APPENDIX-I

Energy Audit, Green Audit & Environment Audit

Technological Institute of Textile & Sciences, Bhiwani (Haryana)

Jan 2021

GTD POWER SYSTEM PVT. LTD .

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Email: skmahepcl@gmail.com

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Acknowledgement

Energy audit, Green Audit and Environment Audit of Educational Institutions are important tool to analyze wastage of energy and create healthy environment of any Institution. GTD Power Systems Pvt. Ltd Bhiwani have been entrusted to carry out these audits by the management of Technological Institute of Textile & Sciences, Bhiwani (TIT&S).

We are thankful to Prof (Dr) G. K. Tyagi Director, Shri Pramod Kumar (Head Administration), Dr Manoj Kumar Nanda, Dr Prem Sagar, Mr. Mukesh Kumar and other non-teaching staff who took pain along with us to gather data through survey. We also thank the office staff who helped us during the document verification.

27.1.21

(S. K. MAHESHWARI)

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CHAPTER -1

Executive Summary

Educational institutions now a day are becoming more sensitive to environmental factors and more concepts are being introduced to make them eco-friendly. To preserve the environment within the campus, various viewpoints are applied by the several educational institutes to solve their environmental problems such as promotion of the energy savings, recycle of waste, water r eduction, water harvesting etc. To protect such situation Energy Audit, Green Audit and Environment Audit are required to be conducted in these institutions. Energy Audit pave the way to save energy consequently reducing Carbon Emissions. Environmental auditing is a process whereby an organiz ation's environmental performance is tested against its environmental policies and objectives. Green audit is defined as an official examination of the effects a n Educational Institution has on the environment. It must also be under stood that Energy Audit, Green Audit and Environment Audit are inter related to each other. If you save Energy, it will save Environment. If you save trees or plant trees, it will save Environment and energy. If you clean Environment, it will save human life and save energy.

In Technological Institute of Textile & Sciences, Bhiwani , the audit process involved initial interviews with management to clarify policies, activities, records and the co - operation of staff and students in the implementation of mitigation measures. This was followed by staff and student interviews, collection o f data through the questionnaire, review of records, observation of practices and observable outcomes.

In Green & Environment Audit, t he baseline data prepared for the Technological Institute of Textile & Sciences, Bhiwani will be a useful tool for campus greening, resource management, planning of future projects, and a document for implementation of sustainable development of the Educational Institution . Existing data will allow the Educational Institution to compare its programme and operations with those of peer institutions, identify areas in need of improvement, and prioritize the implementation of future projects. We expect that the management will be committed to implement the

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recommendations.

In Energy Audit, Energy savings were identified has been shown in Table 1.1.

Sl. No	Name of EE Measures	Qty.	Investment (Lac INR)	Energy saved/ Yr (KWh)	Cost of Energy saved/ Yr (Rs. Lac)	Pay back (Year)	Reference
1	Replacement of 11 W CFL with 6 W LED Lamps	85	7650	1275	8478.75	0.9	Table-4.9
2	Replacement of 40 W traditional FTL with energy efficient 18 W LED Tub-elite	1050	420000	48510	322591.5	1.3	Table-4.10
3	Replacement of old Ceiling Fans with Energy Efficient ceiling fans	475	760000	17812.5	118453.125	6.42	Table-4.11
4	Replacement of conventional 1.5 Ton Window & Split air conditioners with EE star rated Split ACs	110	3885000	91000	605150	6.09-7.3	Table-4.14
5	Replacement of Sodium Street Light with LED Lights	29	435000	14554	96784.1	4.49	Table-4.15
	Total		**5507650**	**173151.5**	**1151457**	**4.78**	

Table 1.1 Energy Saving Measures and Payback Period

We are happy to submit the Energy audit, Green Audit and Environment Audit report to the Technological Institute of Textile & Sciences, Bhiwani authorities.

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Chapter 2

Introduction

Preamble

Energy Audit, Green Audit and Environment Audit are the useful tools for a Educational Institution to determine how and where they are using the most energy or water or resources; the Educational Institution can then consider how to implement changes and make savings. They 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. These can also create health consciousness and promote environmental awareness, values and ethics . They provide staff and students better understanding of green impact on campus. These auditing promote financial savings through reduction of resource use.

Introduction

Technological Institute of Textile & Sciences, Bhiwani is a self-financed Engineering Educational Institution , situated in Bhiwani (Haryana). It is an Indian technical college , which offers engineering and postgraduate programs. It is one of the oldest colleges in India and was founded by India's famous industrialist Padma Vibhushan Dr G. D. Birla.

Location of Technological Institute of Textile & Sciences, Bhiwani

The Technological Institute of Textile & Sciences, Bhiwani is located in Birla Colony, just 1.2 Km away from the Bhiwani Railway Station . The town of Bhiwani has just over half a million people and lies on the railway line connecting Rewari, Bhatinda, Hisar, Jaipur, Rohtak, Delhi, and Chandigarh. It is connected either by direct train or bus service to Delhi and all major towns of Haryana and surrounding states. One of the busiest airports of the country IGI Airport of Delhi is just 119 Km away from the campus.

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The geographic system coordinates are: longitude — 76°7′16.03′′E (76.12112), latitude — 28°48′20.45′′N (28.805682).

Campus

The campus covers 112 acres (45 ha) out of which 109,694 m^2 is exclusive to the institute. The institute's main building has an auditorium. Other facilities include laboratories, men's and women's hostels, staff quarters and a playground. The three libraries are the Textile Lib rary, the MBA Library and the Central Library.

Total Campus Area & Educational Institution Building Spread Area

Campus area	339936 m2
Built up area	200000m2
Green Area	139936m2

Table-2.1: Total Campus Area & Educational Institution Building Spread Area

Technological Institute of Textile & Sciences, Bhiwani has the best infrastructure facilities available for students including a serene external environment through thoughtful landscaping efforts. This creates a vibrant campus and mot ivates students to remain lively and jubilant. Well-equipped library, high quality classroom interiors, well equipped seminar rooms and a state of art auditorium. To add to all these eateries are available within the campus offering healthy and hygienic options to students at reasonable rates .

Infrastructure

- Classrooms
- Library
- Laboratories & Workshops
- Hostel
- Seminar Hall
- Conference Rooms

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- Auditorium
- Medical

Classrooms:

The institute has spacious and well -ventilated classrooms with appropriate furnishing. Classrooms are air -conditioned and fitted with audio -visual aids to ensure ease in learning.

Library

There are two different spacious fully air conditioned and computerized libraries - one for Textiles and Computers and Electronics departments. There are more than 52,000 volumes and bound Periodicals in all the two libraries. The Inst itute also subscribes to over 104 National Journals and 242 International Journals including e -journals. Both libraries are computerized using Libsys software.

Gallery

- Campus View
- Events Gallery
- Video Gallery

Hostel Facility – Accommodation available

There are Four Boy's hostels and a separate girl's hostel having a total of 500 single seated rooms with a large dining hall and a cafeteria. All the Hostel rooms are fitted with ceiling fans. A fully Vegetarian hostel mess is run by students themselves on the co - operative basis under the guidance of designated faculty member. Hostel also provide sports facilities for students with various indoor and outdoor games. Various outdoor games consist of Cricket, Hockey, volleyball, Basketball, Football, Lawn Tennis etc. and indoors have Badminton, Table Tennis, Carom and Chess etc.

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Sl. No.	Name of Hostel	Nos of Present Residents	Residents type
1	Lakshmi Bhawan	200	Boys
2	Saraswati Bhawan		Boys
3	Aryaman Bhawan		Boys
4	Vidya Bhawan		Boys
5	Sarla Bhawan	51	Girls

Table 2.2: Present status of residents Hostelers

Fig 2.1: Vidya Bhawan Hostel (Boys Hostel)

Laboratories & Workshops

Computer Programming Lab	Mechanical Engineering
Data Structure Lab	Vibration Lab
Computer Organization Lab	Tribology Lab
Java Programming Lab	Measurement Lab
Software Engineering Lab	Metrology Lab
Operating Systems Lab	Advanced Manufacturing Technology Lab
Computer Network Lab	Industrial Engineering and Ergonomics Lab
Artificial Intelligence lab	Thermal Engineering Lab
Web Technology Lab	Refrigeration & Airconditioning Lab
Distributed System Lab	Hydraulic Machine Lab
Compiler Designing Lab	Computer and Automation Center
Computer Graphics Lab	

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Seminar Hall

The Seminar Hall of TIT&S is located on the top floor of the new building of the institute. This air-conditioned hall has a seating capacity of over 200 audiences and is fitted with all modern audio -visual aids.

Central Auditorium

The Central Auditorium is a proud structure of TIT&S. Situated in the main building it has witnessed many great souls and events in the past 75 years. Perhaps the most visited place of the institute this old -is-gold corner of the institute is equipped with audio visual facilities and has a seating capacity of 328 spectators. The auditorium hosts numerous events like conferences, seminars, symposia, cultural programs, inter -Institute activities etc. The inaugural ceremony of the recent Platinum Jubilee Celeb rations was held here.

Medical Center

The institute has a Dispensary with a visiting Medical Officer. Specialist doctors visit on weekdays as per schedule. It also organizes Routine Health Checkup Camps, Blood Donation Camps and Medical Awareness Camps in association with the Department of Hea lth, Govt. of Haryana.

Staff, other manpower, Students and Visitors

Sl. No.	Particulars	Regular	Residents	Non-Residents	Total
1	Regular Staff	100	46	54	100
2	Contractual			73	73
3	Students	1033	251	782	1033
4	Average Daily Visitors	26	-	26	26
	Total	1159	297	935	1232

Table 2.3-: Staff, other manpower, Students and Visitors

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Quality Policy

IQAC have been formed t o continuously thrive to provide a congenial and wholesome academic environment and a healthy culture for faculty, staff and students which would motivate teachers' full participation. Members for 2020-21 are as follows:

Sr. No.	Category	Name
1	Head of Institution	Prof (Dr) G. K. Tyagi
2	IQAC Coordinator	Prof (Dr) S. K. Sharma
3	NAAC Coordinator	Sh. Pramod Kumar, Head Administration
4	Senior administrative officer's nominees	1. Sh. Aishwarya Sharma, Manager Accounts 2. Sh. Umesh Kumar Sharma , Establishment Officer
5	Faculty Nominees	1. Dr Mukesh Sharma, Computer Science Engineering 2. Dr Ashwani Goyal, Textile Technology 3. Dr Amit Manocha, Applied Sciences and Humanities 4. Dr Jyoti Chaudhary, Computer Science Engineering 5. Dr Amandeep Kaur, fashion & Apparel Engineering 6. Sh. Kamal Sardana, Electronics and Communication Engineering 7. Dr Manoj Kumar Nanda, Applied Sciences and Humanities
6	Nominee from Management	Dr D. P. Kaushik, Principal TIT&S Sr Sec. School, Bhiwani
7	Nominee from students and alumni	Sh. Prateek Bharatwal - Student Sh. D. K. Singh - Alumni
8	Nominee from employers/industries, stakeholders	Sh. Vikas Agarwal GBTL, Bhiwani - Employer Sh. Daljit Singh -Parents Dr Shelly Khanna - Faculty Sh. Vibhu Sharma - Alumni
9	Nominee from another institute	Prof M. Prasanna, Director BKBIET, Pilani

Table 2.4: List of IQAC Members

2.20 Name of Staff engaged in the Assignment: Er. S. K. Maheshwari (EA -2986)

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Chapter 3

Pre-Audit Stage

A pre-audit meeting provides an opportunityto reinforce the scope and objectives of the audit and discussions were held on the practicalities associated with the audit. This meeting is an important prerequisite for the audit because it is the first opportunity to meet the audit team and deal with any concerns. In Technological Institute of Textile & Sciences, Bhiwani pre-audit meeting was conducted successfully and necessary documents were collected directly from the Educational Institution before the initiation of the audit processes.

Management's Commitment

The Management of the Educational Institution 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, camp us farming, planting more trees on the campus etc., after the green auditing.

Report Formulation Planning

This report has been divided in following three parts:

1. Energy Audit,
2. Green Audit,
3. Environment Audit

The detailed discussions of these Audits will be done in subsequent chapters.

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Chapter-4

Energy Audit

Sources of Energy being used in the Institute

The Institute is using only Conventional sources of energy.

