Energy Environment Green

SEPTEMBER 18, **2023**

BITS Pilani K K Birla Goa Campus

Authored by: EEG Committee

BITS Pilani
K K Birla Goa Campus

innovate achieve lead

Approved Committee

Birla Institute of Technology & Science, Pilani
K K Birla Goa Campus

Mr. Sailesh Narayan Mohanty
Joint Registrar

JRO/ Notice/011/2023 **Date: 17th June 2023**

Notification

To collect, maintain, compile and prepare Energy, Environment and Green Audit Assessment Report of the campus in line with the NAAC accreditation requirement a Campus Level **"Team for EEGA "** has been formed. The following faculty and staff members are been appointed as a member of the Campus Level **"Team for EEGA"**.

Name of the Committee	Name of the Faculty / Staff	Membership	Designation
Campus level Team for EEGA	Prof. Dhananjay Madhukar Kulkarni (G0006)	Chairperson	Senior Professor, Department of Mechanical Engineering
	Prof. Mukund Keshavrao Deshmukh (G0007)	Member	Professor, Department of Electrical and Electronics Engineering
	Prof. Sampatrao Dagu Manjare (G0185)	Member	Professor, Department of Chemical Engineering
	Prof. Ranjit Shankarrao Patil (G0482)	Member	Associate Professor, Department of Mechanical Engineering
	Dr. Pradeep Kumar Sow (G0681)	Member	Assistant Professor, Gr I, Department of Chemical Engineering
	Mr. Anand Kallanna Patil(G0009)	Member	Senior General Manager, Estate & Stores
	Mr. Kaushik Anand Phal Desai (G0835)	Member	Senior Engineer-Electrical, Gr I, Estate & Stores

The appointment of the faculty and staff members of the Institute will be in addition to their normal duties as an employee of the Institute. If the normal date of superannuation/expiry of the term of the appointment falls within the stipulated term, this appointment will be deemed to have terminated on the date of attaining the superannuation of the appointment irrespective of the term specified above.

The tenure of the **"Team for EEGA"** will be for a period of two years w.e.f **17th June 2023**.

This office order is issued with the due approval from the competent authority.

Joint Registrar
Joint Registrar
BITS PILANI-K K Birla Goa Campus

To: Director, Faculty & Staff Members

Birla Institute of Technology & Science, Pilani
K K Birla Goa Campus, NH 17B, Bypass Road
Sancoale, Zuarinagar, South Goa
Goa – 403726, India

Tel: +91 0832 2580138
Fax: +91 0832 2557030
Email: jointregistrar@goa.bits-pilani.ac.in
Web: www.bits-goa.ac.in

Committee Members | Data Analysis

Objectives

The Environmental, Energy, and Green assessment refers to a systematic procedure that involves the identification, quantification, recording, reporting, and analysis of the numerous components of environmental diversity inside the campus.

The objective of this study is to examine the environmental, energy conservation, and green practices implemented inside the campus with the intention of assessing their influence on the development of an eco-friendly atmosphere. Objectives in brief are listed below with reasoning:

#	Objectives
1	Evaluate the functionality of systems such as electricity distribution, water distribution, energy management, waste management, and other relevant factors associated with environmentally friendly operations in order to assess the efficacy and operational outcomes pertaining to sustainable practices on the campus.
2	Conduct a comprehensive performance evaluation to assess the effectiveness of various environmentally-focused initiatives and ecological consequences of operational procedures associated with these initiatives in the campus
3	Establish a comprehensive database of environmentally friendly actions to facilitate the efficacy of various environmentally-focused initiatives
4	Recommend potential strategies for decreasing expenditures and operational costs related to equipment, appliances, and other resources, as well as other methods to increase revenue generation must be explored
5	Recommend appropriate measures to communicate the stakeholders for greater transparency
6	Ensure that the institution's performance in relation to its environmental activities aligns with present laws and regulations, measures need to be taken

Process followed

3 Verticals

Energy	Environment	Green
Electrical & Mech. Engg.	Civil, Chemical and Mech. Engg.	Chemical and Civil Engg.
M K Deshmukh	A K Patil	A K Patil
Ranjit S Patil	S D Manjare	S D Manjare
Kaushik Phaldesai	Pradeep Kumar Sow	Pradeep Kumar Sow
D M Kulkarni	D M Kulkarni	D M Kulkarni
Invitee Members		
Bikram Swain	Sarvesh Pai	Saranya Nair
Mahendra Pednekar	Rajesh Chejara	Imran Sheik
Rajesh Chejara		

Profile of the Committee & Invitee Members

Professor in Electrical & Electronics Engineering

Electrical Energy & System Engineering, Renewable Energy (Solar and Wind)

Prof. M K Deshmukh

Professor in Mechanical Engineering

Electrical Energy & System Engineering, Renewable Energy (Solar and Wind)

Prof. Ranjit Patil

Sr. General Manager, Estate & Maintenance Unit

(EEG – Energy, Environment Green)

