Report

On

Green Audit

At

The International Institute of Information Technology (I²IT), Pune

INNOVATION & LEADERSHIP

www.isquareit.edu.in

(Year 2021-22)

Prepared by

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Nutan Urja Solutions

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Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of The International Institute of Information Technology (I²IT), Pune for awarding us the assignment of Green Audit of their college premises.

We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We hope that the recommendations stated in this report will be useful and worthy of discussions to take things forward to help implementation of energy conservation measures and green practices. While we have made every attempt to adhere to high quality standards, in both data collection and analysis through the report, we would welcome your suggestions so as to improve upon this report further.

Executive Summary

Green Audit of The International Institute of Information Technology (I²IT), Pune is conducted by Nutan Urja Solutions, Pune. Based On the audit field study, following important points can be presented.

1. Present Energy Consumption

The International Institute of Information Technology (I²IT), Pune uses Electrical Energy as the source of Energy for various equipment in the college campus. In the following Table, we present the details of Energy Consumption.

Table no 1: Details of energy consumption

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	62,900	50.3
2	Minimum	24,486	19.5
3	Average	34,153	27.3
4	Total	409,833	327.8

2. Various Measures Adopted for Energy Conservation

1. Usage of STAR Rated ACs at new installations
2. Usage of LED lights at some indoor locations
3. Usage of LED Lights for outdoor lighting.

3. Usage of Renewable Energy

The collage has installed 7 **kW** Solar PV Power Plant. College has also installed 4200 liters capacity solar thermal hot water system.

4. Rain Water Harvesting

The College has installed the Rainwater harvesting project, to reduce dependency on municipal corporation water supply.

5. Waste Management

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

The internal communication is through emails and there is hardly any generation of e-Waste in the premises.

6. Notes and Assumptions

1. Daily working hours-10 Nos
2. Annual working Days-250 Nos
3. Average Rate of Electrical Energy : **Rs 11/- per kWh**

Abbreviations

CFL	:	Compact Fluorescent Lamp
FTL	:	Fluorescent Tube Light
LED	:	Light Emitting Diode
V	:	Voltage
I	:	Current
kW	:	Kilo- Watt
kWh	:	kilo-Watt Hour
kVA	:	Active Power

1. Introduction

The International Institute of Information Technology (I²IT), Pune [pronounced as I Square IT] was established by Late Shri. P. P. Chhabria, Founder Chairman of Finolex Group of Companies, a well-known philanthropist and former President of Mahratta Chamber of Commerce, Industries and Agriculture (MCCIA). As a world class academy to impart high-end education in Engineering and Technology the Institute has strived to meet the growing needs of the industry. Established on 10 acres of land, this institute equips students to accept challenges in the areas of Information Technology, Engineering and other niche areas of expertise.

1.1 Objectives

1. To study present level of Energy Consumption
2. To Study the present CO_2 emissions
3. To assess the various equipment/facilities from Energy efficiency aspect
4. To measure various Electrical parameters
5. To study Scope for usage of Renewable Energy
6. To study various measures to reduce the Energy Consumption

1.2 Audit methodology

1. Study of connected load
2. Study of various Electrical parameters
3. To prepare the Report with various Encon measures with payback analysis

2. Building Survey

1. Square footage / total acres – 10.22 acres
2. Occupancy – 450 nos., Class rooms – 20 nos., Labs – 33, Construction done – 20,463.34 Sq. mtr, free space- 6266.93 Sq. mtr. (Circulation area)
3. Students – a) Boys – 300 . b) Girls – 250
4. Hostel rooms / capacity – a) Boys – 151 nos. Girls – 111 nos.
5. Impervious v/s pervious surface proportion . 51:49.
6. Concrete land/paved surface – 15450 Sq. meters.
7. Garden Land (soil) – 14851 Sq. meters.

3. Study of Electrical Energy Consumption

In this chapter, electricity bills are studied for the analysis of electrical energy consumption.

Table no 3.1: Summary of electricity bills

No	Month	Energy (kWh)	Bill Amount (Rs)
1	May-22	62,900	845,710
2	Apr-22	55,905	763,129
3	Mar-22	48,394	679,853
4	Feb-22	28,401	432,096
5	Jan-22	28,053	426,986
6	Dec-21	32,800	484,225
7	Nov-21	28,212	428,557
8	Oct-21	24,486	383,679
9	Sep-21	24,925	389,730
10	Aug-21	24,813	388,513
11	Jul-21	26,076	403,075
12	Jun-21	24,868	388,077
	Total	409,833	6,013,630

Variation in energy consumption is as follows,

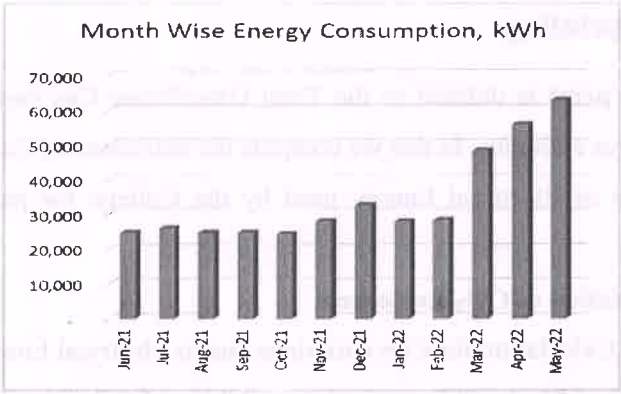


Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

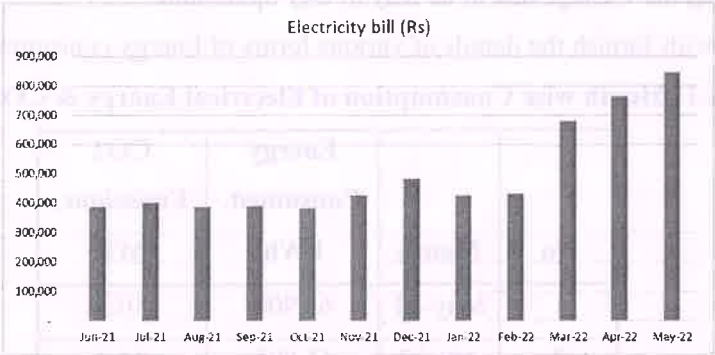


Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	62,900	50.3
2	Minimum	24,486	19.5
3	Average	34,153	27.3
4	Total	409,833	327.8

4. Carbon Foot printing

1. A Carbon Foot print is defined as the Total Greenhouse Gas emissions (CO_2 emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

2. Basis for computation of CO_2 Emissions:

The basis of Calculation for CO_2 emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO_2** into atmosphere.