Electricity Distribution System:

There are nos. Electricity connections as detailed below:

Sl. No	Name of Connection	Contract Load	Remarks
1	TIT&S	700 KVA	Through 1000 KVA Transformer
2	TIT Hostel	9.1 KW	Discom LT
3	GATIT Mill	3.0 KW	Discom LT
4	GATIT Mill	7.70 KW	Discom LT
5	GATIT Mill	22.4 KW	Discom LT
	Total	**742.2 KW**	

Table 4.1: Electricity Connections Details in TIT&S, Bhiwani

The electric supply of TIT&S (700 KVA) is fed from 33/11 KV Substation, of Dakshin Haryana Bijli Vitran Nigam Ltd. through 11 KV feeder. The substation consists one no 11/0.4 KV Transformer of capacity 1000 KVA and an OCB Panel control room.

Fig 4.1: Power Transformer at TITS, Bhiwani

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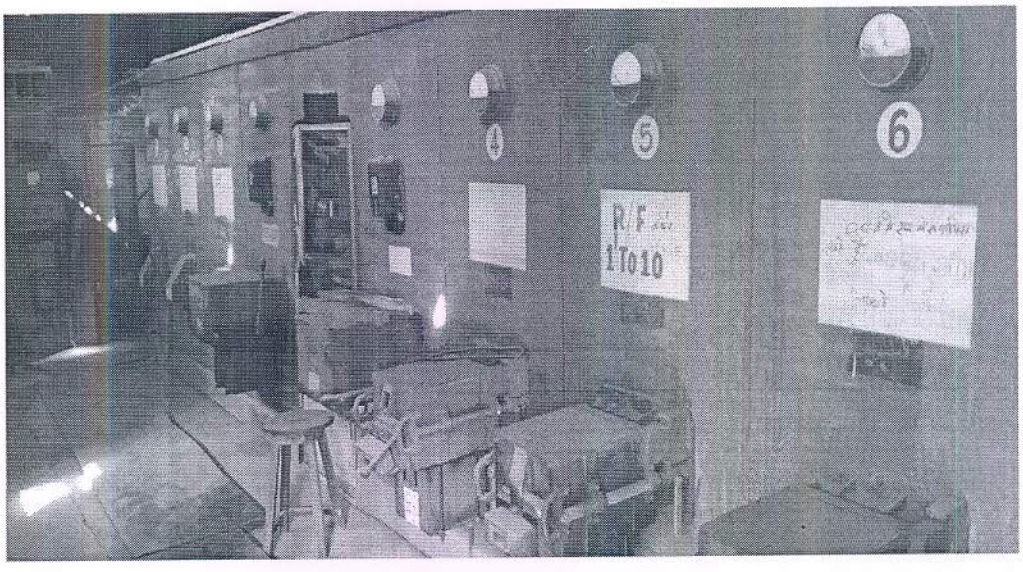

Figure-4.2: OCB Panel Room

Billing Parameters of Main Connection

Sanction Load (KW)	1200
Contract Demand (KVA)	700
Tariff category	HTS
Applicable Tariff/ KVAh (Rs)	6.65
Demand Charges/KVA (Rs)	170
Bill amount for March 21 (Rs)	292734

Energy Consumption from Grid (Year 2020)

S. No.	Con Month 2020	KWh	KVAh	PF	Maxm. Demand	Chargeable Demand
1	January	41808	41840	0.999	140.96	693
2	February	39064	39136	0.998	113.76	693
3	March	28084	28120	0.999	115.2	693
4	April	19558	19590	0.998	51.2	693
5	May	22684	22692	1.000	67.68	693
6	June	23672	23688	0.999	72.64	693

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S. No.	Con Month 2020	KWh	KVAh	PF	Maxm. Demand	Chargeable Demand
7	July	28792	28804	1.000	97.28	693
8	August	29252	29272	0.999	149.76	693
9	September	31896	31920	0.999	145.28	693
10	October	25760	25776	0.999	105.76	693
11	November	20432	20436	1.000	60.32	693
12	December	24100	24112	1.000	64.48	693
	Total	**335102**	**335386**	**0.999**	**1184.32**	**8316**
	Average	**27925.17**	**27948.83**	**0.999**	**98.69**	**693.00**

Table-4.2: Energy Consumption & Demand from Grid (KWH) Year 2020

Maximum Demand of past three years

S. No.	Month	Maxm Demand 2020	Maxm Demand 2019
1	January	140.96	360.32
2	February	113.76	360.32
3	March	115.2	360.32
4	April	51.2	360.32
5	May	67.68	360.32
6	June	72.64	360.32
7	July	97.28	278.56
8	August	149.76	362.4
9	September	145.28	382.24
10	October	105.76	270.4
11	November	60.32	132.95
12	December	64.48	124

Table-4.3: Maximum Demand of past Three years

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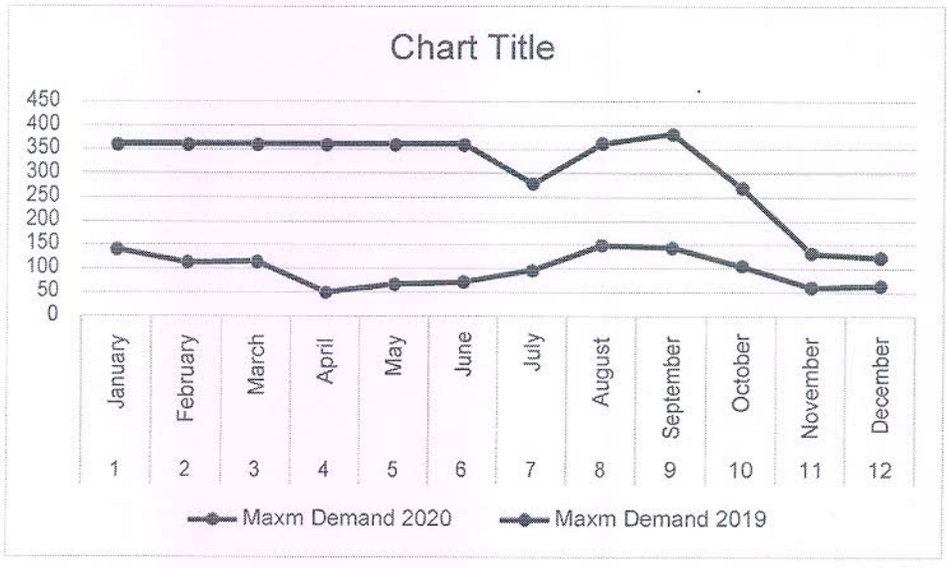

Fig-4.3: Graphical Presentation Maximum Demand of past two years

From Table-4.3, it is observed the maximum demand was 382.24 in September 2019 but has been drastically reduced during past year. The Averaged Demand being charged in billing as per Table - is 693 KVA @ Rs 170 per KVA. It is recommended to reduced Contract Demand from 700 KVA to 400 KVA . It will save demand charges for 300 KVA @ Rs 170 per KVA equivalent to Rs 51000/ -per month i e Rs 612000 per year.

Other Conventional Sources of Energy

Apart from Electrical Energy, the other sources of energy used in Technological Institute of Textile & Sciences, Bhiwani are Diesel and LPG. The consumption of these types of energy sources have been discussed in subsequent Para.

Diesel Generator Set

A Diesel Generator Set of Kirloskar make and 1000 KVA capacity is installed in the Campus.

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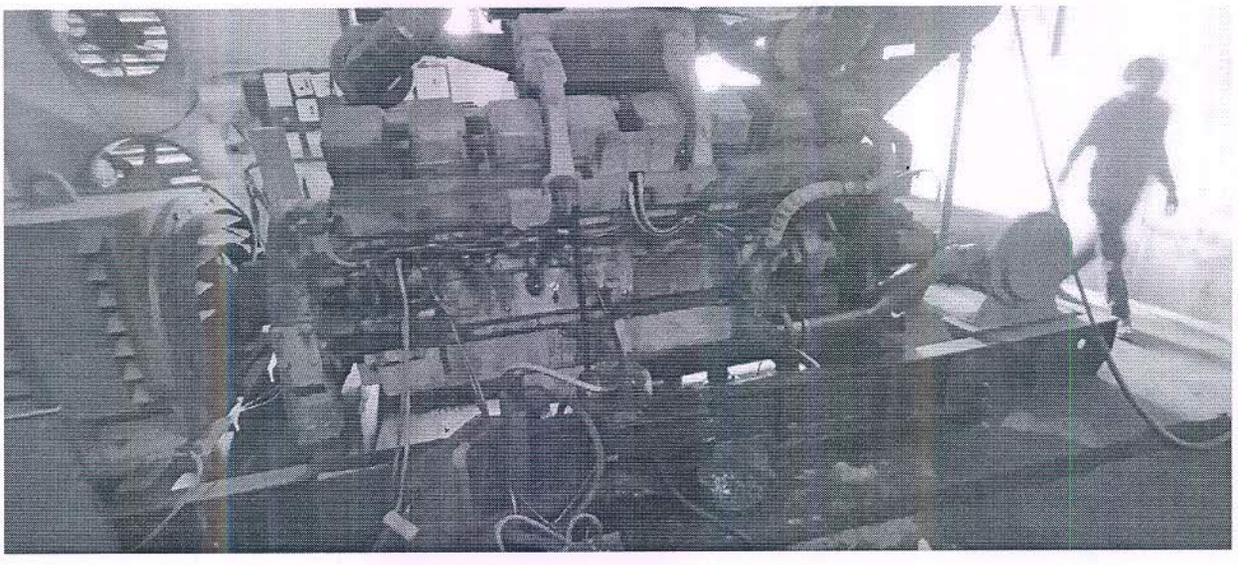

Fig 4.4: DG Set 1000 KVA installed in the Premises

The details of Diesel consumption, running hours and generated Units during year 2021 - 22 are as follows:

a. Diesel Consumption: 12482 Liters
b. Running Hours: 241
c. Units generated: 17381 KWh
d. Diesel Consumption per Hour (a/b): 12482/241=51.79 Liters/Hour
e. Specific fuel consumption (a/c): 0.718 Liters/KWh

Apart from above, a pump of 5 KW is being used for cooling of generator through cooling Tower. The Genset is very old having age of more than 15 years.

LPG Gas

LPG is used in the Institute Canteen. The average consumption of cylinders per year is as below:

Sl. No.	Duration	Quantity
1	01/04/2019-31/03/2020	1900 kg

Table 4.4: LPG Gas Consumption

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Total Energy Consumption of Technological Institute of Textile & Sciences, Bhiwani

Table-4.5 summarize the various sources of energy and their usage in Technological Institute of Textile & Sciences, Bhiwani during Year 2020.

Sl. No	Name of Connection	Contract Load (KVA)	Electricity Consumption 2021
1	TIT&S	700	27925
2	TIT Hostel	9.1	21220
3	GATIT Mill	3	3005
4	GATIT Mill	7.7	25010
5	GATIT Mill	22.4	21050
	Total	**742.2**	**98210**

Table 4.5: Electricity Consumption of all Electrical Consumption Year 202 0

Sl. No.	Particulars	Quantity
1	Electricity (KWh)	98210
2	LPG (Kg)	1900
3	Diesel (Litres)	12482

Table-4.6: Total Energy Consumption Year 2020

Connected Load of Electrical Appliances

Connected Load of Technological Institute of Textile & Sciences, Bhiwani is as shown in Table-4.7.