Mr. Anand K Patil

Campus In charge Electrical (Sr. Engineer Electrical)

(EEG – Energy)

Mr. Kaushik Phaldesai

Professor in Chemical Engineering

Environmental management systems | (EEG – Environment & Green)

Prof. S D Manjare

Professor in Chemical Engineering

Hydrogen Energy and Fuel Cell | (EEG – Environment & Green)

Dr. Pradeep Kumar Sow

Engineer Maintenance (Mechanical & HVAC)

(EEG – Energy & Environment)

Mr. Rajesh Chejara

Technical Assistant (Electrical)

(Invitee Member for EEG – Energy)

Mr. Bikram Swain

Technician (Electrical)

(Invitee Member for EEG – Energy)

Mr. Mahendra Pednekar

Technical Assistant (Waste Management)

(Invitee Member for EEG – Environment)

Mr. Sarvesh Pai

Assistant Prof. in Mathematics

Coordinator Green Champions and Invitee Member for EEG-Green

Dr. Saranya G Nair

Technical Assistant (Horticulturist)

Member, Green Champions and Invitee Member for EEG-Green

Mr. Imran Sheik

Sr. Professor in Mechanical Engineering

Coordinator of EEG – Energy, Environment and Green Teams

Prof. D M Kulkarni

Campus Profile

On-Campus Residents

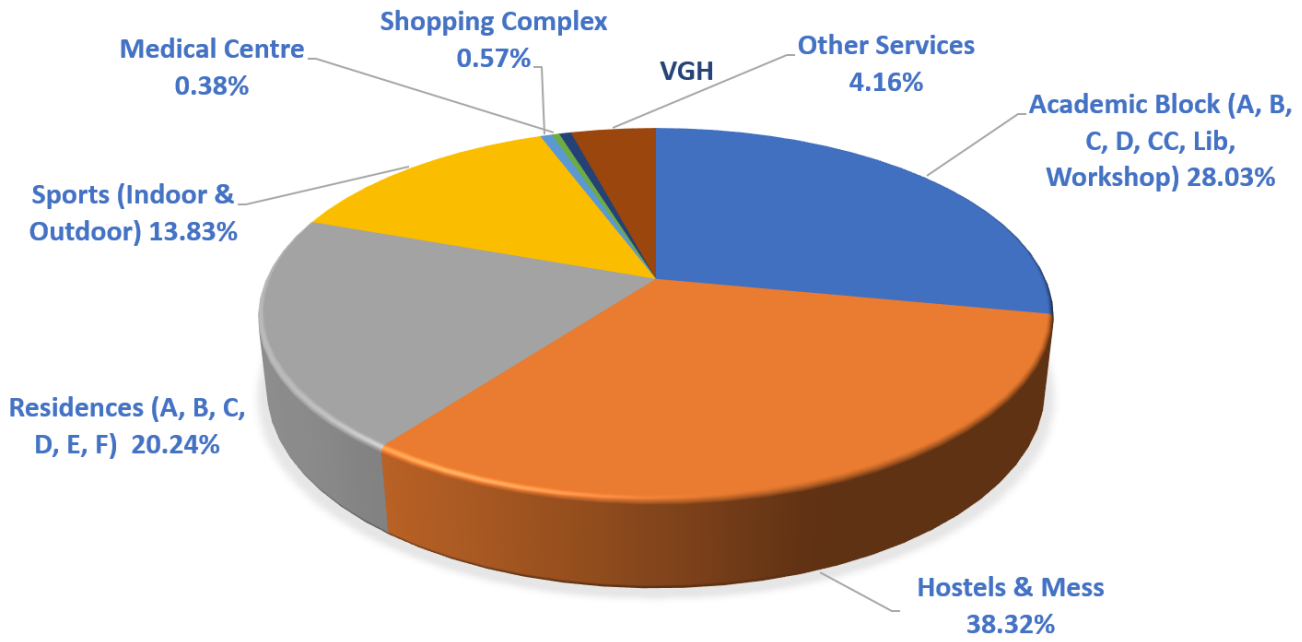
Students	Faculty	N T Staff	Dependents	Total
3828	217	248	966	5259

Area Statement

#	Description	Area (Sq. Mtr)
1	Plot Area (167 Acres)	6,75,500
2	Required Open Space (15% of #3)	1,01,325
3	Available Open Space	1,03,870
4	Permissible Coverage (33% of #3)	2,25,144.15
5	Total Covered Area	93,529.78
6	Total Coverage (7/3*100)	13.84%
7	Permissible FAR (1.00)	6,75,500
8	Present Built-up Area	2,17,825.25

Facilities: Built-up Area

Description	Area (Sq. Mtr)
Academic Block (A, B, C, D, CC, Library, Workshop)	61,064.05
Hostels & Mess	70,187.84
Residence: (A, B, C, D, E, F)	44,078.4
Sports (Indoor & Outdoor)	30,125.66
Shopping Complex	1231.82
Medical Centre	823.96
VGH	1252.52
Other Services	9060.89
Total	**2,17,825.25**



