	4.5	56	0.83	led	9	9	22	198	3.53	358	101.42	36	282%	13.26	742.5	-544.5	-275%	-53.9
46	202	6	22	8	7	4.5	56	0.83	E	12	7	36	252	4.5	306	68.00	36	189%	11.33	634.7	-382.7	-152%	-37.9
47	203	6	22	8	7	4.5	56	0.83	E	20	10	36	360	6.42	175	27.26	36	76%	6.48	363.0	-3.0	-1%	-0.3
48	301	6	22	8	7	4.5	56	0.83	E	9	9	36	324	5.78	125	21.63	36	60%	4.63	259.3	64.7	20%	6.4
49	302	6	22	8	7	4.5	56	0.83	E	8	8	22	176	3.14	115	36.62	36	102%	4.26	238.5	-62.5	-36%	-6.2
50	306	6	22	8	7	4.5	56	0.83	LED	9	9	22	198	3.53	117	33.14	36	92%	4.33	242.7	-44.7	-23%	-4.4

51	401	6	22	12	7	4.5	84	0.98	LED	44	44	22	968	11.52	255	22.14	36	61%	9.44	793.3	174.7	18%	17.3
52	403	6	22	8	7	4.5	56	0.83	E	9	9	36	324	5.78	170	29.41	36	82%	6.30	352.6	-28.6	-9%	-2.8
53	405	6	22	8	6	4.5	48	0.76	LED	8	8	22	176	3.66	175	47.81	36	133%	6.48	311.1	-135.1	-77%	-13.4
54	502	6	22	8	7	4.5	56	0.83	E	22	21	36	792	14.14	408	28.85	36	80%	15.11	846.2	-54.2	-7%	-5.4
55	503	6	22	8	7	4.5	56	0.83	E	16	8	36	288	5.14	173	33.66	36	93%	6.41	358.8	-70.8	-25%	-7.0
56	504	6	22	8	7	4.5	56	0.83	E	16	8	36	288	5.14	283	55.06	36	153%	10.48	587.0	-299.0	-104%	-29.6
57	505	6	22	8	7	4.5	56	0.83	CFL	14	7	36	252	4.5	254.28	56.51	36	157%	9.42	527.4	-275.4	-109%	-27.3
58	508	6	22	8	7	4.5	56	0.83	E	18	10	36	360	6.42	36.22	5.64	36	16%	1.34	75.1	284.9	79%	28.2
59	601	6	22	8	7	4.5	56	0.83	E	20	10	36	360	6.42	392.85	61.19	36	170%	14.55	814.8	-454.8	-126%	-45.0
60	602	6	22	8	7	4.5	56	0.83	E	24	12	36	432	7.71	257.14	33.35	36	93%	9.52	533.3	-101.3	-23%	-10.0
61	604	6	22	8	7	4.5	56	0.83	E	13	7	36	252	4.5		0.00	36	0%	0.00	0.0	252.0	100%	24.9
62	605	6	22	8	7	4.5	56	0.83	E	20	10	36	360	6.42	155.71	24.25	36	67%	5.77	323.0	37.0	10%	3.7
63	609	6	22	8	7	4.5	56	0.83	E	22	5	36	180	3.21	257.14	80.11	36	223%	9.52	533.3	-353.3	-196%	-35.0
64	704	6	22	15	12	4.5	180	1.48	E	48	24	36	864	4.8	557.14	116.07	43	270%	17.28	3109.6	-2245.6	-260%	-222.3
65	706	6	22	8	7	4.5	56	0.83	E	18	9	36	324	5.78	392.85	67.97	36	189%	14.55	814.8	-490.8	-151%	-48.6
66	801	6	22	8	6	4.5	48	0.76	E	14	7	36	252	5.25	151.57	28.87	36	80%	5.61	269.5	-17.5	-7%	-1.7
67	802	6	22	8	6	4.5	48	0.76	E	15	8	36	288	6	162.85	27.14	36	75%	6.03	289.5	-1.5	-1%	-0.1
68	803	6	22	10	7	4.5	70	0.92	E	36	18	36	348	4.97	457.14	91.98	36	255%	16.93	1185.2	-837.2	-241%	-82.9