Sl. No	Name of Item	Capacity (Watts)	Total Nos.	Connected Load (W)	Remarks
1	CFL	11	85	935	
2	**LED Lamps**				
		9	115	1035	
		26	8	208	
3	**Tube light**				
	FTL	40	1050	42000	
	LED	20	300	6000	

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Sl. No	Name of Item	Capacity (Watts)	Total Nos.	Connected Load (W)	Remarks
4	**Pole Lights**				
	FTL	40	25	1000	
	Sodium	250	29	7250	
	LED	50	10	500	
5	Fans	75	975	73125	
	Ceiling Fan	50	42	2100	
	Wall Fans				
6	**Exhaust Fan**	390	29	11310	
	18 inches	300	11	3300	
	15 inches	220	4	880	
	12 inches	40	12	480	
	9 inches				
7	**Air Conditioners**	1200	1	1200	
	1.0 T (W)	1800	114	205200	2 Star
	1.5 T (W)	1600	17	27200	19 nos are 2-star rating
	1.5 T (Split)	2500	17	20000	9 nos are 3-star rating
	2.0 T (W)	2200	8	55000	16 nos 2 star
	2.0 T (Split)	50	10	500	1 no 3-star rating
8	Desert Coolers	250	25	6250	
9	Computer system	100	348	34800	
10	Projectors	800	7	5600	
11	Printers	200	23	4600	
12	Photocopier	1000	2	2000	
13	Blower Heater	1500	12	18000	
14	Room Heaters	1500	12	18000	
15	Refrigerator	300	20	6000	
16	**Pumps**				
	5 HP	3725	1	3725	
	3 HP	2250	2	4500	
	Grand Total			**562198**	

Table-4.7: Connected Load of TITS, Bhiwani

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Illumination Level of various Buildings of TITS Bhiwani

Sl. No.	Name of Bldg.	Av. Illumination Level (Lumens)	Sl. No.	Name of Bldg.	Av. Illumination Level (Lumens)
	Measurement during Night time			**Measurement during Day time**	
1	**Guest House**			**GROUND FLOOR**	
	Room	136	1	**Administrative Block**	
	Visitor Room	78		Lobby GF	85
2	**Gate No 3**			Conference room	195
	Security Room	158		CDC Centre	72
	Outside	14		CDC office	175
	Inside road	7		Director Room	125
3	Parking near Temple	28		PA to Director	105
4	Sarla Girls Hostel	6		Admin Office	148
5	Road near workshop	9		Train Placement office	175
6	Road opp. IT Block	9	2	CE Lab (R. N. 23)	117
7	Gate Dept. of CE	45	3	English Language Lab	187
8	Lobby dept. Of CE	22	4	Auditorium	155
9	**Gate No1**		5	Admin Building entrance	90
	Inside	4	6	Chemistry Lab	195
	Outside	11	7	Class room No2	81
10	Admin Bldg. Passage	68	8	Textile Chemistry Lab	135
11	Inside Passage near Director Room	75		**FIRST FLOOR**	
12	Admin Bldg entry near Gate no 1	28	10	Physics Lab	227
13	**Girls Hostel**		11	Library old Block	190
	Badminton court	57	12	Drawing Hall	174
	Lobby	78	13	Stairs	58
	Room no102	76			
14	Road inside Girls mess	12			
15	Road outside Girls mess	26			

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Sl. No.	Name of Bldg.	Av. Illumination Level (Lumens)	Sl. No.	Name of Bldg.	Av. Illumination Level (Lumens)
16	**Boys Hostel**				
	Security room	76			
	Inside Gate	16			
	Mess inside	16			
	Road outside mess	75			
	Vidya Bhawan Lobby	6			
	Common Hall	11			
	Room no 3	135			

Table 4.8: Illumination Level of various Buildings of TITS Bhiwani

Illumination Level of various Buildings of the Institute appears to be low in night hours. It is recommended to lower the height of luminaries to increase the Lux level.

Energy Efficiency strategies

Two technologies which have been identified in the Demand Side Management are as follows:

I. Replacement of CFL with LED Lamps
II. Replacement of Fluro cent Tube lights with LED Tube lights
III. Replacement of conventional ceiling fans with Energy Efficient ceiling fans
IV. Replacement of conventional air conditioners with EE star rated ACs
V. Replacement of FTL Pole Lights with LED Tube Lights
VI. Replacement of 250-watt Sodium Pole Lights with LED Lights
VII. Replacement of all the Street light fixtures with LEDs and CFLs.

Replacement of CFL with LED Lamps

There are 85 nos. CFL of 11 W. These may be replaced by LED Lamps of capacity as shown in Table -4.9. The payback will be calcu lated on 10 Hrs. per day and 300 days basis.

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Sl. No	Name of existing Fixture	Name of EE Fixture to be replaced	Qty. (Nos)	Power Saving each (W)	Unit rate (Rs.)	Total cost (Rs.)	Yearly power saving on 10 hrs & 300 days basis (Kwh)	Cost of power saved @ Rs. 6.65 per unit (Rs.)	Payback period (Years)
1	CFL 11 W	LED Lamp 6 W	85	5	90	7650	1275	8478.75	0.90

Table-4.9: The Pay Back calculations of Replacement of CFL with LED Lamps

Replacement of Fluro cent Tube lights with LED Tube lights

There are FTLs of 40 W which can be replaced by 18 W LED Tub-elite. By replacing FTLs to 18 W LED Tub-elite saving of 22 W can be achieved for each of the fixtures for 300 days per year on 10 hrs . per day basis for institute.

Particulars	Quantity	Unit
Number of 40 W FTLs to be replaced by 18 W LED Tube lights	1050	Nos.
Cost of replacement @ Rs 400 per LED Tube light	420000	Rs.
Energy saved by replacement of 40 W FTLs per day on 10 hrs basis with 18 W LED Tube -elite @ 22 Watt (W)	161.7	KWh
Energy saved per year on 300 working days basis	48510	KWh
Cost of electricity savings per year @ Rs 6.65 per unit	322591.5	Rs.
Payback period	1.30	Years

Table-4.10: Pay Back Period for replacement of FTL with LED Tub-elite

Replacement of conventional ceiling fans with Efficient ceiling fans

Replacing conventional fans with star rated fans can save substantial amount of electrical energy and money. Out of total 950 Ceiling Fans, 50% fans are very old. We recommend replacement of 475 existing fans. It will cost Rs. 109.42 Lakh @ R s. 1400/- each. It will save 20 W per fan/hr.

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Particulars	Quantity	Unit
Number of Conventional fans to be replaced by EE Fans	475	Nos.
Cost of installation @ Rs 1600 per fan	760000	Rs
Energy saved by replacing all Conventional Fans @ 20 W by EE Fans per day on 12 Hrs/day basis	118.75	Units
Energy saved by replacing all Conventional Fans by EE Fans per year on 150 days basis	17812.5	Units
Cost of electricity savings per year @ Rs 6.65 per Unit	118453.13	Rs
Payback period	6.42	**Years**

Table-4.11: Pay back period for Replacement of old ceiling fans with EE Ceiling fans

Replacement of air-conditioners with EE Five star rated ACs

We recommend replacement o f 95 nos. 1.5 Tons old Window ACs (Non-Five Star) and 16 nos. 1.5 Tons Split Air Conditioners with BEE 5 Star Split AC.

Particulars	Unit	1.5 TR Capacity
Existing Power Input considering for 1.5 TR window AC	W	1850
Power Input of proposed Split AC 1.5 Ton capacity	W	1250
Power Saved per unit	W	600
Daily operating hrs	hrs/day	7
Energy Saved per day per unit	kWh/day	4.2
Operating days per year	days/yr	200
Annual energy saved per AC	kWh/yr	840
Unit rate	Rs./kWh	6.65
Total annual monetary benefit per unit	Rs./yr	5586
Total Investment per unit	Rs.	34000
Payback	**Years**	**6.09**

Table-4.12: Payback period for replacement of Window AC to 5 Five Star Split AC

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Particulars	Unit	1.5 TR Capacity
Existing Power Input considering for 1.5 TR split AC	W	1750
Power Input of proposed Split AC 1.5 Ton capacity	W	1250
Power Saved per unit	W	500
Daily operating hrs	hrs/day	7
Energy Saved per day per unit	kWh/day	3.5
Operating days per year	days/yr	200
Annual energy saved per AC	kWh/yr	700
Unit rate	Rs./kWh	6.65
Total annual monetary benefit per unit	Rs./yr	4655
Total Investment per unit	Rs.	34000
Payback	**Years**	**7.30**

Table-4.13: Payback period for replacement of old Split AC to 5 Five Star Split AC

Sl. No.	Particulars	Nos	Cost of replacement @ Rs 34000 per AC (Rs)	Energy saved (KWh)	Cost of Energy saved @ RS 6.65 per unit (Rs)	Reference
1	Nos of old 1.5 Tons Window Air Conditioners To be replaced with 5 star Split Air conditioners of 1.5 Tons capacity	95	3230000	79800	530670	Table-4.17
2	Nos of old 1.5 Tons Split Air Conditioners To be replaced with 5 star Split Air conditioners of 1.5 Tons capacity	16	544000	11200	74480	Table-4.18
	Total		3774000	91000	605150	

Table 4.14: Payback Calculations for all recommended 1.5 Ton Air Conditioners

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EE measures in Street Lighting

Street lighting is one of the major sources of energy consumption. The different lighting appliances to be replaced in in Technological Institute of Textile & Sciences, Bhiwani , their savings are shown in Table-4.15.

Sl. No	Name of existing Street Light Fixture	Name of EE Fixture to be replaced	Qty. (Nos)	Unit rate (Rs.)	Energy Saving each fixture (W)	Yearly power saving on av. 11 hrs X 365 days basis (Kwh)	Total cost (Rs.)	Cost of power saved @ Rs. 6.65/ unit (Rs.)	Payback period (Years)
1	Sodium Light (250 W)	LED Light (125 W)	29	15000	125	14554.38	435000	96786.59	4.49

Table-4.15: EE measures in Street Lighting

Summary of EE Strategy The estimated potential of energy savings has been shown in Table-4.16.

Sl. No.	Name of EE Measures	Qty.	Investment (Lac INR)	Energy saved/ Yr (KWh)	Cost of Energy saved/ Yr (Rs. Lac)	Pay back (Years)	Reference
1	Replacement of 11 W CFL with 6 W LED Lamps	85	7650	1275	8478.75	0.9	Table-4.9
2	Replacement of 40 W traditional Tube lights with energy efficient 18 W LED Tub-elite	1050	420000	48510	322591.5	1.3	Table-4.10
3	Replacement of old conventional Ceiling Fans with Energy Efficient ceiling fans	475	760000	17812.5	118453.125	6.42	Table-4.11

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Sl. No.	Name of EE Measures	Qty.	Investment (Lac INR)	Energy saved/ Yr (KWh)	Cost of Energy saved/ Yr (Rs. Lac)	Pay back (Years)	Reference
4	Replacement of conventional 1.5 Ton Window & Split air-conditioners with EE star rated Split ACs	110	3885000	91000	605150	6.09-7.3	Table-4.14
5	Replacement of Sodium Street Light with LED Lights	29	435000	14554	96784.1	4.49	Table-4.15
	Total		**5507650**	**173151.5**	**1151457**	**4.78**	

Table-4.16 Summary of EE Strategy

Instruments Used:

Followings Instruments were used for carrying Energy audit of the Institute:

i. Digital Lux meter,
ii. Three Phase Power Analyzer
iii. Digital Thermos Hygrometer,
iv. Digital Thermometer,
v. Digital Capacitance meter,
vi. Digital Clamp on Power, current, voltage meter

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Chapter-5

Green Audit

Scope and Goals of Green Auditing

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. Green Audit is the most efficient and ecological way to manage environmental problems. It is a kind of professional care which is the responsibility of each individual who are the part of economical, financial, social, environmental factor. It is necessary to conduct green audit in Educational Institution campus because students become aware of the green audit, its advantages to save the planet and they become good citizen of our country. Thus, Green audit becomes necessary at the Educational Institution level.

Benefits of the Green Auditing

- More efficient resource management
- To provide basis for improved sustainability
- To create a green campus
- To enable waste management through reduction of waste generation, solid - waste and water recycling
- To create plastic free campus and evolve health consciousness among the stakeholders
- Recognize the cost saving methods through waste minimizing and managing
- Authenticate conformity with the implemented laws
- Empower the organizations to frame a better environmental performance
- Enhance the alertness for environmental guidelines and duties
- Impart environmental education through systematic environmental management

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approach and improving environmental standards

- Benchmarking for environmental protection initiatives
- Financial savings through a re duction in resource use
- Development of ownership, personal and social responsibility for the Educational Institution and its environment

Institute Green Policy

The TIT&S recognizes that in pursuing its strategic objectives, in relation to research and teaching, it has a responsibility towards, and should aim to protect and nurture the environment. By exercising proper control over all its activities, the Institute will aim to ensure sustainable use of resources and prevent wasteful or damag ing practices.