Faculty & Non-Teaching Staff Housing

	A-Type Sr. Prof & Prof	B-Type Asso Prof	C-Type ASTP	D-Type ASTP + NTS	E-Type NT Staff	F-Type NT Staff	Total
Old	4	8	46	88	41	24	211
New	16	48	80+2	0	8	0	154
Total	20	56	128	88	49	24	365

Students Housing

#	Hostel	Rooms	Capacity	No of Students
1	AH1	186	184	176
2	AH2	186	184	178
3	AH3	186	184	178
4	AH4	186	184	176
5	AH5	186	185	175
6	AH6	186	184	179
7	AH7	186	185	177
8	AH8	186	185	178
9	AH9	214	214	212
10	CH1	247	245	233
11	CH2	122	121	102
12	CH3	122	121	114
13	CH4	247	245	236
14	CH5/6	242	239	228
15	CH7	75	150	135
16	DH1	100	200	190
17	DH2	100	200	196
18	DH3	100	200	196
19	DH4	100	200	196
20	DH5	319	319	162
21	DH6	206	206	183
	Total	**3682**	**4134**	**3800**

ENERGY

Joining the green revolution and harness the unlimited power of the sun

1. Energy Sources

Commercial Energy Sources	Renewable Energy Sources

Electricity

2000 kVA, 33 kV

Lighting in Buildings, Street Lighting, Pumps & Motors, Compressors, Laboratory Instruments, Workshop, Residential Areas

Diesel

11 Nos. 415 V, 3-Phase, 50 Hz, Total KVA 3777.5

Power Back-up in Institutional Building

LPG

Messes, canteen, Food Outlets, Residential Areas

Solar Energy

150 kWp Installed Roof Top Systems.
6 kWp stand-alone
14.85 kWp Hybrid grid Interactive Roof Top Systems

Captive power generation

1.2 Electrical Supply and Infrastructure

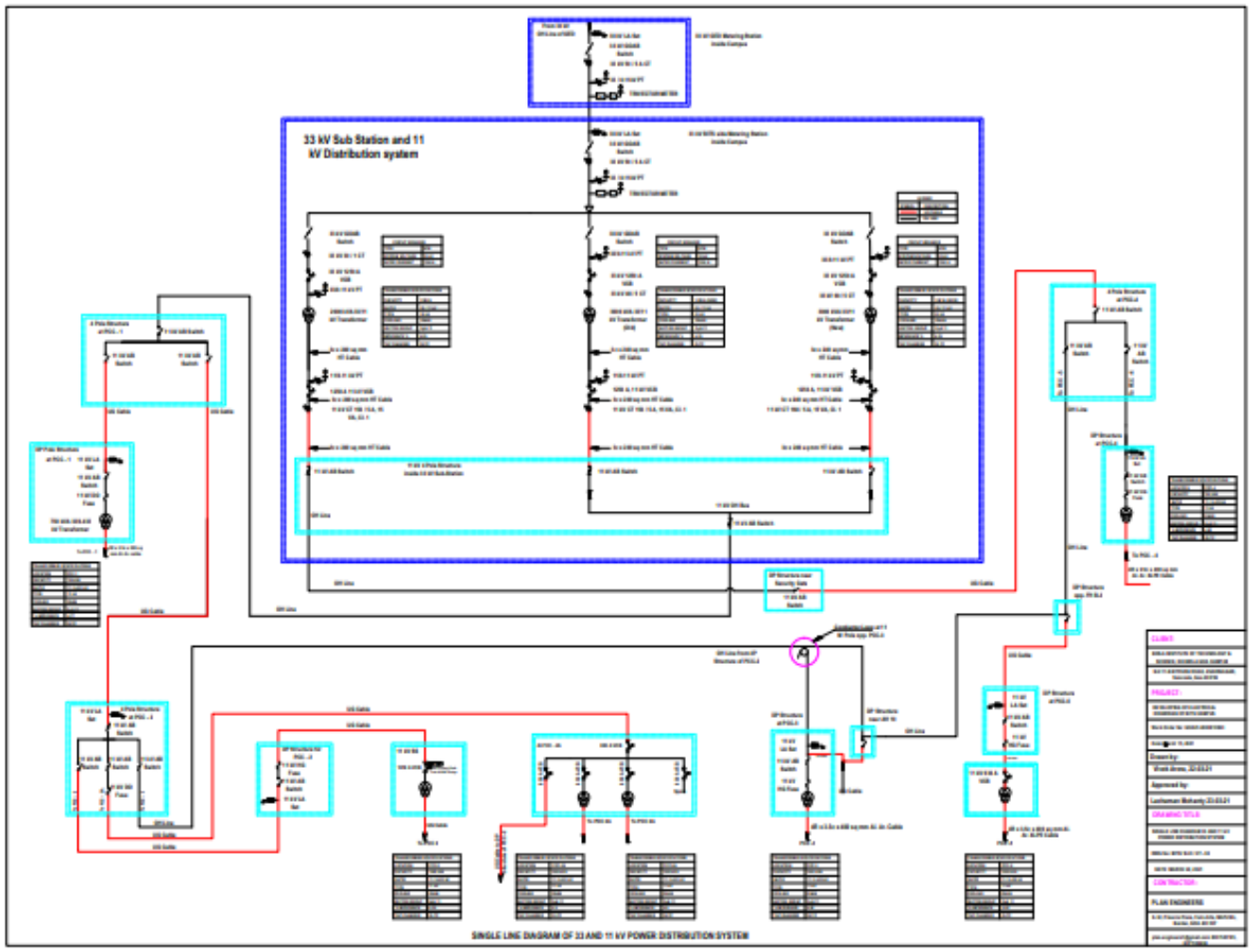
Electricity is the largest source of energy routinely utilized on the campus. The electricity is supplied by the state utility the Goa Electricity Department (GED), Govt. of Goa, through two different sub-stations on campus: (i) 2 MVA at 33 kV Sub-station and, (ii). 1 MVA at PCC2 Sub-station.