69	805	6	22	10	7	4.5	70	0.92	E	24	12	36	432	6.17	242.85	39.36	36	109%	8.99	629.6	-197.6	-46%	-19.6
70	806	6	22	8	7	4.5	56	0.83	E	24	12	36	216	3.85	500	129.87	36	361%	18.52	1037.0	-821.0	-380%	-81.3
71	901	6	22	8	6	4.5	48	0.76	E	16	6	36	216	4.5	110.57	24.57	36	68%	4.10	196.6	19.4	9%	1.9
72	902	6	22	8	7	4.5	56	0.83	E	18	9	36	324	5.78	192.5	33.30	36	93%	7.13	399.3	-75.3	-23%	-7.5
73	906	6	22	8	8	4.5	64	0.89	E	13	4	36	144	2.25	105	46.67	36	130%	3.89	248.9	-104.9	-73%	-10.4
74	907	6	22	8	8	4.5	48	0.89	E	12	4	36	144	3	56.42	18.81	36	52%	2.09	100.3	43.7	30%	4.3
75	1002	6	22	8	5	4.5	40	0.68	E	18	9	36	324	8.1	96.67	11.93	36	33%	3.58	143.2	180.8	56%	17.9
76	1003	6	22	8	5	4.5	40	0.68	E	14	7	36	252	6.3	245	38.89	36	108%	9.07	363.0	-111.0	-44%	-11.0
77	1004	6	22	8	5	4.5	40	0.68	E	22	11	36	396	9.9	195	19.70	36	55%	7.22	288.9	107.1	27%	10.6
78	1005	6	22	8	8	4.5	64	0.89	E	16	8	36	288	4.5	147.5	32.78	36	91%	5.46	349.6	-61.6	-21%	-6.1
79	1006	6	22	8	5	4.5	40	0.68	E	20	10	36	360	9	140	15.56	36	43%	5.19	207.4	152.6	42%	15.1
80	1101	6	22	10	7	4.5	70	0.92	E	28	24	36	864	12.34	9.428	0.76	36	2%	0.35	24.4	839.6	97%	83.1
81	1102	6	22	1	7	4.5	70	0.19	E	13	12	36	432	6.17	102	16.53	36	46%	3.78	264.4	167.6	39%	16.6
82	1103	6	22	10	7	4.5	70	0.92	E	19	17	36	612	8.74	45.42	5.20	36	14%	1.68	117.8	494.2	81%	48.9
83	1104	6	22	10	7	4.5	70	0.92	E	19	16	36	576	8.22	158.42	19.27	36	54%	5.87	410.7	165.3	29%	16.4
84	1105	6	22	15	7	4.5	105	1.06	E	28	23	36	828	7.88	257.14	32.63	40	82%	8.57	900.0	-72.0	-9%	-7.1

Opportunity for Conservation of energy:

Electronic Ballast:

The conventional ballast may be replaced with electronic ballast. The magnetic ballast generally consumes 15 W of power; while the electronic ballast consumes just about 3 W and delivers 10% more light output. However, these ballasts are usually tuned to save about 15 W of power while providing slightly lower light output (about 5%).

Thus energy saving of over 30% can be realized by replacing conventional ballast by electronic ballast. The expected annual savings shall be around Rs 500/- per tube light; while the cost of installing a ballast shall be Rs 250/-

The saving potential can be computed as under.

Description	Unit	Value
Present Condition: Conventional Ballast		
Number of points	No	203
Rating of the point light	Watt	36
Rating of the switchgear	Watt	15
Power consumption of the lamp	Watt	51
Desirable Condition: Electronic Ballast		
Rating of the lamp	Watt	36
Rating of the switchgear	Watt	2
Power consumption of the lamp	Watt	32
Controllable Loss		
Loss	Watt	19
	%	37.3%
Saving Potential		
Cost of power	Rs/kWh	5
Operating period	Hr/Month	110
Diversity Factor	%	75%
Energy Saving	kWh/Month	424.27
	Rs/Month	1591

The magnetic ballast can be replaced by electronic ballast; saving around Rs 1591/- per month. The actual saving shall vary depending on the switching period of the luminaire.

The investment shall be Rs 81200/-; giving a payback period of 51 months.

LED Lamps:

A 15 W LED lamp can provide similar illumination level to that of 36 W TFL. It is thus possible to save about 21 W of power by replacing a 36 W TFL (with conventional ballast) with 15 W LED (with electronic starter). Thus energy saving of over 50% can be realized by replacing TFL with LED lamp.

The expected monthly savings shall be around Rs 2344.65/- for old building and Rs. 5370/- for new building.

The payback for the individual lamp shall be around 18 months.