The Institute believes in the philosophy of protecting the environment and ecosystem by every means. Over the last two decades the institute has largely contributed to the cause of environment not only in its campus but in surrounding areas as well. The institute has ensured plantation of trees across the entire campus i.e. the main academic premises, the hostel premises sprawled on a vast area and the residential area. One can feel proximity to nature despite the institute being located clos e to industries. While the peacocks thrive in a big number in the campus, hornbills, parrots, starlings and other species of birds are also in plethora due to our environmental measures. Staffs are encouraged to protect trees and natural bio -diversity of the campus by all means and wherever possible, in addition to natural habitat, nest -boxes have been installed to help passerine and other birds and squirrels. Due to greenery of campus and presence of a reasonably big pool of water, migratory birds, like st orks and cranes, are also spotted. TIT Social Responsibility Initiative (TSRI) the philanthropic initiative of the institute, which translates into concrete practice the 'Gandhian Ideology of giving back to society', also spreads awareness on avoiding plas tic, planting more trees, using electric vehicles by arranging staff and students to visit different panchayats and blocks.

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The TIT&S will aim to manage its operationsin ways that are environmentally sustainable, economically feasible and socially respons ible i.e., making the Institute a Green Campus where environmentally friendly practices and education combine to promote sustainable and eco -friendly practices. The Institute is striving to develop on a self –sustainable basis in the areas of power, water and cleanliness. Therefore, this policy represents an important component of the Institute's broader sustainability strategy.

This document sets out the Institute's aims and objectives for safeguarding the environment, and details the organization and arra ngements . for implementing and monitoring them.

Reusing Old Water Bottles

Reusing old water bottles or purchasing water bottles that one can refill instead of discarding a new bottle after single use.

Minimise use of Paper

- Maximize use of paperless technology e. sharing of data /Lecture notes on e -mail etc.
- Take Notes Electronically Introduce double -sided printing to reduce paper waste

In-House Recycling Policy

The In-house Recycling Policy of the Institute is a unique step to wards going green. Since the institute was integrated with a manufacturing facility, the workshop and recycling station both are used to create best out of the waste, whether it is iron, plastic or wood. Using this system, the Institute has achieved substa ntial waste diversion rate.

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E-Waste Recycling

The institute shall follow the past practice of extracting working parts out of old, damaged and broken electronic machinery before dumping in its junkyard for further collection by a designated par ty who follows green laws.

Training & Implementation :

The institute believes in proper Training and Education of its staff, students and other stakeholders to imbibe the spirit of its Green Policy. If need be, faculty, supporting staff and service technicians shall be imparted skills and knowledge to effectively apply the tech means used to achieve energy savings.

While the success of the Green Policy depends on the complete change of attitude of the institute's staff, students and stakeholders, effective implementation of the policy also requires an awareness drive to educate the entire campus population. An effect ive programme which provides at least first-hand information on utility costs, trends and user impact will help the institute in achieving its goals. It will enable the campus population to understand the need for this policy, and how it can positively imp act them by freeing up money from utilities for educational purposes.

Green Landscaping

- Though the flora and fauna in and around TIT&S has been flourishing due to continuous efforts, the Institute intends to implement its Environment Policy more comprehensively for through following measures:
- Creation of brick -pots along main walls inside the institute and planting of trees not likely to be disturbed by monkeys.
- Planting of quick growth trees to boost air quality in and around.

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Target Areas of Green Auditing

Green audit forms part of a resource management 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. Target areas included in the green auditing are :

I. Water,
II. Waste,
III. Green campus

Auditing for Water Management

The world's water resources are finite but exist on a planet with a constantly growing population. The development of water resources to man's benefit has been a fundamental factor in the evolution of civilizations throughout history. But, as our populations continue to grow and shift, the availability of quality water resources is in decline. Pollution, climate change and cons truction of cities in dry regions are some of the factors exacerbating evolving supply/demand imbalances. Many innovative technologies have been developed in recent times to assist the efficient delivery and utilization of drinking water. Water audits prov ide a rational, scientific framework that categorizes all water use in your system. It is a tool to overcome drought related problem, shortage, leakage and losses.

Advantage of Water Audit :

a. Water audits provide decision making tools to utility managers, directors, and operators. i.e., knowing where water is being used in your system allows you to make informed decisions about investing resources such as time, labour and money.
b. Water audits allow managers to efficiently reduce water losses in the system.
c. Reducing water used at the source may even result in delaying or avoiding capital investments such as a new well, more treatment technology or additional

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water rights.

d. Water audits also iden tify which water uses are earning revenue for the utility and which water uses are not. Thus, System personnel can increase revenue by ensuring all appropriate uses are being accurately measured and billed. This leads to more financial capacity in the wate r system, reduced cost per customer and better management of the water resource.
e. Creating awareness among water users i.e., customers can see and understand that the utility is taking proactive steps to manage wasted water and save for the future.
f. It is an effective educational and public relations tool for the water system.

Water Usage in the Institute

Both Treated water and Raw water are used in the Institute depending on the use such as for drinking purpose and non-drinking purpose.

Drinking Water System

Drinking water for the Institute is supplied by Municipal Corporation. Further water purifiers have been insta lled on each water coolers.

Water Quality of Drinking water :

Water quality of Drinking water is regularly monitored through testing by Government approved Agency . Drinking water samples are also taken and checked by Institute's staff regularly and the action is taken by the staff accordingly . The Test Reports are below:

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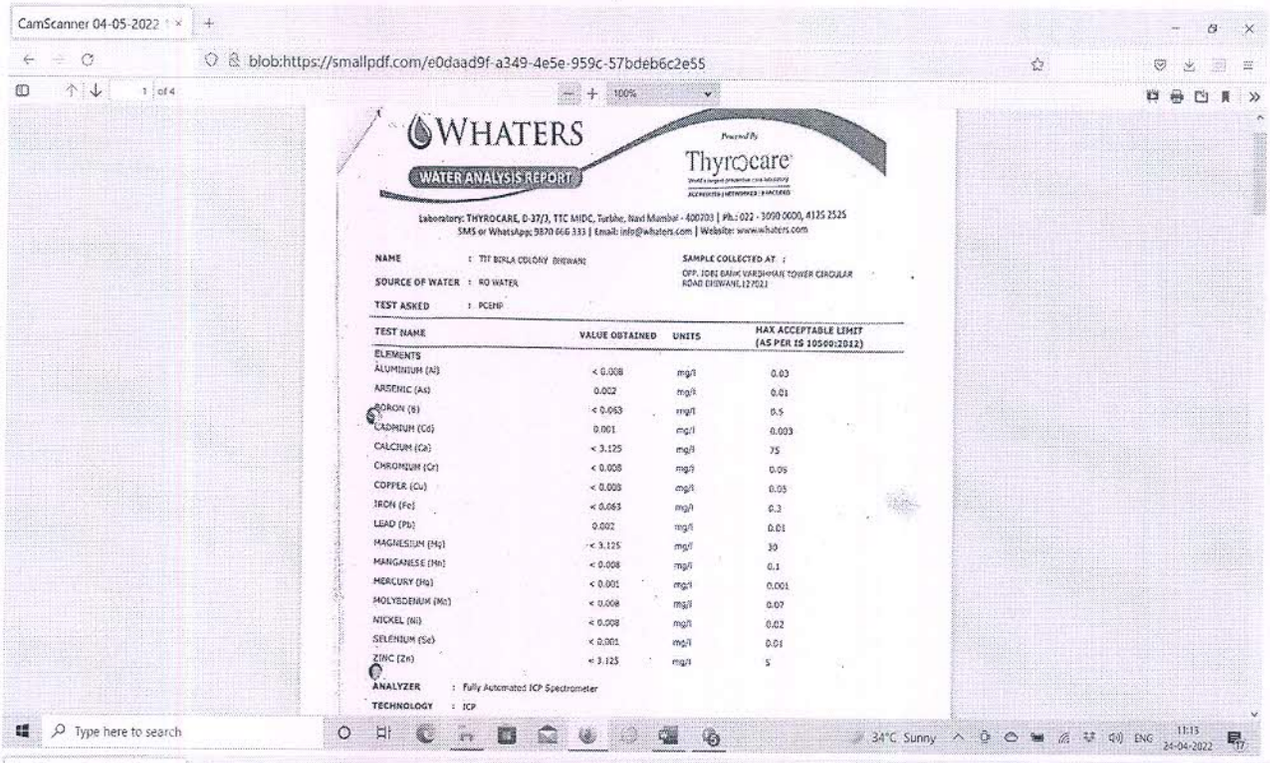


WHATERS

WATER ANALYSIS REPORT

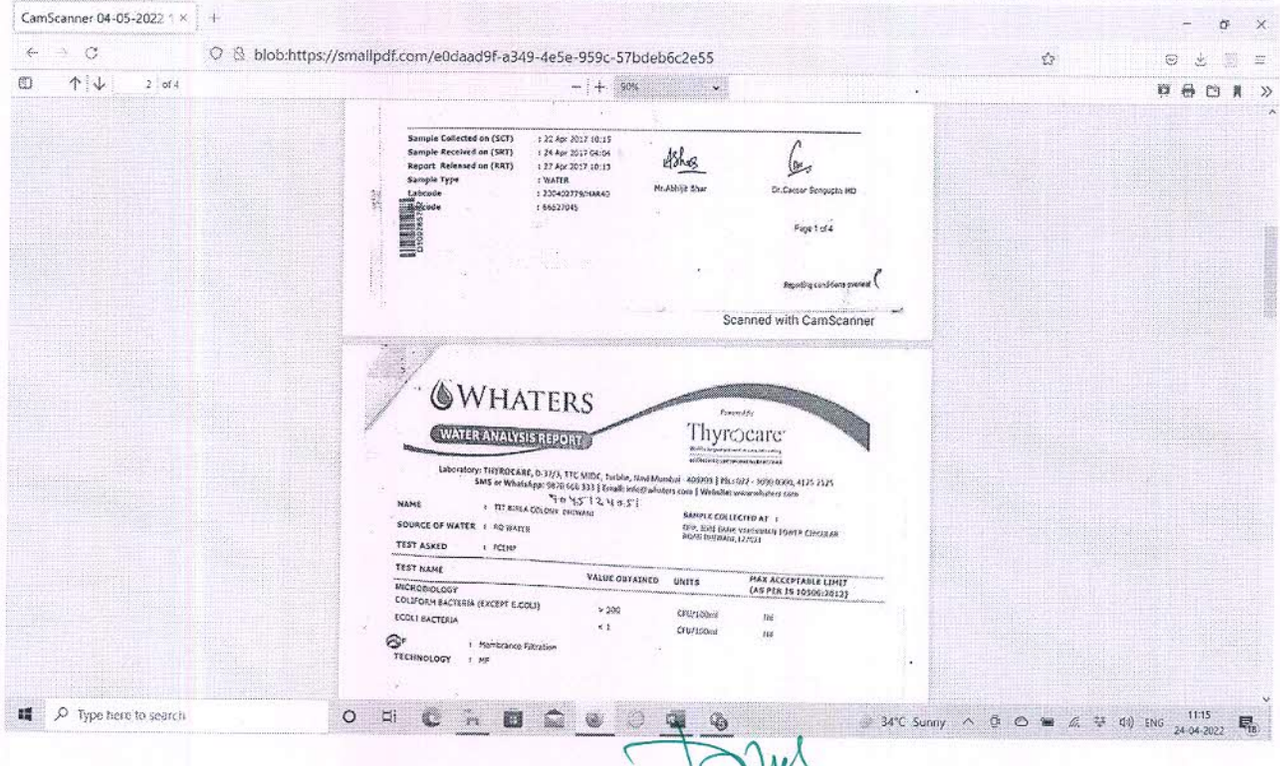
Powered By Thyrocare

Laboratory: THYROCARE, D-37/3, TTC MIDC, Turbhe, Navi Mumbai - 400703 | Ph.: 022 - 3090 0000, 4125 2525
SMS or WhatsApp: 9870 666 333 | Email: info@whaters.com | Website: www.whaters.com

NAME : TIT BIRLA COLONY BHIWANI
SOURCE OF WATER : RO WATER
TEST ASKED : PCEMP
SAMPLE COLLECTED AT : OPP. IDBI BANK VARDHMAN TOWER CIRCULAR ROAD BHIWANI, 127021