At 33-kV Sub-station, there 3 Nos. of 33/11 kV step-down transformers, which consist of 1 Nos. of 2 MVA and 2 Nos. of 3 MVA. Out of these, the 2 MVA transformer supplies power to residential colony area and one of the two 3 MVA transformers supplies power to Institutional Buildings including academic and hostel buildings. A special provision is made for enabling switching for using any combination of these three transformers for supplying uninterrupted power to above said areas as may be required. The received power, after stepping down to 11 kV is distributed to six different Power Control Centers (PCCs) on campus. The six PCCs form ring-network for securing uninterrupted supply of electricity to all areas on the campus. There are a total of eight transformers in-service for stepping down supply voltage of 11 kV to distribution level voltage of 440 V at the six PCCs on Campus. The details of PCC-wise ratings of transformers, and connected loads supplied on campus is as shown in the Table below:

(PCC)	Transformer Rating & Make	Connected Load in Buildings on Campus
PCC-1	1 Nos. of 750 kVA, ONAN, 11 kV/440 V Crompton-Greeves (CG) Make	Students Hostels- CH1, CH2, CH3, CH4, CH5, CH6, and CH7; Students Mess (C-Mess), Visitors Guest House, Mani Gate Security, Library, Street Lights, Food Outlets- Food King, Amul Parlor, and Sub-spot
PCC-2	1 Nos., 1500 kVA ONAN, 11 kV/440 V, CG Make 1 Nos. 1250 kVA, ONAN, 11 kV/440 V, CG Make	Main Institution Building (A, B and C Wing), Auditorium, Workshop, Students Hostels (DH1, Dh2, DH3, DH4, DH5 and DH6 and Students Mess (D-Mess), Institute Cafeteria, NesCafe and Food outlet- Ice and Spice. Central AC Plant Chillers, compressors, pumps, motors, and Cooling Tower (CT) fans, Street Lights
PCC-2A	2 Nos. 1000 kVA, Air Cooled Dry Type, 11 kV /440 V, VOLTAMP Make	New Academic Buildings (NAB-1 and NAB-2 for Lecture Theatres, NAB-3 for Department of Physics and Computer Science, NAB-4 (Department of EEE and Economics and Finance and NAB-5 for New Workshop Department of Mechanical Engineering); Library and Computer Centre, Sewage Treatment Plant (STP), Pumping & Utilities, Street Lights,
PCC-3	1 No 1000 KVA, 11 kV/440 V, ONAN, CG Make	Students Hostel- AH1, AH2, Ah3 Ah4, AH5, AH6, AH7, AH8, AH9, and AH10; Students Mess (A-Mess), Shopping Complex, Medical Centre, Students Activity Centre (SAC), Street Lights
PCC-4	1 No of 750 kVA, ONAN, 11 kV/440 V Crompton-Greeves Make	Residential Colony- Quarters (old) types A, B, C, D, E, F and Pump House for Municipal Water Supply, Street Lights, Laundry
PCC-5	1 No 1000 kVA, Air Cooled Dry Type, 11 kV /440 V, VOLTAMP Make	New Quarters Towers- A, B and C, with utilities and pumping, Lifts

1.3 Electrical Distribution Network

The existing electrical power distribution network on campus is shown in the Figure below:



Single Line Diagram of Existing Power Distribution Network

As shown in the Figure, certain areas demarcated using dark ink-blue line, indicate areas serviced by 33 kV supply and certain areas demarcated by light blue line indicate areas serviced by 11 kV supply. The red lines indicate under-ground transmission line (11 kV) and black lines indicate over-head transmission lines (11 kV).