Based on the above Data we compute the CO_2 emissions which are being released in to the atmosphere by the College due to its Day to Day operations

We herewith furnish the details of various forms of Energy consumption as under

Table 4.1: Month wise Consumption of Electrical Energy & CO2 Emissions

No	Month	Energy Consumed, kWh	CO2 Emissions, MT
1	May-22	62,900	50.3
2	Apr-22	55,905	44.7
3	Mar-22	48,394	38.7
4	Feb-22	28,401	22.7
5	Jan-22	28,053	22.4
6	Dec-21	32,800	26.2
7	Nov-21	28,212	22.5
8	Oct-21	24,486	19.5
9	Sep-21	24,925	19.9
10	Aug-21	24,813	19.8
11	Jul-21	26,076	20.8
12	Jun-21	24,868	19.8
	Total	**409,833**	**327.8**

In the following Chart we present the CO2 emissions due to usage of Electrical Energy

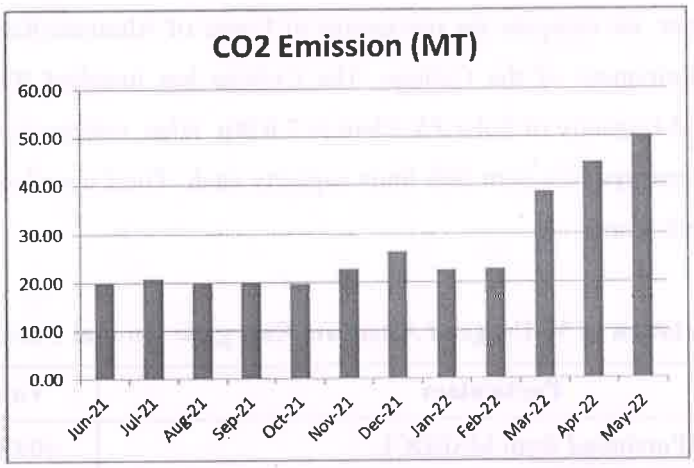


Figure 4.1: Month wise CO2 Emission

5. Study of Usage of Alternate Energy

In this Chapter, we compute the percentage of Usage of Alternate/Renewable Energy to Annual Energy Requirement of the College. The College has installed Roof Top Solar PV System. The Installed Capacity of Solar PV Plant is **7 kWp**. Also, college has installed 7 nos of solar thermal hot water systems with 600 liters capacity each. Total installed solar thermal hot water capacity is 4200 liters.

Table 5.1: Computation of % Usage of Alternate Energy to Annual Energy Requirement

No	Particulars	Value	Unit
1	Annual Energy Purchased from MSEDCL	409,833	kWh/Annum
2	Energy Generated by Roof Top Solar PV System	10,500	kWh/Annum
3	Total Energy Requirement of College	420,333	kWh/Annum
4	% of Usage of Alternate Energy to Annual Energy Requirement	**2.5**	**%**

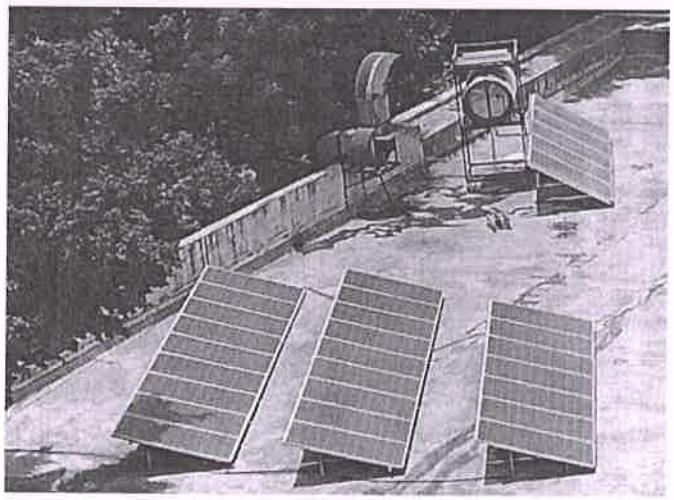


Figure 5.1: Photograph of Solar PV plant

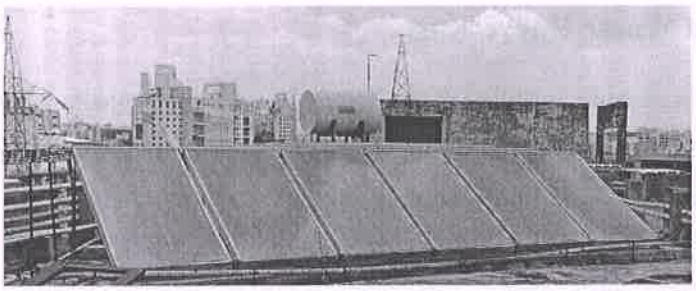
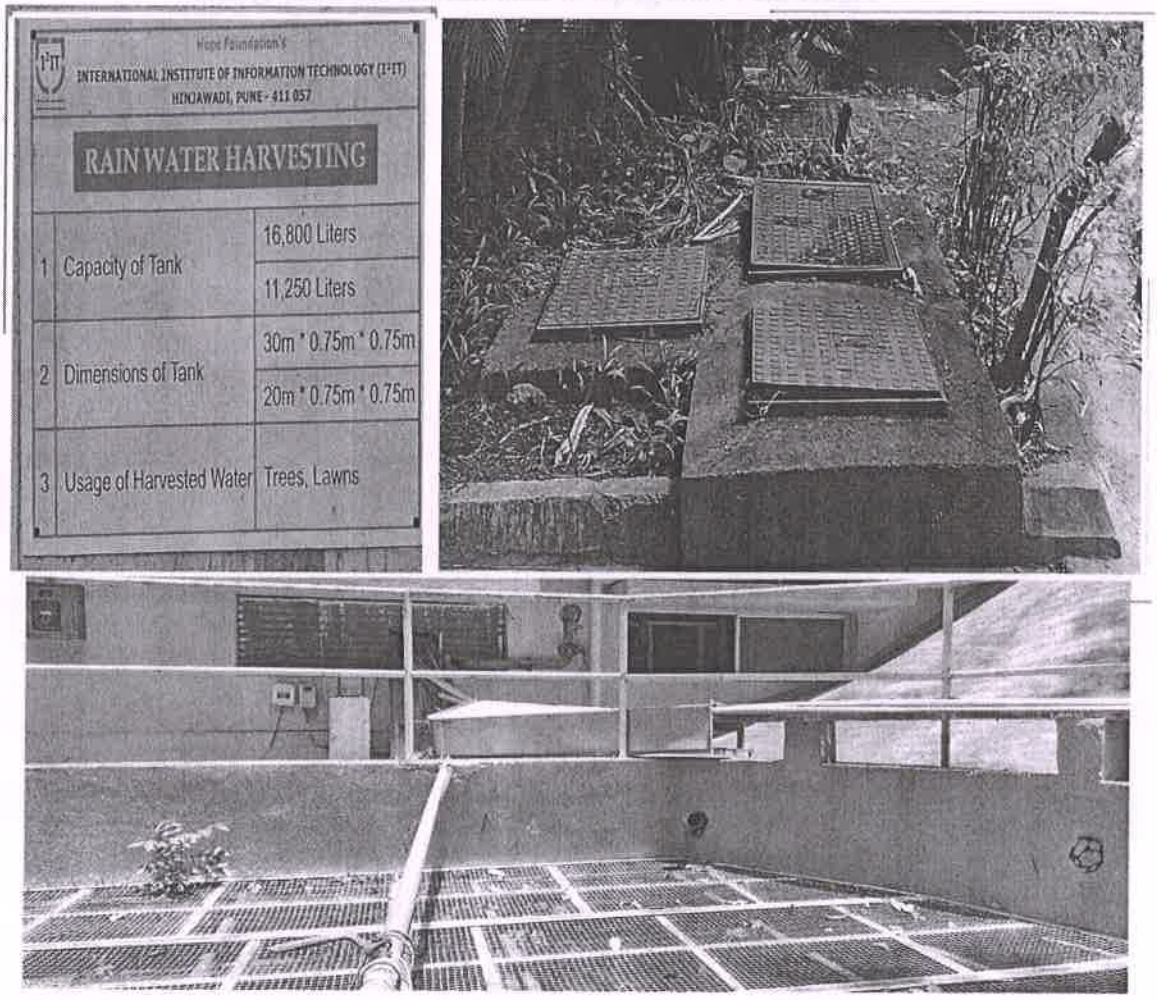


Figure 5.2 : Photograph of solar thermal hot water system

6. Study of Rain Water Harvesting

The College has already installed Rain Water Harvesting project, wherein the rain water falling on the terrace is collected and through pipes it is fed to underground Water Storage tank. This stored water is then reused for domestic purpose.