TEST NAME	VALUE OBTAINED	UNITS	MAX ACCEPTABLE LIMIT (AS PER IS 10500:2012)
ELEMENTS			
ALUMINIUM (Al)	< 0.008	mg/l	0.03
ARSENIC (As)	0.002	mg/l	0.01
BORON (B)	< 0.063	mg/l	0.5
CADMIUM (Cd)	0.001	mg/l	0.003
CALCIUM (Ca)	< 3.125	mg/l	75
CHROMIUM (Cr)	< 0.008	mg/l	0.05
COPPER (Cu)	< 0.008	mg/l	0.05
IRON (Fe)	< 0.063	mg/l	0.3
LEAD (Pb)	0.002	mg/l	0.01
MAGNESIUM (Mg)	< 3.125	mg/l	30
MANGANESE (Mn)	< 0.008	mg/l	0.1
MERCURY (Hg)	< 0.001	mg/l	0.001
MOLYBDENUM (Mo)	< 0.008	mg/l	0.07
NICKEL (Ni)	< 0.008	mg/l	0.02
SELENIUM (Se)	< 0.001	mg/l	0.01
ZINC (Zn)	< 3.125	mg/l	5

ANALYZER : Fully Automated ICP Spectrometer
TECHNOLOGY : ICP



Sample Collected on (SCT) : 22 Apr 2017 10:15
Sample Received on (SRT) : 24 Apr 2017 04:04
Report Released on (RRT) : 27 Apr 2017 10:13
Sample Type : WATER
Labcode : 2304027376MAR40
Mobile : 86627045

Mr.Abhijit Bhar
Dr.Cesar Sengupta MD

Page 1 of 4

Reporting conditions overleaf

Scanned with CamScanner

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WATER ANALYSIS REPORT

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Laboratory: THYROCARE, D-37/3, TTC MIDC, Turbhe, Navi Mumbai - 400703 | Ph.: 022 - 3090 0000, 4125 2525
SMS or WhatsApp: 9870 666 333 | Email: info@whaters.com | Website: www.whaters.com

NAME : TIT BIRLA COLONY BHIWANI
SOURCE OF WATER : RO WATER
TEST ASKED : PCEMP
SAMPLE COLLECTED AT : OPP. IDBI BANK VARDHMAN TOWER CIRCULAR ROAD BHIWANI, 127021

TEST NAME	VALUE OBTAINED	UNITS	MAX ACCEPTABLE LIMIT (AS PER IS 10500:2012)
MICROBIOLOGY			
COLIFORM BACTERIA (EXCEPT E.COLI)	> 200	CFU/100ml	Nil
ECOLI BACTERIA	< 1	CFU/100ml	Nil

TECHNOLOGY : Membrance Filtration : MF

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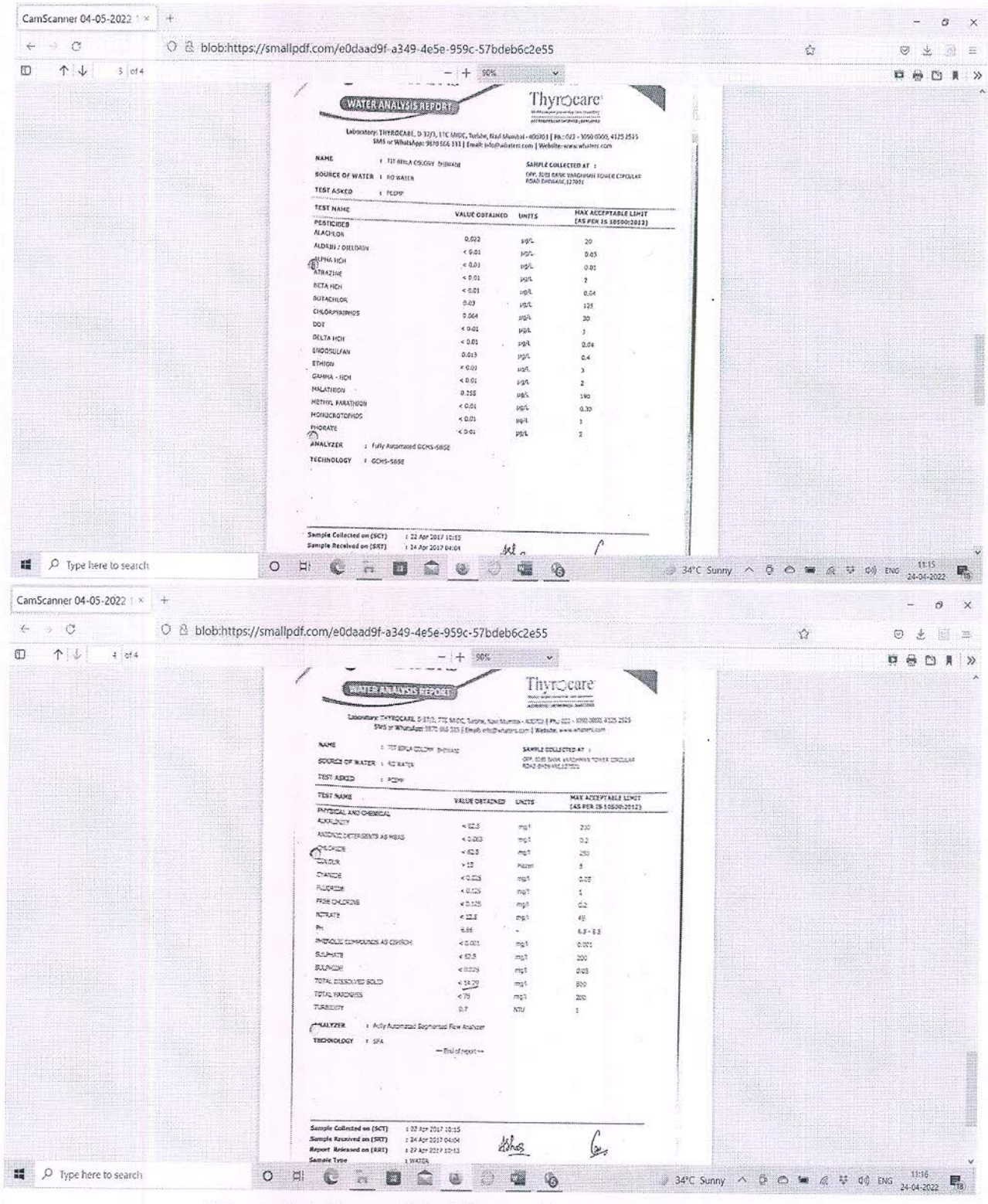

Figure-5.1: Copy of Test Report dated 22.04.2017

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Non-Drinking Water System

Non-Drinking water is supplied through Borewells in the Institute. Water Pumps have been installed on these Borewells. Details of Water Pumps for non-drinking Purpose are as follows:

Sl. No	Location	Capacity (HP)	Make	Tentative Discharge (Cu Meter /Hour)	Average Operating Hrs per day	Associated Tank Capacity (Liters)
1	Near old canteen	7.5HP	Oswal	45.58m3/hr (Approx)	2 hrs	1 lakh litre capacity
2	Opposite w/p	3 HP	Crompton	25.58m3/hr (Approx)	6 hours	50,000 Litre
3	Boys hostel	3 HP	Oswal	35.58m3/hr (Approx)	8 hours	1 lakh litre capacity

Table-5.1: List of other Water Pumps

I. Consumption of Drinking water per day: Approx. 0.8-1 lakh liters
II. Consumption of Non -Drinking water per day: Approx. 5 lakh liters

Baseline of water consumption

In India, the design of water supply systems has been done using certain standards. Currently the standard being used is BIS 1172: 1993, reaffirmed in 199 8. This specifies a consideration of use of the following:

For communities with a population of between 20, 000 to 100,000 — 100 to 150 liters per head per day

For communities with a population o f over 100,000 — 150 to 200 liters per head per day.

In its previous avatar there was also an attempt made in IS 1172 to understand the break-up of this demand which was then put as 135 lit ers per person per day. The

break-up was as follows:

I. Bathing: 55 liters
II. Toilet flushing: 30 liters
III. Washing of clothes: 20 liters
IV. Washing the house: 10 liters
V. Washing utensils: 10 liters
VI. Cooking: 5 liters
VII. Drinking: 5 liters.

Based on above standard water consumption of Campus residents should be maximum 135 Liters per person and Nonresident person should be maximum 40 Liters per person.

As per Para 1.81 and 1.82 of Chapter-1, the nos. of the residents living in Campus are 297 and nos. of Nonresidents are 935.

Thus, total maximum permissible water Consumption as per Standards laid under IS 1172 is as given in Table-5.2.

Sl. No.	Particulars	Nos.	Maximum water consumption per Person per day (Liters)	Total Maximum water consumption Liters per Day
1	Nos. of Campus full time residents	297	135	40095
2	Nos. of Day time persons	935	40	37400
	Grand Total			**77495**

Table-5.2: Total permissible water Consumption as per Standards laid under IS 1172

Actual water consumption as per Para 4.3 is 0.8 to 1 lakh Liters per day, which is as per Standards laid under IS 1172 shown in per Table-4.4. It must be noted that some drinking water is also used for irrigation purpose in kitchen gardens and water coolers in summer seasons.

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Rainwater Harvesting

Rainwater harvesting is the accumulation and deposition of rainwater for reuse on -site, rather than allowing it to run off. Rainwater can be collected from roofs, and in many places the water collected is redirected to a deep pit (well, shaft, or borehole), a reservoir with percolation. Its uses include water for gar dens, livestock, irrigation, domestic use with proper treatment etc. The harvested water can also be used as drinking water, longer-term storage and for other purposes such as groundwater recharge.

Rainwater harvesting provides an independent water supply during regional water restrictions and in developed countries is often used to supplement the main supply. It provides water when there is a drought , can help mitigate flooding of low -lying areas, and reduces demand on wells which may enable groundwater levels to be sustained. It also helps in the availability of potable water as rainwater is substantially free of salinity and other salts. Application of rainwater harvesting in urban water system provides a substantial benefit for both water supply and wastewater subsystems by reducing the need for clean water in water distribution system , less generated storm water in sewer system, as well as a reduction in storm water runoff polluting freshwater bodies.

Supplying rainwater that has gon e through preliminary filtration measures for non - potable water uses, such as toilet flushing, irrigation, and laundry, may be a significant part of a sustainable water management strategy.

Details of Rain Water Harvesting Borings in the Institute

S. No.	Location	Nos of RWH borings	Boring Size L x B x Dia.
1	Open water tank near old canteen	2	140*160*12 (Tank 1) 80*80*12 (Tank 2)

Table-5.3: Details of Rain Water Harvesting Borings in the Institute

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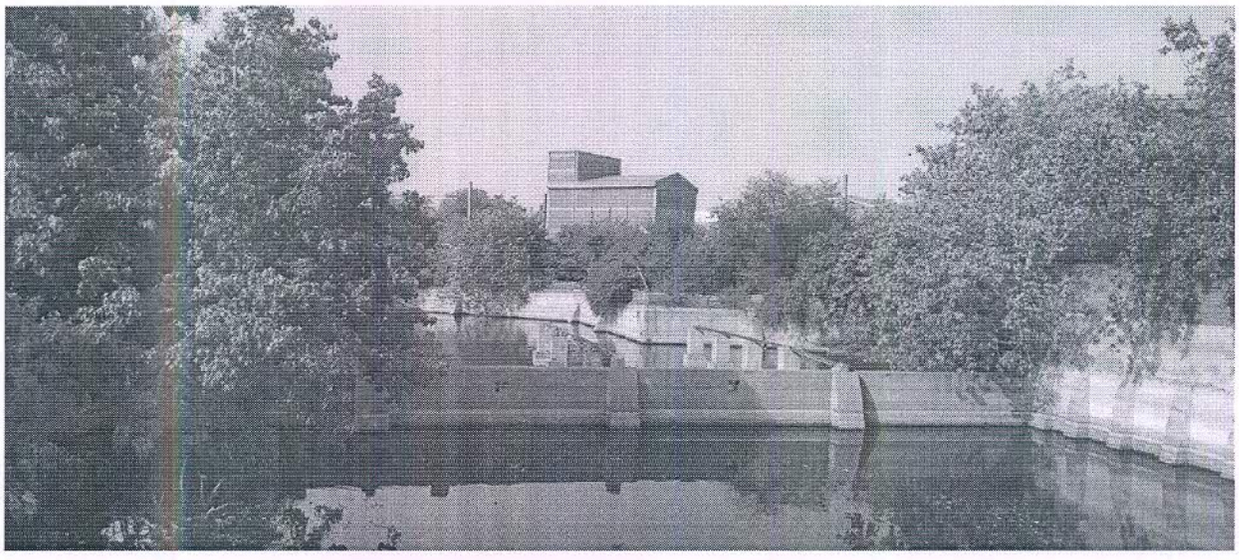

Fig 5.2: Large water Pond inside the institute

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, and recycling. Solid waste can be divided into two categories: general waste and hazardous waste. General wastes include what is usually thrown away in homes and schools such as garbage, paper, tins and glass bottles. Hazardous waste is waste that is 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 often includes wasted material resources that could otherwise be channeled into better service through recycling, repair, and reuse. Thus the minimization of solid waste is essential to a sustainable Educational Institution. 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.