1.4 Electricity Tariff Applicable

As per the regulations of the state utility, the Goa Electricity Department, the electricity tariff applicable to the large HT consumer such as the Campus, is classified as two-part tariff, where elements of billing consist of: the demand charges, energy charges, meter rent, duties and cess, etc. Broadly the billing elements are classified as the Fixed Charges and the Variable Charges. The Fixed Charges consist of demand charges @ INR. 250 per 85% of the Contract Demand, and the meter rent. The variable charges consist of the energy (kWh) charges metered on the basis of the time of the day (TOD). The energy consumption per day is metered in three-time slabs, namely (i). From 06'00 Hrs to 18'00 Hrs @ Normal Tariff, (ii). From 18'00 Hrs to 11'00 Hrs, @ Peak Tariff, and from 23'00-06'00 Hrs @ Off-Peak Tariff, as per the Goa Govt regulations. The billing also includes levy of Fuel power Purchase charges Adjustment (FPCCA) charges, and Electricity and public Lighting Duty (PLD) as per the Govt. regulations.

The rates applicable to the Campus for computing the monthly electricity bill during the past two academic years, are as shown in the Table below:

Year	Demand Charges (Rs/kVA)				FPCCA (Rs/kWh)	Electricity Duty (Rs/kWh)	PLD (Rs/kWh)
		Normal (Rs/kWh)	Peak (Rs/kWh)	Off peak (Rs/kWh)			
2022-23	250	5.250	6.300	4.725	1.36	0.7	0.08
2021-22	250	5.500	6.600	4.950	0.65	0.7	---

1.5 Electricity Bill

The electricity bills for the month of July, 2023, for 33 kV supply and 11 kV HT supply, are shown in the Figure below:

The electricity bill for the 2 MVA supply at 33kV Substation for the month of July 2023, along with the Metering Annexure accounting for Net-metering due to 100 kWp grid integrated Solar PV Roof Top System.

ELECTRICITY DEPARTMENT - GOVERNMENT OF GOA

HT Bill for Month-July-2023 **Ref:EE/Div 11 : Vasco/TECH/**

Name :	BIRLA INST. OF TECHNOLOGY & SCIENCE	Sanctioned Load(KW/KVA) :	2000KVA	CA No :	60002127268
Legacy No :	HTC-179 / / 1679	Contract Demand-CD (KVA) :	2000	Energisation Date :	20/02/2004
Billing Address :	JAIKISSAN BHAVAN ZUARINAGAR GOA 403726	85% of Contract Demand :	1700	MRU No :	HT1111
		Billing Demand :	1700	Meter Status :	OK
		Avg Power Factor (Lag) :	1.00	Connection Status :	Active
Supply Address :	JAIKISSAN BHAVAN ZUARINAGAR GOA 403726	Line Min Charges :		Tariff Category :	HTC-SOLAR
		Security Deposit (SD)-CD/BG :	8200000.00	Voltage Level (KV) :	33.00
		Division :	Div 11 : Vasco	Bill Date :	01/08/2023
		Sub Division :		Bill Basis :	Actual
Mobile / Tel No :	******5880	Prev. Meter Reading Date :	01/07/2023	Bill Number :	10052881397
e-mail Id :	ACCOUNTS@GOA.BITS-PILANI.AC.IN	Curr. Meter Reading Date :	01/08/2023	Last Bill Reading Date:	01/07/2023

Equipment Details		Unit	TOD Period	Meter Reading Current	Meter Reading Previous	Reading Difference	MF	Total Consumption(KWh) Current Month	Total Consumption(KWh) Corresponding Month of Last Year
Meter No Meter Type Meter Make MRT testing date Transformer No CTPT No CTPT make PT Ratio CT Ratio	GOA44412 HTCT Meter HT Solar Net Meter (COD)	As per Annexure							

Your Bill Summary :

Previous Arrears/Advance (A)	Amount under Litigation / Disputed/Deferred (B)	DPC Till Bill Date(C)	Present Total Bill(D)	Rounding amount(E)	Amount Payable on or before due date 16-AUG-2023 (A + C + D + E)
	0.00		4445054.05	0.05-	**4445054.00**

Amount payable - RUPEES FORTY FOUR LAKH FORTY FIVE THOUSAND FIFTY FOUR
Payment after due date attracts penal charges @ 1.5% per month on daily basis compounded every month.
Non-Payment of bill by the due date will render the connection liable for disconnection of power supply as per JERC clause 9.1.
Amount of prompt payment Rebate is Rs. 10,101.61 which will be effected in the next bill subject to realization of payment in our account before 1 week before the due date
Now you can pay bills through RTGS/NEFT/IMPS. For details please check our website at https://www.goaelectricity.gov.in

Current Demand Calculation Details

Particulars	Quantity	Rate	Amount
Demand /	1700	250.0000	425000.00
Fixed Charges			
Energy Charges	158100	4.7250	747022.50
	258270	5.2500	1355917.50
	116700	6.3000	735210.00
Penal Charges (DC)			
Penal Charges (EC)			
FPPCA	532530	1.4600	777493.80