Chapter-VI

Ceiling Fans

6.1 Brief Description:

Total 135 working ceiling fans are counted in the available locations of old building and total 259 working ceiling fans are counted in the available locations of new building. The average rating is around 60W for old fans in the old building. For comparison purpose 45W rating is considered for both old and new buildings.

6.2 Details:

The details are as below.

Sr No	Room No	Operation		Ceiling Fan Details			Energy Eff Fan	Savings per month		
				48'			28W@speed 5	@Rs 5/kWh		
		hr/d	d/m	Fitted	working	Rating	Rating	W	kWh	Rs
TSEC OLD BUILDING										
1	Ground	5	22	3	3	45	28	17	5.61	28.05
2	101	5	22	4	4	45	28	17	7.48	37.40
3	102	5	22	4	4	45	28	17	7.48	37.40
4	103	5	22	4	4	45	28	17	7.48	37.40
5	104	5	22	4	3	45	28	17	5.61	28.05
6	105	5	22	4	4	45	28	17	7.48	37.40
7	106	5	22	5	4	45	28	17	7.48	37.40
8	107	5	22	4	4	45	28	17	7.48	37.40
9	108	5	22	4	4	45	28	17	7.48	37.40
10	201	5	22	4	4	45	28	17	7.48	37.40
11	202	5	22	1	1	45	28	17	1.87	9.35
12	203	5	22	4	2	45	28	17	3.74	18.70
13	204	5	22	2	2	45	28	17	3.74	18.70
14	206	5	22	4	4	45	28	17	7.48	37.40
15	207	5	22	4	4	45	28	17	7.48	37.40
16	301	5	22	2	2	45	28	17	3.74	18.70
17	302	5	22	1	1	45	28	17	1.87	9.35
18	303	5	22	2	2	45	28	17	3.74	18.70
19	304	5	22	5	5	45	28	17	9.35	46.75
20	306	5	22	5	4	45	28	17	7.48	37.40

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21	307	5	22	3	3	45	28	17	5.61	28.05
22	308	5	22	4	4	45	28	17	7.48	37.40
23	401	5	22	3	3	45	28	17	5.61	28.05
24	402	5	22	3	3	45	28	17	5.61	28.05
25	408	5	22	4	4	45	28	17	7.48	37.40
26	409	5	22	1	1	45	28	17	1.87	9.35
27	501	5	22	3	3	45	28	17	5.61	28.05
28	502	5	22	1	1	45	28	17	1.87	9.35
29	503	5	22	5	5	45	28	17	9.35	46.75
30	504	5	22	4	4	45	28	17	7.48	37.40
31	505	5	22	5	5	45	28	17	9.35	46.75
32	506	5	22	4	4	45	28	17	7.48	37.40
33	507	5	22	5	4	45	28	17	7.48	37.40
34	509	5	22	4	1	45	28	17	1.87	9.35
35	601	5	22	1	1	45	28	17	1.87	9.35
36	602	5	22	6	6	45	28	17	11.22	56.10
37	603	5	22	4	4	45	28	17	7.48	37.40
38	604	5	22	4	1	45	28	17	1.87	9.35
39	605	5	22	5	5	45	28	17	9.35	46.75
40	606	5	22	4	4	45	28	17	7.48	37.40
41	608	5	22	4	4	45	28	17	7.48	37.40
TSEC NEW BUILDING										
42	101	5	22	2	2	45	28	17	3.74	18.70
43	102	5	22	1	1	45	28	17	1.87	9.35
44	103	5	22	4	4	45	28	17	7.48	37.40
45	office	5	22	2	2	45	28	17	3.74	18.70
46	201	5	22	5	5	45	28	17	9.35	46.75
47	202	5	22	1	1	45	28	17	1.87	9.35
48	203	5	22	6	6	45	28	17	11.22	56.10
49	204	5	22	2	2	45	28	17	3.74	18.70
50	206	5	22	1	1	45	28	17	1.87	9.35
51	301	5	22	5	6	45	28	17	11.22	56.10
52	302	5	22	6	6	45	28	17	11.22	56.10
53	306	5	22	7	7	45	28	17	13.09	65.45
54	403	5	22	4	4	45	28	17	7.48	37.40
55	405	5	22	1	1	45	28	17	1.87	9.35
56	502	5	22	6	6	45	28	17	11.22	56.10
57	503	5	22	7	6	45	28	17	11.22	56.10
58	504	5	22	7	7	45	28	17	13.09	65.45
59	505	5	22	4	4	45	28	17	7.48	37.40
60	508	5	22	4	4	45	28	17	7.48	37.40
61	601	5	22	5	5	45	28	17	9.35	46.75
62	602	5	22	8	8	45	28	17	14.96	74.80
63	604	5	22	7	6	45	28	17	11.22	56.10
64	605	5	22	7	2	45	28	17	3.74	18.70