Photograph of Rain Water Harvesting pipe

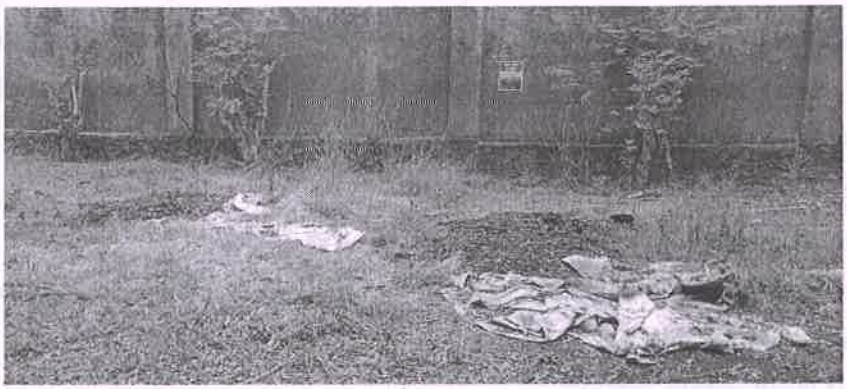


7. Study of Waste Management

7.1 Solid Waste Management

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

Photographs of Bio Composting Storage Tanks:



7.2 e-Waste Management

Here we study the disposal of E-wastes, Non-working computers, monitors and printers. Workshop on Electronic waste management is conducted in college. E waste collected from college is depsited to Ecocentric Management Pvt Ltd.

8. Study of Green Practices

8.1 No of students who don't use own Vehicle for coming to Institute

Out of total students coming to Institute, about 60% students use own Automobile.

8.2 Usage of Public Transport

Student hostels are within the campus. Many students stay there during academic semesters. During the Students transport study, it was revealed that the local students who are residing near areas make use of Public Transport like Municipal Transport local buses, local sharing type auto rickshaws. The average number of students is approximately 20 %. Institute encourages students to not to use automobiles.

8.3 Pedestrian Friendly Roads

The Institute has well defined pedestrian foot paths as to facilitate the easy movement of the students within the campus.

Photograph of Road within campus

8.4 Plastic Free Campus

The Institute is an active participant in the Government of India's most prestigious project of SWATCHH BHART ABHIYAN. The Institute has displayed boards in the Campus, to make the campus plastic free. Various measures adopted for this purpose are as follows

- Installation of Separate waste bins for Dry waste & wet waste
- Usage of paper tea cups in the Institute canteen
- Display of boards in the campus for Plastic Free campus

8.5 Paperless Office

The internal communication of the Institute is through the Internet. There are hardly any day to day operations, where printing is required.

9. Green Landscaping with Trees and Plants

The Institute has beautiful maintained Garden. Data of trees in campus is as follows.

Table 9.1: Trees in campus

Sr. No	Tree name	Numbers
1	Ficus	16
2	Badam	12
3	Kalak	150
4	Palm Arka	100
5	Bottle Palm	15
6	Mohguni	70
7	Chapha	17
8	Apta	8
9	Coconut	13
10	Neem	18
11	Australian Jojoba	3
12	Gulmohar	17
13	Tikoma	19
14	Bottle brush	22
15	Shindada	5
16	Pomegranate	2
17	Rudraksha	1
18	Bakula	1
19	Mango	6
20	Lemon	2
21	Vegzara	15
22	Suruchi	12
23	Shevga	4
24	Mosambi	2
25	Custard Apple	3
26	Ramphal	4
27	Christmas	2

Figure 9.1: Beautiful maintained Garden of college

10. Recommendations

1. Installation of 200kW grid connected PV panel.
2. Plant more indigenous species of trees in and around the campus.
3. Set up sewage treatment plant for waste water treatment.

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Executive Summary

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the Energy Consumption & mitigate the CO_2 emissions. College consumes Energy in the form of Electrical Energy used for various gadgets, Office & other facilities.

1. Present Energy Consumption

In the following Table, we present the details of Energy Consumption.

Table no 2.1: Details of energy consumption

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	62,900	50.3
2	Minimum	24,486	19.5
3	Average	34,153	27.3
4	Total	409,833	327.8

2. Energy Conservation Projects already installed

1. Usage of STAR Rated ACs
2. Usage of LED lights at some indoor locations
3. Usage of LED Lights for outdoor lighting.

3. Key Observations

1. Usage of LED lights.
2. Usage of star rated equipment.
3. Maintained a good power factor.
4. There are about 1493 Nos old T-8 type fittings which need to be replaced by 20 W LEDs.

4. Percentage of Usage of Alternate Energy

The College has installed a Roof Top Solar PV Plant. The percentage of usage of Alternate Energy to Annual Energy Requirement is 2.5 %.

5. Percentage of Usage of LED Lighting

The College has various Types of Light fittings, namely: LED, FTL & CFL. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 21 %.

6. Recommendations

Table no 1: Recommendations for energy savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 1493 Nos T-8 fittings with 20W LED fittings	29,860	328,460	957,013	35
2	Replacement of 1721 Nos Old Ceiling Fans with STAR rating fans	22,373	246,103	3,741,454	182
3	Replacement of 17 Nos of CFL street lights with LED focus lights	510	5,610	34,000	73
4	Installation of 200kW grid connected PV panel	300,000	3,300,000	10,000,000	36
	Total	**352,743**	**3,880,173**	**14,732,467**	**46**

7 Notes & Assumptions

1. Daily working hours-10 Nos
2. Annual working Days-300 Nos

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3. Average Rate of Electrical Energy : **Rs 11/- per kWh**

Abbreviations

CFL	:	Compact Fluorescent Lamp
FTL	:	Fluorescent Tube Light
LED	:	Light Emitting Diode
V	:	Voltage
I	:	Current
kW	:	Kilo- Watt
kWh	:	kilo-Watt Hour
kVA	:	Active Power

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1.1 Objectives

1. To study present level of Energy Consumption
2. To Study Electrical Consumption
3. To assess the various equipment/facilities from Energy efficiency aspect
4. To study various measures to reduce the Energy Consumption

1.2 Audit Methodology:

1. Study of connected load
2. Study of various Electrical parameters
3. To prepare the Report with various Encon measures with payback analysis

1.3 General Details of College

Table No-1.1: Details of college

No	Head	Particulars
1	Name of Institution	The International Institute of Information Technology (I²IT), Pune
2	Address	P-14, Phase 1, Hinjewadi Rajiv Gandhi Infotech Park, Hinjawadi, Pune, Maharashtra 411057.
3	Affiliation	Savitribai Phule Pune University

2. Study of connected load

In this chapter, we present details of various connected electrical equipment and electrical load.