Present Bill Charges

Particulars		Amount
Demand Charges		425000.00
Energy charges		2838150.00
FPPCA		777493.80
Penal Charges (DC)		0.00
Penal Charges (EC)		0.00
Sundry Charges		
Adv./ PF Rebate		10963.15-
Meter Rent		0.00
Electricity Duty @ Rs 0.70/KWh		372771.00
Power Factor Penalty / Incentive @	0.00	0.00
Installment due		
Wheeling Charges		0.00
Public Lighting Duty @ Rs. 0.05 per KWH		42602.40
Total Current Demand		4445054.05

Consumption History

Billing Period	Consumption
02/07/23 to 01/08/23	532530
02/06/23 to 01/07/23	644100
02/05/23 to 01/06/23	873645
02/04/23 to 01/05/23	885435
02/03/23 to 01/04/23	822390
02/02/23 to 01/03/23	727740

Bank Guarantee Details

Sl. No.	B. G. No.	Amount	Validity Date
1	0411618SBG0000055	3070000.00	11/06/2024
2	0411622SBG0000031	2030000.00	25/04/2027

Last Payment of 4873053.00 Received on 07-JUL-2023

Help Line 1912

Please note that amount in Arrears column is to be paid as per previous bill dute date falling which DPC shall be levied.

X----------X

Payment Slip:-

GOA ELECTRICITY DEPARTMENT

Name:BIRLA INST. OF TECHNOLOGY & SCIENCE
Legacy No :-HTC-179 / / 1679

Division :Div 11 : Vasco
Sub Division :

CA No :- 60002127268
Bill Number :- 10052881397

Now you can pay bills throug RTGS/NEFT/IMPS. For details please check our website at https://www.goaelectricity.gov.in	Telephone Number: Pay your electricity bill online at www.goaelectricity.gov.in

Bill Amount Payable Rs. 4445054.00 Due Date : 16-AUG-2023 :

Copy to Accounts

ELECTRICITY DEPARTMENT - GOVERNMENT OF GOA

Name :	BIRLA INST. OF TECHNOLOGY & SCIENCE	Bill Basis :	Actual
CA No :	60002127268	Bill Date :	01/08/2023
Bill No :	10052881397	Bill Period :	02/07/2023 to 01/08/2023

METERING ANNEXURE

Export Units Summary							
Prev.Balance	0	Curr.Period		Adjusted	0	Carried over	0

Meter No	Unit	Tod Period	Current Meter Reading		Previous Meter Reading		Reading Difference	Multiplication Factor	Current Consumption
			Date	Reading	Date	Reading			
23099746	KWH	CUML	01.08.2023	5587.00	01.07.2023	2228.00	3359.00	1.00	3359.00
GOA44412	KWH	CUML	01.08.2023	2982.30	01.07.2023	2804.79	177.51	3000.00	532530.00
GOA44412	KW	CUML	01.08.2023	0.3574	01.07.2023	0.4376	0	3000.00	1072.2000
GOA44412	KVAH	CUML	01.08.2023	2999.23	01.07.2023	2821.53	177.70	3000.00	533100.00
GOA44412	KVA	CUML	01.08.2023	0.3590	01.07.2023	0.4412	0	3000.00	1077.0000
GOA44412	KVAR	CUML	01.08.2023	262.66	01.07.2023	257.21	5.45	3000.00	16350.00
GOA44412	KWH	PEAK	01.08.2023	657.65	01.07.2023	618.75	38.90	3000.00	116700.00
GOA44412	KWH	NORMAL	01.08.2023	1477.31	01.07.2023	1391.37	85.94	3000.00	257820.00
GOA44412	KWH	OFF PEAK	01.08.2023	847.33	01.07.2023	794.66	52.67	3000.00	158010.00
GOA44412	KVAH	PEAK	01.08.2023	661.28	01.07.2023	622.38	38.90	3000.00	116700.00
GOA44412	KVAH	NORMAL	01.08.2023	1489.13	01.07.2023	1403.04	86.09	3000.00	258270.00
GOA44412	KVAH	OFF PEAK	01.08.2023	848.81	01.07.2023	796.11	52.70	3000.00	158100.00
GOA44412	KWH	PEAK EXPORT	01.08.2023	0.00	01.07.2023	0.00	0.00	3000.00	0.00
GOA44412	KWH	NORMAL EXPORT	01.08.2023	1.63	01.07.2023	1.63	0.00	3000.00	0.00
GOA44412	KWH	OFF PEAK EXPORT	01.08.2023	0.00	01.07.2023	0.00	0.00	3000.00	0.00
GOA44412	KVAH	PEAK EXPORT	01.08.2023	0.00	01.07.2023	0.00	0.00	3000.00	0.00
GOA44412	KVAH	NORMAL EXPORT	01.08.2023	1.89	01.07.2023	1.89	0.00	3000.00	0.00
GOA44412	KVAH	OFF PEAK EXPORT	01.08.2023	0.00	01.07.2023	0.00	0.00	3000.00	0.00
GOA44432	KWH	CUML	01.08.2023	3788.24	01.07.2023	3612.27	175.97	40.00	7038.80

The electricity bill for the 1 MVA supply at 11 kV Substation for the month of July 2023