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Quantity of Waste Generated

Data provided by the Institute regarding the quantity of waste (Biodegradable, Non-biodegradable and E Waste) generated in the Institute is as follows:

Biodegradable - 100 tons/year

Non-biodegradable and E Waste - 30 tons/year

Disposal of Waste generated

(A) Biodegradable

Canteen waste :

It was shared by the authorities that Canteen waste is being given to Municipal body through their Truck.

Leaves and others:

Leaves and others are used to prepare Vermi post, which is used as manure in the Institute. Different methods such as pit composting, vermi -composting, are used to treat this waste.

(B) Non-bio-degradable

(C) This waste including metals, bottles, plastics, cans, broken glass wares, tins etc., are disposed through Municipal Trucks .

(D) E Waste:

E Waste is disposed to Local Venders. Authorities are advised to dispose the E Waste to only Government authorized Venders onl y and keep proper accounting.

Liquid Waste Management System

There is one Sewage Treatment Plant in the Institute.

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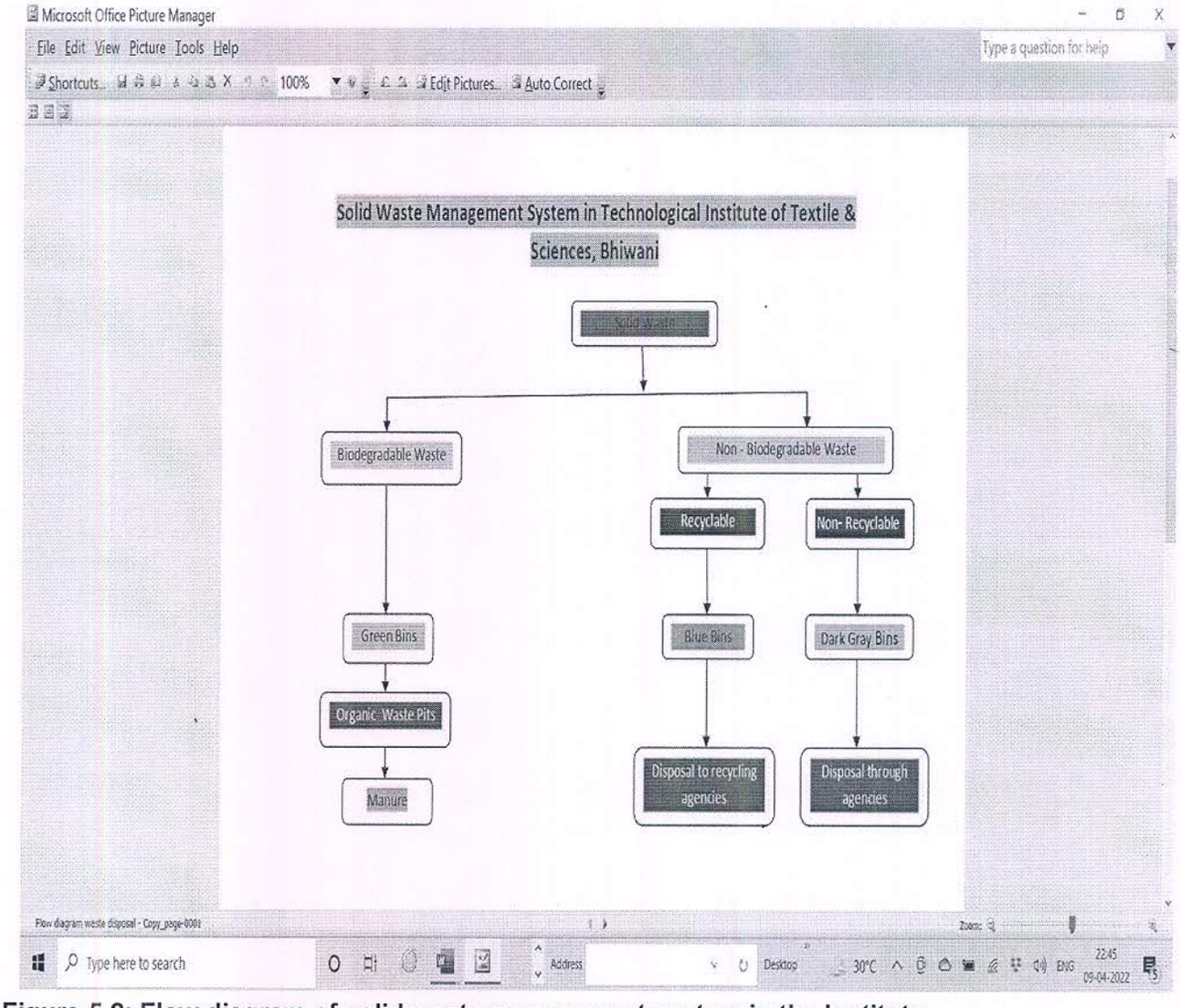

Figure-5.2: Flow diagram of solid waste management system in the Institute

Auditing for Green Campus Management

Unfortunately, biodiversity is facing serious threats from habitat loss, pollution, over consumption and invasive species. Species are disappearing at an alarming rate and each loss affects nature's delicate balance and our qua lity of life. Without this variability in the living world, ecological systems and functions would break down, with detrimental consequences for all forms of life, including human beings. Newly planted and existing trees decrease the amount of carbon dioxi de in the atmosphere. Trees play an important ecological role within the urban environment, as well as support

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improved public health and provide aesthetic benefits to cities. In one year, a single mature tree will absorb up to 48 pounds of carbon dioxide from the atmosphere, and release it as oxygen. The amount of oxygen that a single tree produces is enough to provide one day's supply of oxygen for people.

Methodology of Green Auditing

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.

List of Garden Trees in the Campus

List of Trees in the Institute Campus are as per Table-5.4.

Sl. No	Name of Tree/Plant	Nos.	Sl. No	Name of Trees/Plant	Nos
1	Alstonia	10	24	Harshingar	18
2	Amla	8	25	Jamun	20
3	Amun	0	26	Jatrupa	4
4	Ananas	0	27	Kachnar	10
5	Anar	17	28	Kadam	2
6	Ashoka	45	29	Kanak Champa	2
7	Bargad	25	30	Kanher	3
8	Bel patra	20	31	Kathal	5
9	Bismarckia		32	Mango	25
10	Bottle Brush	12	33	Mosambi	10
11	Eucalyptus	65	34	Money Plant	100
12	Chakresia		35	Neem	30
13	Champa	30	36	Nimbu	15
14	Chandan	0	37	Papdi	25
15	Chandani	18	38	Peepal	20
16	Chiku	0	39	Rubber Plant	3
17	Ephobia Mili		40	Samuel	4
18	Ficus	40	41	Semul	2
19	Gajraula	15	42	Sisum	10
20	Golden	0	43	Silbahar	4
21	Guava	23	44	Sopen	
22	Gular	20	45	Syngonium	30
23	Gulmohar	15	46	Adenium	10
	Sub Total	363		Sub Total	**298**
				GRAND TOTAL	**661**

Table-5.4: Technological Institute of Textile & Sciences, Bhiwani Trees Details

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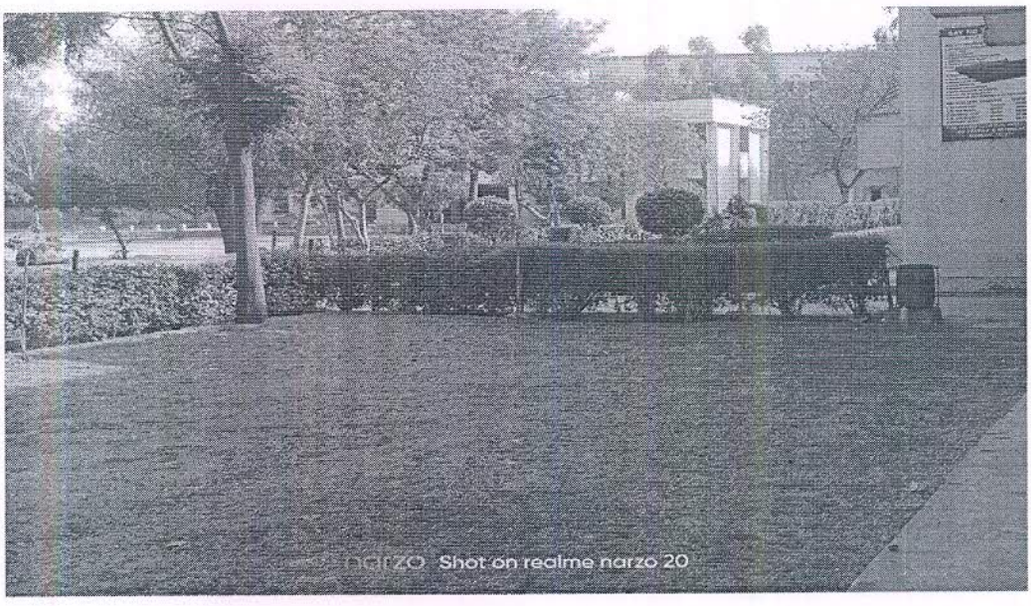

Fig 5.3: Photograph of Dense Green Plantation in the Institute

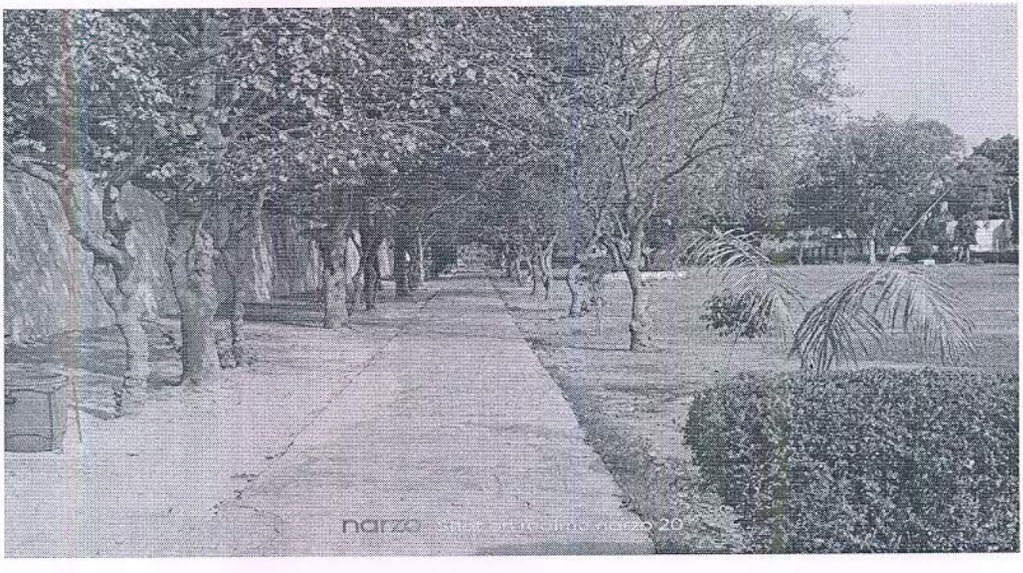

Fig 5.4: Dense Plantation on both side Road inside the Institute

Evaluation of Audit Findings

A. Major Audit Observations in General

- Gardens inside the Educational Institution premises are found well maintained.

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- Use of notice boards and signs are inadequate to reduce over exploitation of natural resources.
- Programs on green initiatives have to be increased.
- Environmental education programs have to b e strengthened.

B Water Audit

- The waste water from laboratories, canteen and kitchens are not suitably controlled and are not used for gardening.
- Display boards against the misuse of water use are lacking.