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65	609	5	22	7	7	45	28	17	13.09	65.45
66	702	5	22	6	6	45	28	17	11.22	56.10
67	703	5	22	21	21	45	28	17	39.27	196.35
68	706	5	22	7	6	45	28	17	11.22	56.10
69	801	5	22	6	6	45	28	17	11.22	56.10
70	802	5	22	5	5	45	28	17	9.35	46.75
71	803	5	22	15	15	45	28	17	28.05	140.25
72	805	5	22	7	6	45	28	17	11.22	56.10
73	806	5	22	7	6	45	28	17	11.22	56.10
74	901	5	22	6	6	45	28	17	11.22	56.10
75	902	5	22	4	6	45	28	17	11.22	56.10
76	906	5	22	6	5	45	28	17	9.35	46.75
77	907	5	22	5	4	45	28	17	7.48	37.40
78	1002	5	22	5	5	45	28	17	9.35	46.75
79	1003	5	22	5	5	45	28	17	9.35	46.75
80	1004	5	22	6	5	45	28	17	9.35	46.75
81	1005	5	22	2	2	45	28	17	3.74	18.70
82	1006	5	22	3	3	45	28	17	5.61	28.05
83	1101	5	22	9	9	45	28	17	16.83	84.15
84	1102	5	22	6	5	45	28	17	9.35	46.75
85	1103	5	22	6	5	45	28	17	9.35	46.75
86	1104	5	22	9	9	45	28	17	16.83	84.15
87	1105	5	22	17	16	45	28	17	29.92	149.60

6.3 Economics:

Replacing old fans with new energy efficient fans can be considered. These fans save energy while delivering similar air flows.

The cost of replacement of 394 working ceiling fans (excluding non-working, wall and exhaust fans) shall be around Rs 9,85,000/- giving a payback period of around 22.28 years. It is calculated by considering 45W consumption on average operation basis.

The expected saving potential is around Rs 3683/- per month.

Thus, the investment is high and the payback period is not much attractive.

Chapter-VII

Miscellaneous Consumers

7.1 Brief Description:

The other consumers include elevators, street lighting, passage lighting, water pumps, fire pumps, machine tools in the work shop, xerox machines, printers and computers.

The consumption of above equipment was not possible due to unavoidable circumstances.

Chapter-VIII

Renewable Energy

8.1 Brief Description:

The institute should prefer the installation of solar system for both the old and new buildings.

It is possible to cut down the cost of electricity to great extent.

Also, solar water pumping must be considered which will save significant electricity as presently consumed by conventionally operated centrifugal pumps.

ENVIRONMENT AUDITREPORT

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CONTENTS

1. ACKNOWLEDGMENT

VARSHASOOKT CONSULTANTS Environment Audit Team thanks the management of THADOMAL SHAHANI ENGINEERING COLLEGE for assigning this important work of Environmental Audit. Our special thanks are due to:

- Honorable Principal G.T. Thampi
- Teaching & Supporting Staff of Collage for giving us necessary inputs to carry out this very vital exercise of Environmental Audit. We are also thankful to other staff members who were actively involved while collecting the data and conducting field measurements.

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

ENVIRONMENT AUDIT CERTIFICATE

This is to certify that "Environment Audit" for Thadomal Shahani College of Engineering, Linking Rd, TPS III, Bandra West, Mumbai, Maharashtra 400050, has been conducted in Feb -2021 to assess the green initiatives planning and efforts implemented in the college **campus like** Green Campus Management. Carbon Footprint, plantations, waste management, rainwater harvesting and conservation of energy. This green audit is also aimed to assess eco-friendly initiatives for maintenance of **impact of green** campus.

Place: Bandra

Date: 12th March 2021

Ms. Chitralekha Vaidya

(Lead Auditor)

VARSHASOOKT CONSULTANTS THANE

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2. CONTEXT

The National Board of Accreditation Council (NBA) have made it mandatory that all Higher Educational Institutions (HEI) should submit Environmental Audit Report. Moreover, it is part of Corporate Social Responsibility of the Higher Educational Institutions to ensure that they contribute towards the reduction of global warming through Carbon Footprint reduction measures. In view of the NBA circular regarding Environmental Auditing, the College Management decided to conduct an external Environment Evaluation by a competent Environment Auditor along with an Environment Audit Assessment Team headed by Ms. Chitralekha Vaidya.