ELECTRICITY DEPARTMENT - GOVERNMENT OF GOA

HT Bill for Month-July-2023 **Ref:EE/Div 11 : Vasco/TECH/**

Name :	BIRLA INSTITUTE OF SCIENCE & TECHNOLOGY	Sanctioned Load(KW/KVA) :	1000KVA	CA No :	60002127508
		Contract Demand-CD (KVA) :	1000	Energisation Date :	01/08/2012
Legacy No :	HTC-232 / / 1732	85% of Contract Demand :	850	MRU No :	HT1111
Billing Address :	178, NH 17ARINAGAR, GOA 403726	Billing Demand :	850	Meter Status :	OK
		Avg.Power Factor (Lag) :	0.99	Connection Status :	Active
		Line Min Charges :		Tariff Category :	HTC
Supply Address :	178, NH 17ARINAGAR, GOA 403726	Security Deposit (SD)-CD/BG :	2500000.00	Voltage Level (KV) :	11.00
		Division :	Div 11 : Vasco	Bill Date :	01/08/2023
		Sub Division :		Bill Basis :	Actual
Mobile / Tel No :	******5880	Prev. Meter Reading Date :	01/07/2023	Bill Number :	10052881416
e-mail id :	ACCOUNTS@GOA.BITS-PILANI.AC.IN	Curr. Meter Reading Date :	01/08/2023	Last Bill Reading Date:	01/07/2023

Equipment Details		Unit	TOD Period	Meter Reading Current	Meter Reading Previous	Reading Difference	MF	Total Consumption(KWh) Current Month	Total Consumption(KWh) Corresponding Month of Last Year
Meter No	12042302	KWH	Cumulative	10379.78	10314.68	65.10	1000	65100.00	73970
Meter Type	HTCT Meter	KVAH	Cumulative	10500.84	10435.09	65.75		65750.00	74040
Meter Make	HT Meter 110 V, -/5 A (GED)	KVA	Cumulative	0.5190				519.00	374
MRT testing date		KWH	Peak	1657.98	1647.44	10.54		10540.00	7480
Installation Date	05/05/2016	KWH	Normal	8031.99	7981.67	50.32		50320.00	64230
Transformer No		KWH	Off Peak	689.77	685.55	4.22		4220.00	2580
CTPT No		KVAH	Peak	1670.36	1659.78	10.58		10580.00	
CT PT Make		KVAH	Normal	8109.87	8058.95	50.92		50920.00	
PT Ratio	11000 / 110	KVAH	Off Peak	720.57	716.34	4.23		4230.00	
CT Ratio	50.0 / 5.0								

Your Bill Summary :

Previous Arrears/Advance (A)	Amount under Litigation / Disputed/Deferred (B)	DPC Till Bill Date(C)	Present Total Bill(D)	Rounding amount(E)	Amount Payable on or before due date 18-AUG-2023 (A + C + D + E)
	0.00		710065.52	0.62-	710065.00

Amount payable - RUPEES SEVEN LAKH TEN THOUSAND SIXTY FIVE

Payment after due date attracts penal charges @ 1.5% per month on daily basis compounded every month.
Non-Payment of bill by the due date will render the connection liable for disconnection of power supply as per JERC clause 9.1.
Amount of prompt payment Rebate is Rs. 1,653.72 which will be effected in the next bil subject to realization of payment in our account before 1 week before the due date
Now you can pay bills through RTGS/NEFT/IMPS. For details please check our website at https://www.goaelectricity.gov.in

Current Demand Calculation Details

Particulars	Quantity	Rate	Amount
Demand /	850	250.0000	212500.00
Fixed Charges			
Energy Charges	4230	4.7250	19986.75
	50920	5.2500	267330.00
	10580	6.3000	66654.00
Penal Charges (DC)			
Penal Charges (EC)			
FPPCA	65080	1.4600	95016.80

Present Bill Charges

Particulars		Amount
Demand Charges		212500.00
Energy charges		353970.75
FPPCA		95016.80
Penal Charges (DC)		0.00
Penal Charges (EC)		0.00
Sundry Charges		
Adv./ PP Rebate		2184.33-
Meter Rent		0.00
Electricity Duty @ Rs 0.70/KWh		46556.00
Power Factor Penalty / Incentive @	0.00	0.00
Installment due		
Wheeling Charges		0.00
Public Lighting Duty @ Rs. 0.06 per KWH		5206.40
Total Current Demand		710065.62

Consumption History

Billing Period	Consumption
02/07/23 to 01/08/23	65080
02/06/23 to 01/07/23	105320
02/05/23 to 01/06/23	159690
02/04/23 to 01/05/23	137400
02/03/23 to 01/04/23	135670
02/02/23 to 01/03/23	107630

Bank Guarantee Details

SL No.	B. G. No.	Amount	Validity Date

Last Payment of 952826.00 Received on 07-JUL-2023

Help Line 1912

Please note that amount in Arrears column is to be paid as per previous bill date date failing which DPC shall be levied.