Table No-2.1: Location wise study of Electrical fittings in various buildings

No	Location	FTL (40W)	CFL	Led Sq. light (36W)	Led lamp (9W)	Led lamp (22W)	LED light (20)	Fans
	Admin Building							
	Admin Building (Ground Floor)							
1	A-001 (Maintenance)	2						
2	A-002 (Admin Office)		5		1			2
3	A-003			4	9		7	6
4	A-004 (Electrical & Electronics Lab.)				6	3		6
5	A-005 (Drawing Hall)				7	9		4
6	A-006 (A) (IT - Computer Center)				3	6		4
7	A-006 (B) (Project and R & D)				4	4		4
8	A-007 (Maintenance)	5						2
9	A-008 / 009 (Pantry f& Maintenance)	3						
10	A-010 (Classroom)				7	4		5
11	A-011 (A) (Server Room)				3	2		
12	A-011 (B) (Language					2		2

	lab)							
13	A-012 (Toilets)	6			6			
14	A-013 (Amin office)		11					2
15	A-014 (Board Room)		16					3
16	A-015 (Principal' Office)		16					1
17	A-016 (Toilet)		1					
18	A-017 (Admin Office)		12					1
19	A-018		3					1
20	A-019 (Maintenance)	1						
21	A-020 (Housekeeping Room)	1					3	
	Admin Building (First Floor)							
22	A- 101(Faculty Room)				2			1
23	A - 102 (Electronics Design Laboratory)				4	9		4
24	A-103 (Faculty Room)				2			2
25	A-104 (Digital and VLSI Laboratory)				4	3		3
26	A-105 (Electronic Devices and Circuits Laboratory)				4	6		4
27	A- 06 (Faculty Office)	2						2
28	A - 107 (C.C. E & TC)				5	3		4
29	A-108 (Maintenance)	2						
30	A-109 (Toilets)	6	30		21	11		
31	A -110 (Maintenance)	2						
32	A-111 (Seminar Hall)	10			5	60		

33	A-112 (Signal Processing Laboratory)				3	4		4
34	A-113 (Faculty Room)		2			1		1
35	A-114 (Training & Placement cell)	2	15					2
36	A-115 (Communication Laboratory)		4		2	3		3
37	A-116 (Exam Control Room)		14					2
38	A-117 (Faculty Room)		16		1			3
39	A-118 (Cabin for HoD)	1	3		1			1
40	A-119 (Maintenance)	1						
41	A- 120 (Central Store)	3						1
42	A - 121 (Classroom)				3	6		4
43	A - 122 (Classroom)	4			16	6		4
44	A-123 (President Office)		40					4
	Admin Building (Second Floor)							
45	A-201 (Other Office)				1			
46	A-202 (Microcontroller & Embedded Laboratory)		10			2		3
47	A-203(Web technology lab.)		12			4		3
48	A-204 (Data Analytics				2	6		6

	lab.)							
49	A-205 (Internet of Thinks lab.)				2	6		6
50	A-206 (Programming & Software test lab.)				2	3		3
51	A-207 (Toilets)		16	1				
52	A - 208 (Maintenance)	1						1
53	A-209 (Central Computing Facility)				9	4		4
54	A-210 Object Oriented Programmeing)				3	4		3
55	A-211 (CE - Computer Center)				3	4		3
56	A-212 (A) (Cabin for HoD)	2		2		1		1
57	A-212(B) (Department Office)			2		1		1
58	A-212(C) (Department Office)					1		1
59	A-212 (D) (Cabin for HoD)			1		1		1
60	A-212(E) (Department Office / Faculty Room)			1		2		1
61	A-213 (Data Structure Laboratory)				3	4		4
62	A-214(Network Laboratory)				2	4		3
63	A-215 (Faculty Room)				1			2
64	A-216(Tutorial Room)	2			6			1

65	A-217(Student association)	3			4	2		3
66	A-218 (Faculty Room)	17						1
67	A-219 (Internal Quality A. Cell.)				1	1		1
68	A-220 (maintenance)	1			1			
69	A-221 (Sports Room)	2			6			1
70	A-222 (Classroom)		6			6		4
71	A-223 (Classroom)					6		5
72	A-224 (Database Laboratory)	2				6		6
73	A-225 (Artificial Intelligence Laboratory)					6		5
	Admin Building (Third Floor)							
74	A-301 (Class Room)				3	2		4
75	A-302 (Class Room)	1			2	2		5
76	A-303 (Toilets)		8		20			
77	A-304 (faculty Office)				9			1
78	A-305 (Classroom)				4	4		4
79	A-306 (faculty Office)	8			2	10		11
80	A-307 (Seminar Hall)		30			8		13
81	A-308 (Tutorial Room)				2			1
82	A-309 (Student Association)					3		6
83	A-310 (Hood and Dept. Office)				4			1
84	A-311 (Faculty Room)				2	1		1

85	A-312 (Stationery Store & Reprographic Centre)		1					
86	A-313 (NSS)					1		1
87	A-314 (Classroom)		24		4	6		4
88	A-315 (Classroom)		24			6		4
89	A-316 (Operating Systems Laboratory)				8	2		6
90	A-317 (Digital Electronics & Microprocessor Laboratory)		22	15	8	2		4
91	W-1 (Workshop)			35		2		5
92	S-001 (Security)			3				2
93	(DG and Pump rooms)			22				
	Building C							
94	C-01 (Reception Area)					2		
95	C-02 (A) & (B) (Cafeteria Dining)				8	13		30
96	C-03 (Cafeteria Kitchen)	6				10		12
97	C-04 /5 / 6 (Toilets)			16	8			
98	C -7 (Girls Common Room)					8		4
99	C- 8 (Boyes Common Room)					8		4
100	C- 9 (Physica Lab)					8		4
101	C -10 (C.C. IT)					8		4

102	C-11 (Library and Reading Room)					28		26
103	C-12 (Class Room)				8	3		4
104	C-13 (Toilets)		15					
105	C-14 (Applied Chemestry Lab.)					3		4
106	C-15 (Class Room)					3		4
107	C-16 (Class Room)					3		4
108	C-17 (Class Room)					4		6
109	C-18 (Basic Mechanical Engg.)					3		3
110	C-19 (Basic Civil Engg.)					4		3
111	**Takshshila Hostel**	66	2		76			54
112	**Nalanda Hostel**	423			717		50	423
113	**Mithila Hostel**	494	699		5		112	483
114	**Vikramshila Hostel**	414	792	0			100	411
		1493	**1849**	**102**	**1055**	**373**	**272**	**1721**

Apart from above load, the school has pumps, Packaged ACs, CFLs and LED focus street lights on streets and grounds. Individual fitting wise load is as under.

Table No 2.2: Equipment wise Connected Load

No	Equipment	Qty	Load, W/Unit	Load, kW
1	Ceiling Fan	1721	65	111.9
2	F T L-40 W	1493	40	59.7
3	CFL	1849	24	44.4
4	Led Sq. light (36 W)	102	36	3.7
5	Led lamp (9W)	1055	9	9.5

6	Led lamp (22W)	373	22	8.2
7	LED-20W	272	20	5.4
8	AC-New (2 TR)	2	2450	4.9
9	Package AC (16TR, 8.5TR)			30.0
10	Pumps 3HP (4nos), no of 5HP (5 nos), 7.5HP (5 nos),			56.2
11	LED street lights	45	50	2.3
12	CFL street lights	17	90	1.5
	Total			**337.7**

Data can be represented in terms of PIE chart as under,

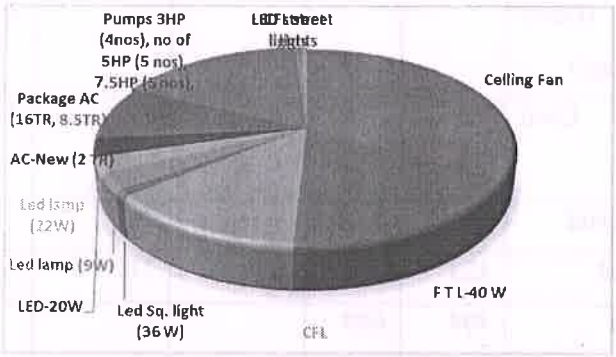

Figure 2.1: Distribution of connected load.

3. Study of Electrical Energy Consumption

In this chapter, electricity bills are studied for the analysis of electrical energy consumption.