Thadomal Shahani Engineering College, Bandra. Green Audit or Environment Audit focuses on the Green Campus, Waste Management, Water Management, and Energy Management being implemented by the College Management. The concept, structure, objectives, methodology, tools of analysis, objectives of the auditor mentioned below.

3. CONCEPT

The term 'Environmental audit' or 'Green audit' means differently to different people. Terms like 'assessment', 'survey' and 'review' are also used to describe similar activities. Furthermore, some organizations believe that an 'environmental audit' addresses only environmental matters, whereas others use the term to mean an audit of health, safety and environment-related matters. Although there is no universal definition of Green Audit, many leading companies/institutions follow the basic philosophy and approach summarized by the broad definition adopted by the International Chambers of Commerce (ICC) in its publication of Environmental Auditing (1989). The ICC defines Environmental Auditing as: "A management tool comprising a systematic, documented, periodic and objective evaluation of how well environmental organization, management and equipment are performing with the aim of safeguarding the environment and natural resources in its operations/projects." The European Commission, in its proposed regulation on environmental auditing, has also adopted the ICC definition of Environmental Audit. However, the outcome of Green Audit should be established with concrete evidence that the measures undertaken and facilities in the institution under green audit.

4. EXECUTIVE SUMMARY

A nation's growth starts from its educational institutions. Where, the ecology is thought as a prime factor of development associated with environment. A clean and healthy environment aids effective learning and provides a conducive learning environment. Educational institutions, now- a-days, 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 viewpoints are applied by several educational institutes to solve their environmental problems such as promotion of the energy savings by installing more efficient electronics and electrical equipment, proper segregation and recycle of waste, water use reduction, water harvesting and conservation etc. The activities pursued by colleges can also create a variety of adverse environmental impacts.

Environmental auditing is a process whereby an organization's environmental performance is tested against its environmental policies and objectives. Environment audit is defined as an official examination of the effects a college has on the environment. As a part of such practice, internal environmental audit is conducted to evaluate the actual scenario at the campus.

Environment audit can be a useful tool for a college to determine how and where they are using the most energy or water or resources. The college can then consider how to implement changes and make savings. It can also be used to determine the type and volume of waste, which can be used for a recycling project or to improve waste minimization plan. Environment auditing and the implementation of mitigation measures is a win-win situation for all the college, the learners and the planet. It can also create health consciousness and promote environmental awareness, values and ethics. It provides staff and students better understanding of Environment impact on campus. Environment auditing promotes financial savings through reduction of resource use. It gives an opportunity for the development of ownership, personal and social responsibility for the students and teachers. If self-enquiry is a natural and necessary outgrowth of a quality education, it could also be stated that institutional self-enquiry is a natural and necessary outgrowth of a quality educational institution. Thus, it is imperative that the college evaluate its own contributions toward a sustainable future. As environmental sustainability is becoming an increasingly important issue for the nation, the role of higher educational institutions in relation to environmental sustainability is more prevalent. This audit report contains observations and recommendations for improvement of environmental consciousness.

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5. INTODUCTION

A clean and healthy environment aids effective learning and provides a conducive learning environment. There are various efforts around the world to address environmental education issues. Environmental Management Systems (EMS) is very popular in the industrial sector, but the general belief is that EMS is something pertaining to industries only. Other parts of the world have started adopting compatible environmental management systems either voluntarily or for promoting standards by external certification. International environmental standards do not suit the existing Indian educational system. Hence EHS Alliance has developed a compatible system by developing locally- applicable techniques. A very simple indigenized system has been devised to monitor the environmental performance of educational institutions. It comes with a series of questions to be answered on a regular basis. Environmental conditions may be monitored from angles that are relevant to Indian requirements, without stress on legal issues or compliance. This innovative scheme is user-friendly and totally voluntary. The environmental monitoring system helps the institution to set environmental examples for the community and to educate young learners. It can be adapted to urban and / or rural situations.