C Waste Audit

- Solid waste management systems established are insufficient. Bio degradable waste may be used for non -conventional Energy Generation or Steam Generation for cooking food/ Washing cloths etc.
- Waste bins in the class rooms, veranda, canteen and campus are inadequate.
- Bio gas plant should be installed

D Green Campus Audit

- Display boards to all plants identified are lacking.

Criteria wise List of Recommendations

A Water

- Manual water Taps should be replaced with Auto closed water Taps
- Drip irrigation for gardens and vegetable cultivation can be initiated.
- Establish water treatment systems to recycle drain water
- Awareness programs on water conservation to be conducted.
- Install display boards to control over exploitation of water.

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B Waste

- A model solid waste treatment system to be established.
- Practice of waste segregation to be strengthened.

C Green Campus

- Grow potted plants at both verandah and class rooms.
- Beautify the Educational Institution building with maximum use of oxygen generating indoor plants
- All trees in the campus should be named scientifically.

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Chapter -6

Environmental Audit

Current Scenario

The Institute is located at Bhiwani (Haryana) State. The Environmental condition of an Institute largely depend on the place of location . In spite of best effort of the Institution, surrounding conditions have great influence on its envir onmental conditions. There is Flyover just close to the Gate of the Institute namely Bhiwani -Tosham Road Flyover, which is a major source of Pollution. Also, there is a big Factory close to the Institution namely Gwar -Gum Factory. It is also creating Pollution.

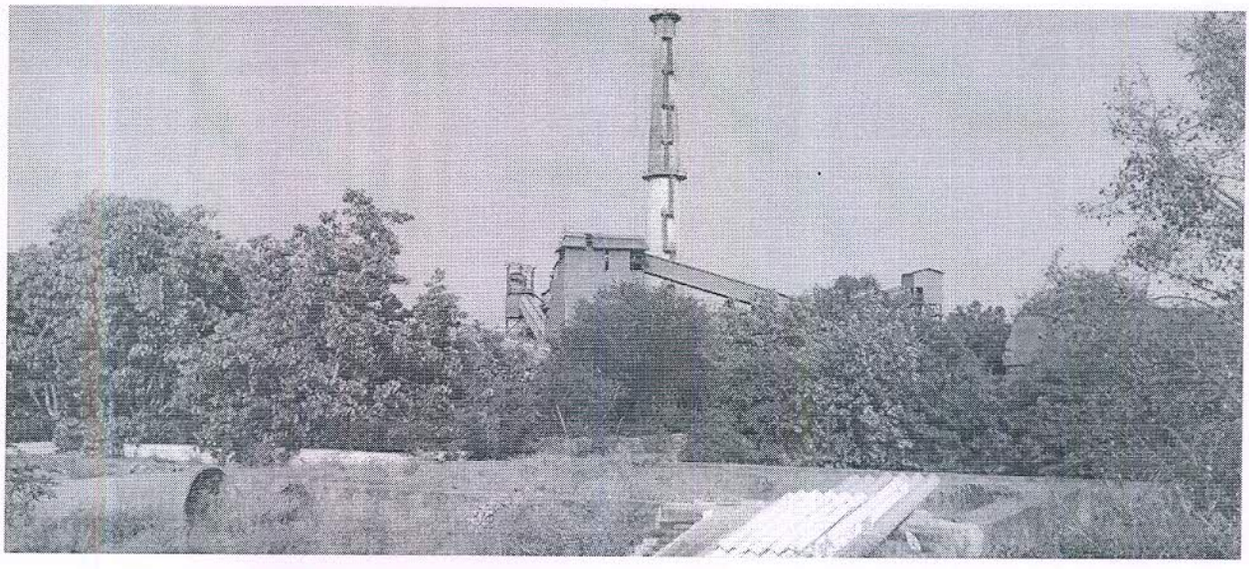

Fig 6.1: Gwar-Gum Factory close to the boundary wall of Institution

It will be better to consider the Environmental conditions of district Bhiwani also. District Bhiwani is situated between 28.19 deg. & 29.05 dėg. North latitude and 75.26 deg. and 76.28 deg. East Longitude. The Bhiwani District is bordered by Hissar District on its north, some area of Jhunjunu and Churu districts of Rajasthan on its west, Mahendergarh and Jhunjunu districts on its south and District Rohtak to the east. District Bhiwani is located 124 km of India capital New Delhi and 295 km of Haryana capital Chandigarh.

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Bhiwani is 295 Km far from Chandigarh.

- Longitude: 76.7, Latitude: 28.78
- Area: 32.83 sq. km | Altitude: 225 m
- Population: 1,96,057 (Census 2011)
- Literacy Rate: 76.70 %

The city of Bhiwani has expanded its trade and commerce aspirations in the recent times by many folds making it a economically successful city. This city is the apple of the eye for many industrialists and commercial giants, due to its fertile land and trade friendly policies, which makes it very easy for the industrial giants and manufacturing companies to set up their base here. The district Bhiwani mainly has stone crusher units, Mining units, Plastic recycle, Gawar GUM, Bio Mass Based Power plants, Textile etc.

Since the Bhiwani district falls under the National capital region ,it has made rapid stride in the sphere of development of industries. The District Bhiwani has achieved a phenomenal growth in the field of small scale industries sector. The total number of small-scale industries in existence are 2250. The main industries of wood based, Mineral based and Rubber& Plastic based. The total numbers Mineral based 256 and other manufacturing/servicing and repairing units are 7 00. These units are providing employment to over 18000 persons. The Textile units in district Bhiwani in a big way and earned a good name for the State not only in National Market but also in International Market. M/S GBTL of Bhiwani is famous not only in India but also in foreign countries and clothes are exported in many countries.

The Government of Haryana also developed an Industrial Estate in Bhiwani Through Haryana State Industrial Development Corporation. HSIIDC carved out 354 plots in Sector-21 and sector-26 HSIIDC Industrial sector and all the Plots stands allotted.

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The district is famous for its mineral resources. Different types of mineral resources such as kankar, saltpeter road metal are available in the district. There are about 0 2 nos. queries of kankar and building stone in the district. There are about 270 stone crushing units mostly situated in village Khanak and Dadam in Tehsil Tosham. These stone crushers are meeting the building material demand of the major area.

There are 4 Large & Medium scale units in the district. Out of these, two units are Bio Mass based Power Plant in the District which has capital investment of Rs. 3173 Lakhs and 2982 Lakhs. The total power generation capacity of the plants is approximately 17 MW. The other two units are stone mine units in Topsham which extract rock stone mineral and fulfill the demand of stone crushers.

Geography & Demography

Bhiwani district is one of the 22 districts of the northern Indian state of Haryana. Created on 22 December 1972, the district was the largest district of the state by area, before the creation of Charkhi Dadri as a separate district, as it occupied an are a of 4,778 square kilometers and administered 272 villages with a population of 11,32,169.

According to the 2011 census Bhiwani district has a population of 1,96,057. The district has a population density of 341 inhabitants per square kilometer (880/sq mi). Its population growth rate over the decade 2001–2011 was 14.32%. Bhiwani has a sex ratio of 884 females for every 1000 males and a literacy rate of 76.7%. After bifurcation the district has a population of 11,32,169. Scheduled Castes make up 251,736 which is 22.23% of the population. At the time of the 2011 Census of India, 79.98% of the population in the district spoke Haryanvi and 18.12% Hindi as their first language

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Environmental Policy of Institute

The institute has resolved to adopt the following Environmental Policy:

- To create awareness of the institute's Green Policy among stude nt, staff and other stakeholders by circulation through appropriate channels and display on website.
- To sensitize students and staff on environmental measures adopted by the government.
- To create awareness on proper use of water and avoid wastage of water.
- To avoid open disposal of chemicals hazardous to environment or individual.
- Ban on Plastic consumables like polythene bags, plastic crockery etc.
- To segregate different types of waste and arrange its disposal in lawful and ethical manner.
- To arrange disposal of e-waste through appropriate parties.
- To implement sustainable resource management practices, based on reduce, reuse and recycle
- To encourage electronic resources and avoid printing wherever it is possible.
- To educate students and staff to dump dry and wet litter separately in the bins provided.
- To encourage students and staff for use ICT tools for academic purposes like periodic assessment and assignments, projects, sessional etc.
- To ensure minimum/restricted entry of vehicles in the campus whether in the college or hostel compound.
- Use of public transport, e -vehicles and bicycles by those not residing in the campus.
- To ensure regular cleaning, maintenance and monitoring of water channels leading to the reservoir meant for collecting rain wa ter.
- To monitor and maintain STP on regular basis.

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Sources Of Pollution in Bhiwani

The main sources of air pollution in Bhiwani city are Vehicular, Road dust, Construction & Demolition activities, Industries (Point source & Area's source), Garbage burning & Agriculture waste burning etc.

Air Quality Index in Bhiwani, Haryana, India

Air Quality Index Standards are shown in Table 6.1

AQI Category, Pollutants and Health Breakpoints								
AQI Category (Range)	PM_{10} (24hr)	$PM_{2.5}$ (24hr)	NO_2 (24hr)	O_3 (8hr)	CO (8hr)	SO_2 (24hr)	NH_3 (24hr)	Pb (24hr)
Good (0-50)	0-50	0-30	0-40	0-50	0-1.0	0-40	0-200	0-0.5
Satisfactory (51 -100)	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400	0.5-1.0
Moderately polluted (101-200)	101-250	61-90	81-180	101-168	2.1-10	81-380	401-800	1.1-2.0
Poor (201-300)	251-350	91-120	181-280	169-208	10-17	381-800	801-1200	2.1-3.0
Very poor (301 -400)	351-430	121-250	281-400	209-748	17-34	801-1600	1200-1800	3.1-3.5
Severe (401-500)	430+	250+	400+	748+	34+	1600+	1800+	3.5+

Table- 6.1: Air Quality Index Standards

Graphic Presentation of various Constituents

The Graphic Charts of various constituents of Air Quality at H.B. Colony Center of Bhiwani at 22 Hrs. for dated 15.01.2021 is shown in Figure 5.1 :

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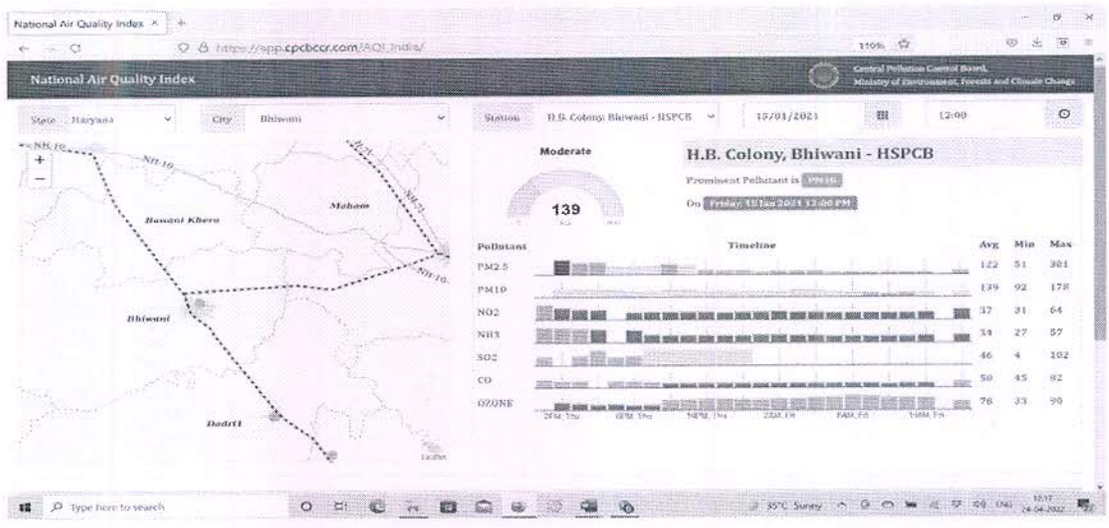

Fig 6.2: Air Quality constituents Graph

Various constituents on 15 Jan 2021 at H. B. Colony Center Bhiwani are as follows:

Air Quality Index

Moderate140AQI0500
H.B. Colony, Bhiwani - HSPCB
Prominent Pollutant is PM10
On Friday, 15 Jan 2021 11:00 AM