Table no 3.1: Summary of electricity bills

No	Month	Energy (kWh)	Bill Amount (Rs)
1	May-22	62,900	845,710
2	Apr-22	55,905	763,129
3	Mar-22	48,394	679,853
4	Feb-22	28,401	432,096
5	Jan-22	28,053	426,986
6	Dec-21	32,800	484,225
7	Nov-21	28,212	428,557
8	Oct-21	24,486	383,679
9	Sep-21	24,925	389,730
10	Aug-21	24,813	388,513
11	Jul-21	26,076	403,075
12	Jun-21	24,868	388,077
	Total	**409,833**	**6,013,630**

Variation in energy consumption is as follows,

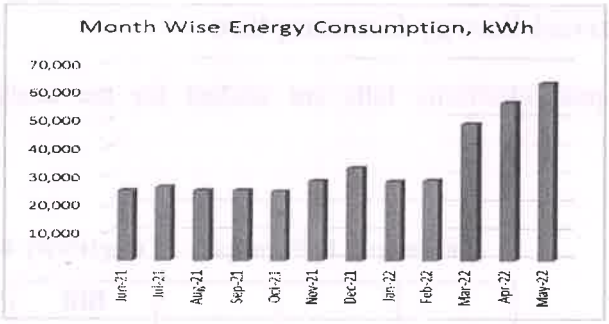

Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

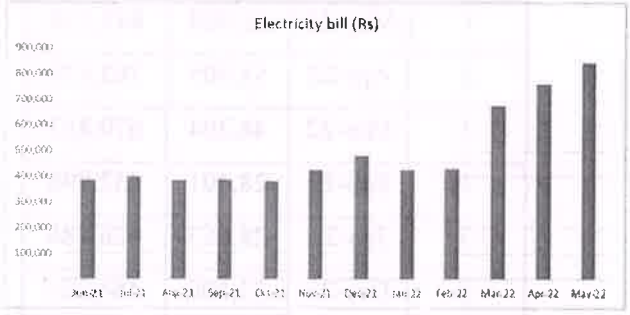

Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	62,900	50.3
2	Minimum	24,486	19.5
3	Average	34,153	27.3
4	Total	409,833	327.8

4. Carbon Foot printing

1. A Carbon Foot print is defined as the Total Greenhouse Gas emissions (CO_2 emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

2. Basis for computation of CO_2 Emissions:

The basis of Calculation for CO_2 emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO_2** into atmosphere.

Based on the above Data we compute the CO_2 emissions which are being released in to the atmosphere by the College due to its Day to Day operations

We herewith furnish the details of various forms of Energy consumption as under

Table 4.1: Month wise Consumption of Electrical Energy & CO2 Emissions

No	Month	Energy Consumed, kWh	CO2 Emissions, MT
1	May-22	62,900	50.3
2	Apr-22	55,905	44.7
3	Mar-22	48,394	38.7
4	Feb-22	28,401	22.7
5	Jan-22	28,053	22.4
6	Dec-21	32,800	26.
7	Nov-21	28,212	22.5
8	Oct-21	24,486	19.5
9	Sep-21	24,925	19.9
10	Aug-21	24,813	19.8
11	Jul-21	26,076	20.8
12	Jun-21	24,868	19.8
	Total	**409,833**	**327.8**

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

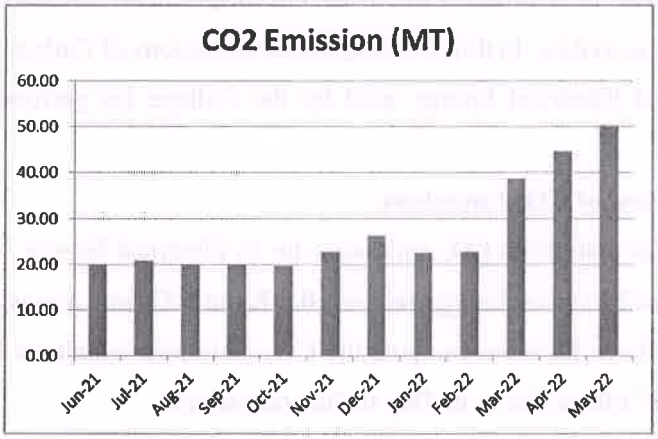

Figure 4.1: Month wise CO2 Emission

5. Study of utilities

5.1 Study of Lighting

In the facility, the lighting system can be divided mainly in to parts, indoor lighting and outdoor lighting. There are 1493 FTL fittings with Electronic/ magnetic chokes, 272 LED tubes, 1849 CFLs, 102 no of LED square lights (36W), 1055 no of LED lamps (9W) and 373 no of LED lamps (22W) in indoor lightings. It is recommended to install the 20 W LED Tube light fittings in place of old T-8 fittings. There are 17 number of CFL street lights and 45 No of LED street lights.

5.2 Air-conditioners

In the facility, there are about 02 Nos. of 2 Tr star rated Air-conditioners. Also, in the facility there are package ACs with 8.5Tr and 16 Tr respectively.

5.3 Ceiling Fans

At building facility, there are about 1721 Nos Old Ceiling Fans, which consumed about 65 W of Electrical Energy. It is recommended to replace these old Fans with BEE STAR Rated Ceiling Fans.

5.4 Water Pumps

There are 4 no of 3HP capacity , 5 no of 5HP capacity and 5 nos of 7.5HP capacity pumps.

6. Study of usage of alternate energy

In this Chapter, we compute the percentage of Usage of Alternate/Renewable Energy to Annual Energy Requirement of the College. The College has installed Roof Top Solar PV System. The Installed Capacity of Solar PV Plant is **7 kWp**. Also, college has installed 7 nos of solar thermal hot water systems with 600 liters capacity each. Total installed solar thermal hot water capacity is 4200 liters.

Table 6.1: Computation of % Usage of Alternate Energy to Annual Energy Requirement

No	Particulars	Value	Unit
1	Annual Energy Purchased from MSEDCL	409,833	kWh/Annum
2	Energy Generated by Roof Top Solar PV System	10,500	kWh/Annum
3	Total Energy Requirement of College	420,333	kWh/Annum
4	% of Usage of Alternate Energy to Annual Energy Requirement	**2.5**	**%**

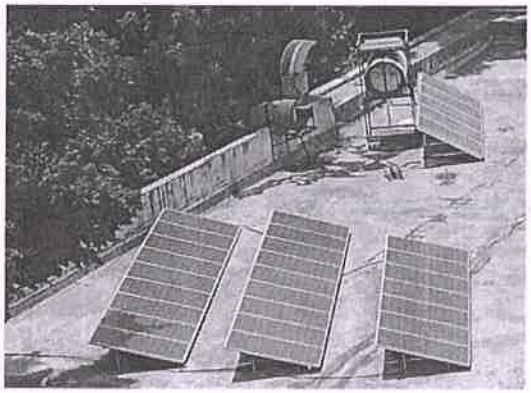

Figure 6.1: Photograph of Solar PV plant

Figure 6.2 : Photograph of solar thermal hot water system

7. Study of usage of LED lighting

In this chapter we study the lighting system of college and compute the percentage of total load catered by LED lighting.

Table 7.1: Total lighting load

No	Particulars	Qty	Load, W/Unit	Load, kW
1	F T L-40 W	1493	40	59.72
2	CFL	1849	24	44.376
3	CFL street lights	17	90	1.53
	LED lighting load			
1	LED tube	272	20	5.44
2	Led Sq. light (36 W)	102	36	3.672
3	Led lamp (9W)	1055	9	9.495
4	Led lamp (22W)	373	22	8.206
5	LED street lights	30	35	1.05
	Total LED lighting load			**27.863**
	Total Lighting load			**133.489**

It can be seen that out of total lighting load 21% load is LED lighting load.