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

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5.1 About the College

Thadomal Shahani Engineering College (TSEC) is an engineering college in Mumbai, India. Founded in 1983, it is the first and the oldest private engineering institute affiliated with the University of Mumbai. TSEC was founded by the Hyderabad (Sind) National Collegiate Board (HSNC Board) in the year 1983. It is named after one of Mumbai's most respected philanthropists, Dada Kishinchand T. Shahani's father, Thadomal Shahani. The HSNC board is a charitable trust established by the Sindhi Community in 1922. With active support and encouragement from one of Bombay's influential Barrister H.G. Advani, the HSNC Board came into existence in 1949 at Bandra, Mumbai. The Late Barrister became the Founder-President, whereas Vidyasagar Principal K.M. Kundnani was the Founder-Secretary and Founder-Principal of the first college started by the board was R.D National College. Since then the Board has been offering unique pre-degree study, undergraduate and post graduate degrees in a wide range of programs. It has produced professionals' par excellence in the fields of Arts, Science, Commerce, Management, Education, Law, Engineering, Technology and Para- Medical.

5.2 Vision

- Contributing to evolving supply chain of human capital for National Economy
- Creating entrepreneurs and 'game changers' to support heightened level of economic activities underpinning ever increasing human aspiration
- Helping the Nation evolve as a total solution provider
- Value and wealth creation for the mankind

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5.3 Mission

- Product and processes innovation
- Leveraging human cognitive and behavioral science for creating instructional content
- Pervasive and ubiquitous Information Communication Technologies for customized content for learning
- Acknowledge and facilitate various learning styles and learning abilities
- Migrating from teaching paradigm to learning paradigm
- Every day discourse shall inculcate research culture and further the cause of societal advancement
- Understand various markets and cultures
- Collaborative learning and emotional integrity
- Sensitizing about opportunities in Energy, Education, Environment and Health care sectors
- Extensively promoting computer aided design, analysis, and manufacturing procedures
- Theoretical rigor to develop conceptual clarity
- Modelling and design of experiments to inculcate culture of investigation
- Helping foot print on Project management and collaborative human endeavor.
- Interdisciplinary studies and exposure to functional areas.

5.4 Other Facilities

- Library
- Seminar Hall
- Laboratory
- Canteen
- Wi-fi and 3G communication enabled campus
- Spacious student loun

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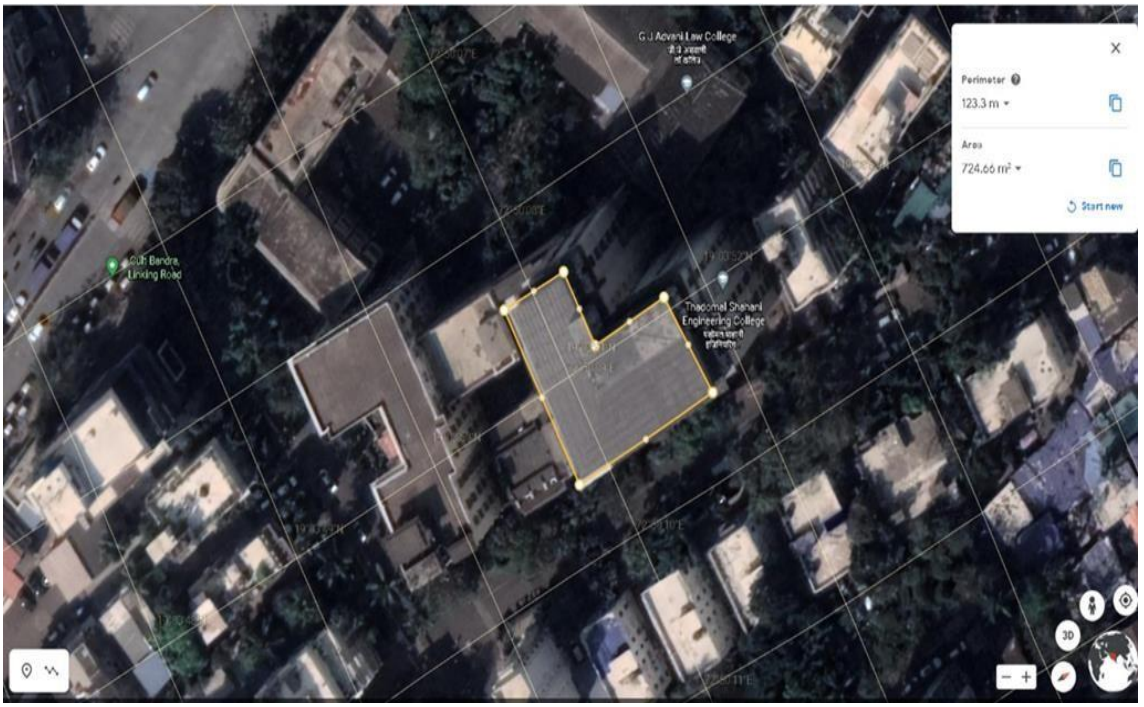
No. of Buildings	2
No. of Floors in Building-1	11
No. of Floors in Building-2	6