PM2.5

Time	Parameter Index
Jan 14, 2021, 12:00:00 PM	NaN
Jan 14, 2021, 1:00:00 PM	NaN
Jan 14, 2021, 2:00:00 PM	301
Jan 14, 2021, 3:00:00 PM	241
Jan 14, 2021, 4:00:00 PM	245
Jan 14, 2021, 5:00:00 PM	176
Jan 14, 2021, 6:00:00 PM	175
Jan 14, 2021, 7:00:00 PM	180
Jan 14, 2021, 8:00:00 PM	214
Jan 14, 2021, 9:00:00 PM	182
Jan 14, 2021, 10:00:00 PM	96
Jan 14, 2021, 11:00:00 PM	83
Jan 15, 2021, 12:00:00 AM	83
Jan 15, 2021, 1:00:00 AM	67

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Jan 15, 2021, 2:00:00 AM	75
Jan 15, 2021, 3:00:00 AM	69
Jan 15, 2021, 4:00:00 AM	69
Jan 15, 2021, 5:00:00 AM	61
Jan 15, 2021, 6:00:00 AM	51
Jan 15, 2021, 7:00:00 AM	52
Jan 15, 2021, 8:00:00 AM	62
Jan 15, 2021, 9:00:00 AM	53
Jan 15, 2021, 10:00:00 AM	57
Jan 15, 2021, 11:00:00 AM	Na N

PM10

Time	Parameter Index
Jan 14, 2021, 12:00:00 PM	Na N
Jan 14, 2021, 1:00:00 PM	Na N
Jan 14, 2021, 2:00:00 PM	178
Jan 14, 2021, 3:00:00 PM	171
Jan 14, 2021, 4:00:00 PM	162
Jan 14, 2021, 5:00:00 PM	161
Jan 14, 2021, 6:00:00 PM	150
Jan 14, 2021, 7:00:00 PM	152
Jan 14, 2021, 8:00:00 PM	159
Jan 14, 2021, 9:00:00 PM	154
Jan 14, 2021, 10:00:00 PM	151
Jan 14, 2021, 11:00:00 PM	140
Jan 15, 2021, 12:00:00 AM	136
Jan 15, 2021, 1:00:00 AM	135
Jan 15, 2021, 2:00:00 AM	144
Jan 15, 2021, 3:00:00 AM	154
Jan 15, 2021, 4:00:00 AM	155
Jan 15, 2021, 5:00:00 AM	130
Jan 15, 2021, 6:00:00 AM	106
Jan 15, 2021, 7:00:00 AM	99
Jan 15, 2021, 8:00:00 AM	92
Jan 15, 2021, 9:00:00 AM	98
Jan 15, 2021, 10:00:00 AM	104
Jan 15, 2021, 11:00:00 AM	Na N

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NO2

Time	Parameter Index
Jan 14, 2021, 12:00:00 PM	79
Jan 14, 2021, 1:00:00 PM	64
Jan 14, 2021, 2:00:00 PM	50
Jan 14, 2021, 3:00:00 PM	45
Jan 14, 2021, 4:00:00 PM	43
Jan 14, 2021, 5:00:00 PM	Na N
Jan 14, 2021, 6:00:00 PM	31
Jan 14, 2021, 7:00:00 PM	34
Jan 14, 2021, 8:00:00 PM	35
Jan 14, 2021, 9:00:00 PM	36
Jan 14, 2021, 10:00:00 PM	35
Jan 14, 2021, 11:00:00 PM	32
Jan 15, 2021, 12:00:00 AM	34
Jan 15, 2021, 1:00:00 AM	36
Jan 15, 2021, 2:00:00 AM	37
Jan 15, 2021, 3:00:00 AM	36
Jan 15, 2021, 4:00:00 AM	35
Jan 15, 2021, 5:00:00 AM	32
Jan 15, 2021, 6:00:00 AM	32
Jan 15, 2021, 7:00:00 AM	32
Jan 15, 2021, 8:00:00 AM	32
Jan 15, 2021, 9:00:00 AM	32
Jan 15, 2021, 10:00:00 AM	34
Jan 15, 2021, 11:00:00 AM	Na N

NH3

Time	Parameter Index
Jan 14, 2021, 12:00:00 PM	66
Jan 14, 2021, 1:00:00 PM	57
Jan 14, 2021, 2:00:00 PM	55
Jan 14, 2021, 3:00:00 PM	52
Jan 14, 2021, 4:00:00 PM	50
Jan 14, 2021, 5:00:00 PM	Na N
Jan 14, 2021, 6:00:00 PM	48
Jan 14, 2021, 7:00:00 PM	31
Jan 14, 2021, 8:00:00 PM	28
Jan 14, 2021, 9:00:00 PM	28
Jan 14, 2021, 10:00:00 PM	28

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Jan 14, 2021, 11:00:00 PM	28
Jan 15, 2021, 12:00:00 AM	29
Jan 15, 2021, 1:00:00 AM	30
Jan 15, 2021, 2:00:00 AM	30
Jan 15, 2021, 3:00:00 AM	28
Jan 15, 2021, 4:00:00 AM	28
Jan 15, 2021, 5:00:00 AM	27
Jan 15, 2021, 6:00:00 AM	27
Jan 15, 2021, 7:00:00 AM	27
Jan 15, 2021, 8:00:00 AM	27
Jan 15, 2021, 9:00:00 AM	27
Jan 15, 2021, 10:00:00 AM	28
Jan 15, 2021, 11:00:00 AM	Na N

SO2

Time	Parameter Index
Jan 14, 2021, 12:00:00 PM	97
Jan 14, 2021, 1:00:00 PM	58
Jan 14, 2021, 2:00:00 PM	Na N
Jan 14, 2021, 3:00:00 PM	62
Jan 14, 2021, 4:00:00 PM	100
Jan 14, 2021, 5:00:00 PM	56
Jan 14, 2021, 6:00:00 PM	70
Jan 14, 2021, 7:00:00 PM	102
Jan 14, 2021, 8:00:00 PM	102
Jan 14, 2021, 9:00:00 PM	102
Jan 14, 2021, 10:00:00 PM	102
Jan 14, 2021, 11:00:00 PM	101
Jan 15, 2021, 12:00:00 AM	101
Jan 15, 2021, 1:00:00 AM	4
Jan 15, 2021, 2:00:00 AM	6
Jan 15, 2021, 3:00:00 AM	6
Jan 15, 2021, 4:00:00 AM	5
Jan 15, 2021, 5:00:00 AM	6
Jan 15, 2021, 6:00:00 AM	6
Jan 15, 2021, 7:00:00 AM	5
Jan 15, 2021, 8:00:00 AM	6
Jan 15, 2021, 9:00:00 AM	6
Jan 15, 2021, 10:00:00 AM	5
Jan 15, 2021, 11:00:00 AM	Na N

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Time	Parameter Index
Jan 14, 2021, 12:00:00 PM	83
Jan 14, 2021, 1:00:00 PM	82
Jan 14, 2021, 2:00:00 PM	70
Jan 14, 2021, 3:00:00 PM	68
Jan 14, 2021, 4:00:00 PM	Na N
Jan 14, 2021, 5:00:00 PM	63
Jan 14, 2021, 6:00:00 PM	61
Jan 14, 2021, 7:00:00 PM	57
Jan 14, 2021, 8:00:00 PM	48
Jan 14, 2021, 9:00:00 PM	48
Jan 14, 2021, 10:00:00 PM	47
Jan 14, 2021, 11:00:00 PM	47
Jan 15, 2021, 12:00:00 AM	47
Jan 15, 2021, 1:00:00 AM	49
Jan 15, 2021, 2:00:00 AM	49
Jan 15, 2021, 3:00:00 AM	49
Jan 15, 2021, 4:00:00 AM	47
Jan 15, 2021, 5:00:00 AM	47
Jan 15, 2021, 6:00:00 AM	47
Jan 15, 2021, 7:00:00 AM	49
Jan 15, 2021, 8:00:00 AM	45
Jan 15, 2021, 9:00:00 AM	47
Jan 15, 2021, 10:00:00 AM	49
Jan 15, 2021, 11:00:00 AM	Na N

OZONE

Time	Parameter Index
Jan 14, 2021, 12:00:00 PM	Na N
Jan 14, 2021, 1:00:00 PM	Na N
Jan 14, 2021, 2:00:00 PM	46
Jan 14, 2021, 3:00:00 PM	44
Jan 14, 2021, 4:00:00 PM	37
Jan 14, 2021, 5:00:00 PM	39
Jan 14, 2021, 6:00:00 PM	33
Jan 14, 2021, 7:00:00 PM	34
Jan 14, 2021, 8:00:00 PM	61

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Jan 14, 2021, 9:00:00 PM	67
Jan 14, 2021, 10:00:00 PM	71
Jan 14, 2021, 11:00:00 PM	70
Jan 15, 2021, 12:00:00 AM	66
Jan 15, 2021, 1:00:00 AM	67
Jan 15, 2021, 2:00:00 AM	69
Jan 15, 2021, 3:00:00 AM	72
Jan 15, 2021, 4:00:00 AM	78
Jan 15, 2021, 5:00:00 AM	84
Jan 15, 2021, 6:00:00 AM	90
Jan 15, 2021, 7:00:00 AM	85
Jan 15, 2021, 8:00:00 AM	80
Jan 15, 2021, 9:00:00 AM	79
Jan 15, 2021, 10:00:00 AM	78
Jan 15, 2021, 11:00:00 AM	Na N

Auditing for Carbon Footprint

Commutation of stakeholders has an impact on the environment through the emission of greenhouse gases into the atmosphere consequent to burning of fossil fuels (such as petrol). The most common greenhouse gases are carbon dioxide, water vapor, methane, nitrous oxide and ozone. Of all the greenhouse gases, carbon dioxide is the most prominent greenhouse gas, comprising 402 ppm of the Earth's atmosphere. The release of carbon dioxide gas into the Earth's atmosphere through human activities is commonly known as carbon emissions.

Carbon footprint

- Establish a system of carpooling among the staff to reduce the number of four wheelers coming to the Educational Institution .
- Introduce Educational Institution bus services to the students and staff.
- Encourage students and staff to use cycles.
- Establish a more efficient cooking system to save gas.
- Discourage the students using two wheelers for their commutation.

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Chapter-7

Energy Conservation Tips

Lighting System

- One of the best energy -saving devices is the light switch. Turn off lights when not required.
- Many automatic devices can help in saving energy used in lighting. Consider employing infrared sensors, motion sensors, automatic timers, dimmers and solar cells wherever applicable, to switch on/off lighting circuits.
- As for as possible use task lighting, which focuses light where it's needed. A reading lamp, for example, lights only reading material rather than the whole room.
- Dirty tube lights and bulbs refle ct less light and can absorb 50 percent of the light; dust your tube lights and lamps regularly.
- Replace your electricity -guzzling ordinary bulbs (incandescent lamps) with more efficient types. Compact fluorescent lamps (CFLs) use up to 75 percent less electricity than incandescent lamps.
- A 15-watt compact fluorescent bulb produces the same amount of light as a 60 - watt incandescent bulb.

Room Air Conditioners

- Use ceiling or table fan as first line of defence against summer heat. Ceiling fans, for instance, cost about 30 paisa an hour to operate - much less than air conditioners (Rs.10.00 per hour).
- You can reduce air-conditioning energy use by as much as 40 pe rcent by shading your home's windows and walls. Plant trees and shrubs to keep the day's hottest sun off your house.
- One will use 3 to 5 percent less energy for each degree air conditioner is set above 22°C (71.5°F), so set the thermostat of room air conditioner at 25°C (77°F) to provide the most comfort at the least cost.

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- Using room ceiling or room fans allows you to set the thermostat higher because the air movement will cool the
- A good air conditioner will cool and dehumidify a room in about 30 minutes, so use a timer and leave the unit off for some time.
- Keep doors to air-conditioned rooms closed as often as possible.
- Clean the air-conditioner filter every month. A dirty air filter reduces airflow and may damage the unit. Clean filters enable the unit to cool down quickly and use less energy.
- If room air conditioner is older and needs repair, it's likely to be very inefficient. It may work out cheaper on life cycle costing to buy a new energy-efficient air conditioner.

7.3 PUMPS

- Operate pumping near best efficiency point.
- Modify pumping to minimize throttling.

For GTD Power Systems Pvt. Ltd.
27.1.21
Director

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