8. Energy conservation proposals

8.1 Replacement of Old T-8 FTLs with 20 W LED fittings

In the facility, there are about 1493 Nos, T-8, FTL fittings with Electronic/magnetic chokes. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Present Qty of T-8 fittings	1493	Nos
2	Energy Demand of T-8 fitting	40	W/Unit
3	Energy Demand of 20 W LED fittin	20	W/Unit
4	Reduction in demad	20	W/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	119.44	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	29860	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	328460	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	957013	Rs lump sum
13	Simple Payback period	35	Months

8.2 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 1721 no of fans. It is recommended to replace these old fans with STAR Rated fans.

In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Present Qty of Old Ceiling Fan fittings	1721	Nos
2	Energy Demand of Old Ceiling Fan fitting	65	W/Unit
3	Energy Demand of STAR Rated Fan	52	W/Unit
4	Reduction in demad	13	W/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	89.492	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	22373	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	246103	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	3741454	Rs lump sum
13	Simple Payback period	182	Months

8.3 Replacement of CFL street lights with 50W focus LEDs

In the facility, there are about 17 Nos CFL street lights. It is recommended to install the 50 W LED flood in place of these old halogen street lights.

In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Present Qty of CFL street lights	17	Nos
2	Energy Demand of Halogen lights	90	W/Unit
3	Energy Demand of LED flood lights	50	W/Unit
4	Reduction in demad	40	W/Unit
5	Average Daily Usage period	3	Hrs/Day
6	Daily saving in Energy	2.04	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	510	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	5610	Rs/Annum
11	Cost of LED flood light	2000	Rs/Unit
12	Investment required	34000	Rs lump sum
13	Simple Payback period	73	Months

8.4 Installation of 200kW Solar PV panel

It is recommended to install 200 kW solar PV panel. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Installation of 200kW PV unit	200	kW
2	Energy saving	300,000	kWh/Annum
3	Rate of electrical energy	11	Rs
4	Annual monetory savings	33,00,000	Rs/ Annum
5	Investment required	100,00,000	Rs lump sum
6	Simple payback period	36	Months

8.5 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 1493 Nos T-8 fittings with 20W LED fittings	29,860	328,460	957,013	35
2	Replacement of 1721 Nos Old Ceiling Fans with STAR rating fans	22,373	246,103	3,741,454	182
3	Replacement of 17 Nos of CFL street lights with LED focus lights	510	5,610	34,000	73
4	Installation of 200kW grid connected PV panel	300,000	3,300,000	10,000,000	36
	Total	**352,743**	**3,880,173**	**14,732,467**	**46**

Report

On

Environmental Audit

At

The International Institute of Information Technology (I²IT), Pune

INNOVATION & LEADERSHIP

www.isquareit.edu.in

(Year 2021-22)

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Nutan Urja Solutions

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Acknowledgement

We at Nutan Urja Solutions, Pune wish to express our sincere gratitude to the management of The International Institute of Information Technology (I²IT), Pune for assigning the work of Environmental Audit of college campus.

We appreciate the co-operation and support extended to our team members during the entire tenure of field study.

We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We are also thankful to all other staff members who helped us during the Measurements at the field and for giving us the necessary inputs to carry out this vital exercise.

Executive Summary

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the dependency on Natural resources & reduce the pollution.

The International Institute of Information Technology (I²IT), Pune consumes various resources for day to day operations, namely: Air, Water, Electrical Energy & LPG.

1. Various Pollution due to College Activities:

- Air pollution: Mainly CO_2 on account of Electricity & LPG Consumption
- Solid Waste: Bio degradable Kitchen Waste, Garden Waste
- Liquid Waste: Human liquid waste

2. Present Level of CO_2 Emissions:

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	62,900	50.3
2	Minimum	24,486	19.6
3	Average	34,153	27.3
4	Total	409,833	327

3. The various projects already implemented for Environmental Conservation:

- Usage of Energy Efficient BEE STAR Rated ACs
- Usage of Natural Day light in corridors
- Implementation of Bio Composting pit for disposal of Bio degradable waste
- Implementation of Rain Water Harvesting
- Installation of 7 **kW** Solar PV Power Plant.
- Usage of solar thermal hot water system with 4200 liters capacity.

4. Recommendations:

1. Installation of Bio Gas Generator Plant instead of Bio composting Plant.
2. Installation of Sewage treatment Plant to make campus a Zero Discharge campus.

5. Notes & Assumptions:

1. **1 kWh** of Electrical Energy releases **0.8 Kg of CO_2** into atmosphere
2. 1 kWp Solar PV plant generates 5 kWh/day Electrical Energy for 300 days in an year.

Abbreviations

AC	:	Air conditioner
PES	:	Progressive Education Society
CFL	:	Compact Fluorescent Lamp
FTL	:	Fluorescent Tube Light
LED	:	Light Emitting Diode
kWh	:	kilo-Watt Hour
Qty	:	Quantity
W	:	Watt
kW	:	Kilo Watt
PF	:	Power Factor
M D	:	Maximum Demand
PC	:	Personal Computer
MSEDCL	:	Maharashtra State Electricity Distribution Company Ltd

1. Introduction

1.1 Important Definitions:

1.1.1 Environment: Definition as per environment Protection Act: 1986

Environment includes water, air and land and the inter-relationship which exists among and between Water, Air, Land and Human beings, other living creatures, plants microorganism and property

1.1.2. Environmental Audit: Definition:

An audit which aims at verification and validation to ensure that various environmental laws are compiled with and adequate care has been taken towards environmental protection and preservation

According to UNEP, 1990, "Environmental audit can be defined as a management tool comprising systematic, documented and periodic evaluation of how well environmental organization management and equipment are performing with an aim of helping to regularize the environment

1.1.3. Environmental Pollutant: means any solid, liquid and gaseous substance present in the concentration as may be, or tend to be, injurious to Environment.

1.1.4. Relevant Environmental Laws in India: Table No-1:

1927	The Indian Forest Act
1972	The Wildlife Protection Act
1974	The Water (Prevention and Control of Pollution) Act
1977	The Water (Prevention & Control of Pollution) Cess Act
1980	The Forest (Conservation) Act
1981	The Air (Prevention and Control of Pollution) Act
1986	The Environment Protection Act
1991	The Public Liability Insurance Act
2002	The Biological Diversity Act
2010	The National Green Tribunal Act

1.1.5. Some Important Environmental Rules in India: Table No-2:

1989	Hazardous Waste (Management and Handling) Rules
1989	Manufacture, Storage and Import of Hazardous Chemical Rules
2000	Municipal Solid Waste (Management and Handling) Rules
1998	The Biomedical Waste (Management and Handling) Rules
1999	The Environment (Siting for Industrial Projects) Rules
2000	Noise Pollution (Regulation and Control) Rules
2000	Ozone Depleting Substances (Regulation and Control) Rules

2011	E-waste (Management and Handling) Rules
2011	National Green Tribunal (Practices and Procedure) Rules
2011	Plastic Waste (Management and Handling) Rules

1.1.6 National Environmental Plans & Policy Documents: Table No-3:

1.	National Forest Policy, 1988
2.	National Water Policy, 2002
3.	National Environment Policy or NEP (2006)
4.	National Conservation Strategy and Policy Statement on Environment and Development, 1992
5.	Policy Statement for Abatement of Pollution (1992)
6.	National Action Plan on Climate Change
7.	Vision Statement on Environment and Human Health
8.	Technology Vision 2030 (The Energy Research Institute)
9.	Addressing Energy Security and Climate Change (MoEF and Bureau of Energy Efficiency
10	The Road to Copenhagen; India's Position on Climate Change Issues (MoEF)