6. OVERVIEW OF INSTITUTE

- **New Building**



- **Old Building**

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7. OBJECTIVES

- Environmental education through systematic environmental management approach
- Financial savings through a reduction in resource use
- Reduction in resource use
- Improving environmental standards
- Developing an environmental ethic and value systems in young people
- Enhancement of university profile

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8. ENVIRONMENTAL AUDIT - QUESTIONARE

The areas of eco/environmental/green auditing to be followed/practiced by participating institutions:

1. Waste Minimization and Recycling
2. Greening
3. Energy Conservation
4. Water Conservation
5. Animal Welfare
6. Environmental Legislative
7. General Practices

TOTAL POPULATION OF THE COLLEGE

Particulars	Male	Female
Professor	02	08
Associate Professor	11	10
Assistant Professor	27	57
Students	1,200	800
Total	1,240	875

Approximate Number of Visitors (Per day) -100

What is the total number of working days of your campus in a year? -291

9. Geographical Assessment of the college

Which of the following are available in your college?

1. Garden area	Present
2. Playground	NA
3. Kitchen	Present
4. Toilets	Present
5. Garbage or Waste Store Yard	NA
6. Laboratory	Present
7. Canteen	Present
8. Hostel Facility (numbers)	NA
9. Guest House Available	Present

Which of the following are found near your institute?

1. Garbage heap	NA
2. Public convenience	Present
3. Sewer line	Present
4. Stagnant water	NA
5. Open drainage	NA
6. Industry – (Mention the type)	NA
7. Bus / Railway station	Present
8. Market / Shopping complex / Public halls	Present

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I – WASTE MINIMIZATION AND RECYCLING

What is the approximate amount of waste generated per day? (In Kilograms/month) (approx.) Bio Degradable and Non-Biodegradable Hazardous others 50kg & 10kg Yes

Does your institute generate any waste? If so, What are they?	Yes, Solid waste Canteen waste, Paper, plastic, Horticulture Waste etc.		
What is the approximate amount of waste generated per day?	**Biodegradable**	**Non-Biodegradable**	**Hazardous**
	30kg	5kg	0 kg
Do you use recycled paper in institute?	No		
Do you use reused paper in institute?	No		
Does college have waste segregation?	Yes On each floor there are two dustbins Blue(non-biodegradable) and Green(Biodegradable)		

II – GREENING

Is there is a garden in your college?	Yes
Do students spend time in the garden?	Yes
Total number of Plants in Campus	26
Is the college campus have any Horticulture Department?	No
Number of Staff for Gardening activity	One

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III – ENERGY CONSERVATION

List ways that you use energy in your institute.	a. Lighting Requirements b. Centralized AC c. Water Pump
Are, there any energy saving methods employed in your institute? If yes, please specify. If no, suggest some	No
Fire Hydrant in College?	On each floor there is Fire Extinguisher on each floor and there is a Fire Hose box present
Are your computers and other equipment's put-on power-saving mode?	Yes
Do you run "switch off" drills at institute?	Yes
List of Electronic Equipment	Yes, Electronic Timer for Water Pump

Fig-1. Fire Extinguisher on each Floor

IV – WATER CONSERVATION

List four uses of water in your institute	Basic use of water in campus: 1. Drinking 2. Gardening 3. Kitchen and Toilets 4. Others
Does your college harvest rain water?	Yes, water is stored in underground tank by Rain water
Is there any water recycling System?	No
Write down four ways that could reduce the amount of water used in your institute	Basic Four ways: 1. Close the taps after usage 2. Maintenance and monitoring of valves in supply system to avoid overflow, leakage and spillage 3. Water Conservation awareness for new students
If there is water wastage, specify why and How can the wastage be prevented / stopped?	No

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V – ANIMAL WELFARE

List the animals (wild and domestic) found on the campus (dogs, cats, squirrels, birds, insects, etc.)	Birds
How many dogs in your area have undergone Animal Birth Control - Anti Rabies (ABC - AR)?	No

VI – ENVIRONMENTAL LEGISLATIVE COMPLIANCE

Are you aware of any environmental Laws pertaining to different aspects of environmental management?	Yes
Does Environmental Water and Wastewater Quality monitoring conduct by the college?	No
Does any Hazardous waste generate by the Institute? If yes explain its category and disposal method	No
Does Environmental Ambient Air Quality Monitoring conduct by the college?	No