1.2 Objectives

1. To study present usage of Natural resources the College is consuming
2. To Study the present pollution sources
3. To study various measures to make the campus Self sustainable in respect of Natural resources
4. To suggest the various measures to reduce the pollution: Air, Water, Noise

1.3 Audit Methodology:

1. Study of College as System
2. Study of Electrical Energy Consumption
3. Study of CO2 emissions
4. Suggestions on usage of Renewable Energy

1.4 General Details of College

No	Head	Particulars
1	Name of Institution	The International Institute of Information Technology (I²IT), Pune
2	Address	P-14, Phase 1, Hinjewadi Rajiv Gandhi Infotech Park, Hinjawadi, Pune, Maharashtra 411057.
3	Affiliation	Savitribai Phule Pune University

2. Study of Consumption of Various Resources

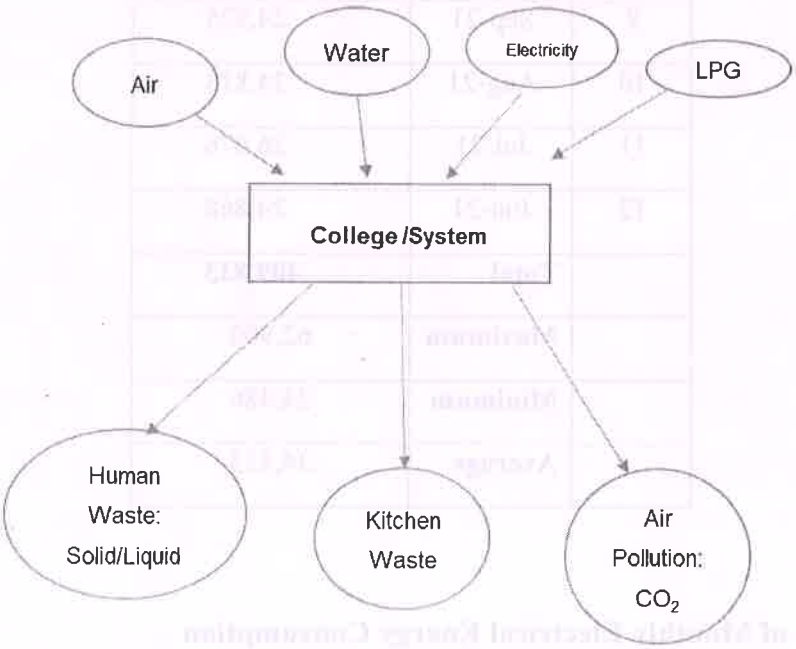
The Institute consumes following basic/derived Resources:

1. Air
2. Water
3. Electrical Energy
4. Liquefied Petroleum Gas

Also, college emits following pollutants to environment

1. Human Waste: Solid/ Liquid
2. Kitchen waste
3. Air pollution

We try to draw a schematic diagram for the College System & Environment as under.



Now we compute the Generation of CO2 on account of consumption of Electrical Energy & LPG as under.

The calculation of electrical energy consumption by college can be given as,

Table 2.1: Electrical Energy Consumption

No	Month	Energy (kWh)
1	May-22	62,900
2	Apr-22	55,905
3	Mar-22	48,394
4	Feb-22	28,401
5	Jan-22	28,053
6	Dec-21	32,800
7	Nov-21	28,212
8	Oct-21	24,486
9	Sep-21	24,925
10	Aug-21	24,813
11	Jul-21	26,076
12	Jun-21	24,868
	Total	**409,833**
	Maximum	62,900
	Minimum	24,486
	Average	34,153

2.1 Variation of Monthly Electrical Energy Consumption

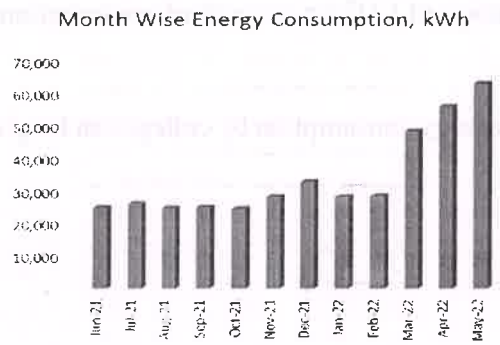


Figure 2.1 : Monthly Electrical Energy Consumption

2.2 Key Inference drawn

From the above analysis, we present following important parameters:

Table 2.2: Variation in Important Parameters

No	Parameter/ Value	Energy Consumed, kWh
1	**Maximum**	62,900
2	**Minimum**	24,486
3	**Average**	34,153
4	**Total**	409,833

3. Study of Air Pollution

In this Chapter, we present the various types of Pollution as under:

3.1 Study of Carbon Emission

The College is using two forms of Energies, namely: Thermal in the form of LPG and Electrical Energy used for day to day operations of the College. The major pollutant on account of above Energy forms is the Carbon Di Oxide.

- 1 unit (kWh) of Electrical Energy emits 0.8 Kg of CO_2 in the atmosphere
- 1 Kg of LPG emits 3 Kg of CO_2 in the atmosphere

In the following Table, we present the CO_2 emissions.

Table 3.1: Month wise Consumption of Electrical Energy & CO_2 Emissions:

No	Month	Energy Consumed, kWh	CO2 Emissions, MT
1	May-22	62,900	50.3
2	Apr-22	55,905	44.7
3	Mar-22	48,394	38.7
4	Feb-22	28,401	22.7
5	Jan-22	28,053	22.4
6	Dec-21	32,800	26.2
7	Nov-21	28,212	22.5
8	Oct-21	24,486	19.5
9	Sep-21	24,925	19.9
10	Aug-21	24,813	19.8
11	Jul-21	26,076	20.8
12	Jun-21	24,868	19.8
	Total	**409,833**	**327.8**
	Maximum	62,900	50.3
	Minimum	24,486	19.5
	Average	34,153	27.3

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

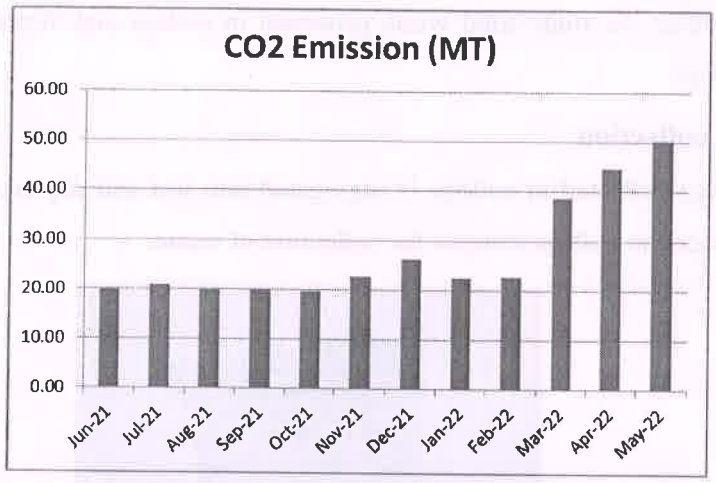


Figure 3.1: CO2 emission due to usage of electrical energy.

3.2 Air pollution from vehicles

Pollution Under Control (PUC) is mandatory for the Vehicles coming in the campus. The following practices are observed in college premises

1. Staff and student entries are strictly prohibited without wearing of helmets.
2. The campus have dense canopy of indigenous bloomed plants.
3. Most of plants play major role in minimize the air and noise pollution

4. Study of Solid Waste Generation

In this chapter, we study solid waste generated in college and disposal mechanism of solid waste in college.

4.1 Solid waste collection

The garbage collected in college is segregated into wet and dry centrally in campus. Waste bins are placed in college campus for collection of waste.

Figure 4.1: Waste bin placed in college for garbage collection

4.2 Canteen food wastage

The students and canteen staff are encouraged to have minimal food wastage. Canteen contractor have food license and shop act certificate. Food waste collected in canteen disposed for vermicomposting pit. The canteen is encouraged for usage of paper tea cups.

4.3 E-waste management

Here we study the disposal of E-wastes, Non-working computers, monitors and printers. Workshop on Electronic waste management is conducted in college. E waste collected from college is depsited to Ecocentric Management Pvt Ltd.

4.4 Paper wastage

The students and office staff are encouraged to work with minimal use of paper. Regular activities of students are digitally monitored. Two sides of paper (back to back) printing method is preferable. The projects reports pages (one Sided) submitted by students was used to avoid the dependence on fresh pages.

4.5 Bio composting Plant

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

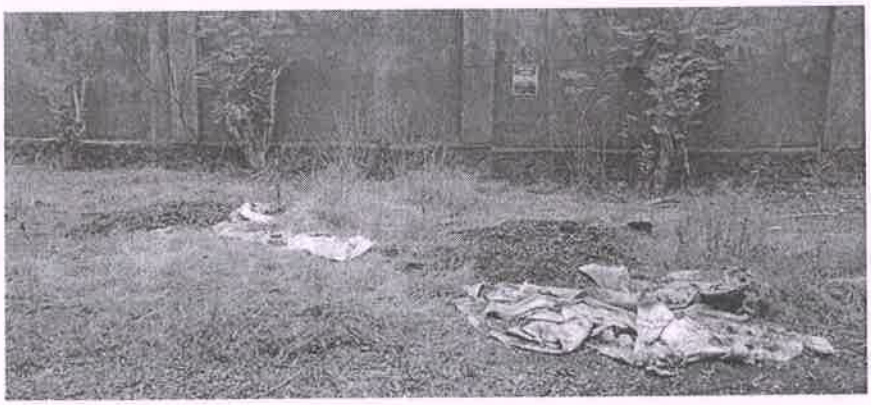


Figure 4.2 Photograph of Bio Composting Processing Tanks

5. Study of Liquid Waste

In this chapter, we study water consumption and wastage.

5.1 Water Usage

MIDC treated water is available for drinking water and the washroom water. In the institute daily above 3 lakh liters water consumption seen. There are total 20 number of water storage tanks are available in institute. There are 34 number of gents toilets and 35 number of ladies toilets.

Drinking water consumption is 10,000 litres per day Drinking water testing done once in 3 month. In rainy season it is done more frequently. RO plant of capacity 500 Litres per hour. 17 Aqua guard filters fitted in campus. Water sample is tested regularly.

5.2 Disposal of liquid waste

At present the most of the liquid waste generated due to day to day operations is drained off to the municipal Corporation through a pipe. Some of the water used in bathrooms of hostel is used for gardening.

We recommend sewage treatment plant in college for water treatment.

5.3. Study of Rain Water Harvesting

The College has already installed Rain Water Harvesting project, wherein the rain water falling on the terrace is collected and through pipes it is fed to underground Water Storage tank. This stored water is then reused for domestic purpose.

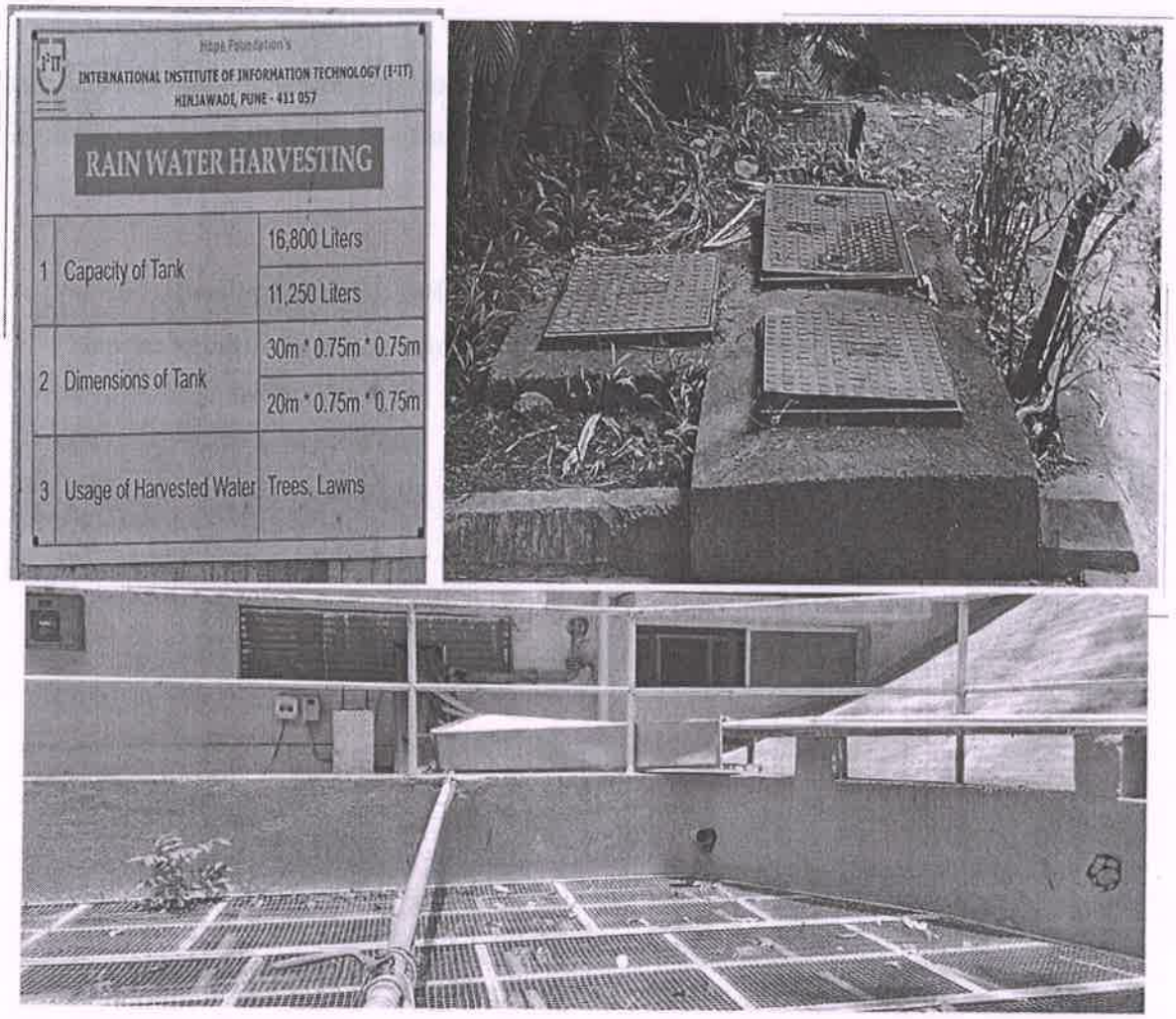


Figure 5.1: Photograph of Rainwater Harvesting

6. Recommendations

In order to reduce the dependency on Natural resources and also in order to reduce the various pollutions arising due to the day to day operations of the College we herewith recommend following recommendations.

- Installation of Bio Gas Generator Plant instead of Bio composting Plant.
- Installation of Sewage treatment Plant to make campus a Zero Discharge campus