VII – GENERAL

Does housekeeping schedule in your campus?	Yes
Are students and faculties aware of environmental cleanliness ways? If Yes Explain	Yes, Swachh Bharat Abhiyan.
Does Important Days Like World Environment Day, Earth Day, and Ozone Day etc. eminent in Campus?	No
Does Institute use renewable energy?	No
Does college have any Recognition/certification for environment friendliness?	No

10. RECOMMENDATION

Following are the recommendations to make the college completely in environmental sustainable,

Water Management

The study observed that water comes from BMC and it is used for drinking purpose, canteen, toilets, laboratory and gardening. During the survey, no loss of water is observed, neither by any leakages nor by over flow of water from overhead tanks. The rain water harvesting system in installed in one building which stores in one underground tank and the water is for Gardening purpose. This is one of the unique steps towards greening practices for storing and reuse of rain water.

- To indicate the water consumption, water sources, irrigation, storm water appliances and fixtures the college must go undergo water audit purpose.
- Repair sources of water leakage, such as dripping taps. Regular checking and maintenance of pipelines can be done to control water wastage.
- Minimize wastage of water and use of electricity during water filtration process, Minimize wastage of water and use of electricity during water filtration process, such as Aquaguard filtration process and ensure that the equipment's are regularly serviced with no wastage of water.
- Encourage to decrease the water source at various water usage points.
- Test the water parameters ph, BOD, COD, TSS etc to know the water condition.

Waste Management

College is working on 3Rs concept "Reduce. Reuse and Recycle" by reducing paper demand with the help of digital concept. All offices work on paper less concept by digital display of all the notices and information, Re-use one-sided paper for notes, sketches, rough work, etc.

- College must installed different colour (Red, Green and Blue) dustbins for segregated dumping of waste as recyclable (Red), degradable (Green) and Non-biodegradable (Blue). In their campus.

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- Routine disposal of debris and droppings from trees are done through TSEC housekeeping staffs. They dust all the floors of academic buildings, hostels and pathways as per timeline and ensure campus cleanliness. All the waste of fallen leaves and tree branches should be Dumped in to the vermin composting pits for manure. Or college must go for composting method.
- Reduce the absolute amount of waste that it produces from college staff offices.
- Make full use of all recycling facilities provided by City Municipality and private suppliers, including glass, cans, white, colored and brown paper, plastic bottles, batteries, print cartridges, cardboard and furniture.

Energy Consumptions

Energy source utilized by all the departments and common facility center is electricity only. Total energy consumption is determined for Feb month 2021 is, the total units consumptions are 9,041units and electricity bill pay for the Feb month is 1,60,010/- of all 12 meters present in the campus. The Water bill for the month Feb 2020 to Feb 2021 is 24,888/-. All the departments and common facility centers are equipped with Led bulb and CFL. The college can install the solar power generation to save electricity.

- Energy saving through the replacement of incandescent bulbs, CFL lamps and tube lights to LED light.
- Awareness programs for the stakeholders to save energy may also increase sustainability in the utilization of various energy source.
- Use energy efficient light-emitting diode (LED) bulbs instead of incandescent and CFL bulbs, maintain appliances and replace old appliances.
- Installation of complete solar power generation system in order to reduce conventional power and to have larger saving in power consumption and electricity bills.

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11. CONCLUSION

This audit involved extensive consultation with all the campus team, interactions with key personnel on wide range of issues related to Environmental aspects. The audit has identified several observations for making the campus premise more environmental friendly. The recommendations are also mentioned with observations for campus team to initiate actions.

The Environment audit assists in the process of testing performance in the environmental arena and is fast becoming an indispensable aid to decision making in a college. The Environment 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 Environment 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.

A few recommendations are added to curb the menace of environment management using eco-friendly and scientific techniques. This may lead to the prosperous future in context of Environment Campus and thus sustainable environment and community development.

It has been shown frequently that the practical suggestions, alternatives, and observations that have resulted from audits have added positive value to the audited organization. A Environment audit report is a very powerful and valuable communications tool to use when working with various stakeholders who need to be convinced that things are running smoothly and systems and procedures are coping with natural changes and modifications that occur.

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Amenities at College

- **Aqua gaurd filter on each floor**

- **Two separate dustbins on each floor**

- **Dustbins present backyard of college**

- **Entrance of old building**

- **Planted trees in campus**

- **Fire Hose Box to extinguish fire in the Campus**

- **Parking area in Campus**