X----------X

Payment Slip:-

GOA ELECTRICITY DEPARTMENT

Name:BIRLA INSTITUTE OF SCIENCE & TECHNOLOGY
Legacy No :-HTC-232 / / 1732

Division :Div 11 : Vasco
Sub Division :

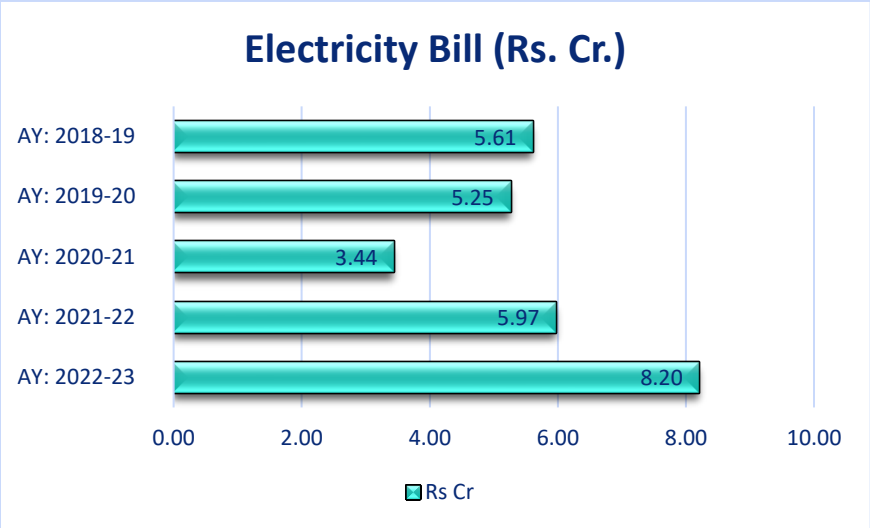
CA No :- 60002127508
Bill Number :- 10052881416

Now you can pay bills throug RTGS/NEFT/IMPS. For details please check our website at https://www.goaelectricity.gov.in	Telephone Number: Pay your electricity bill online at www.goaelectricity.gov.in

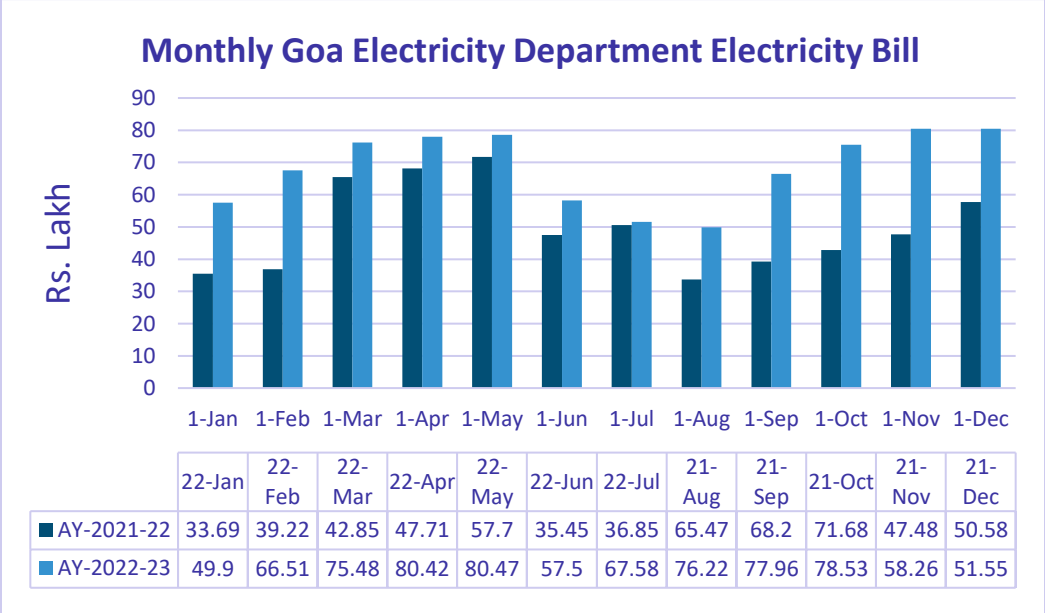
Bill Amount Payable Rs. 710065.00 **Due Date : 18-AUG-2023 :**

Copy to Accounts

The major electricity-consuming equipment installed in the campus are Chillers, AHU, STP equipment, pumps, blowers, air conditioners, deep freezers, ovens, fans, tube lights, computers, UPS. fire alarm and fire Hydrant systems in the academic block and other service areas. Residential quarters have household appliances that include refrigerators, air-conditioners, microwaves, etc. following graph shows annual electricity bill for the last 5 academic years.



Following graph shows monthly electricity bill of the last two academic years:



	22-Jan	22-Feb	22-Mar	22-Apr	22-May	22-Jun	22-Jul	21-Aug	21-Sep	21-Oct	21-Nov	21-Dec
AY-2021-22	33.69	39.22	42.85	47.71	57.7	35.45	36.85	65.47	68.2	71.68	47.48	50.58
AY-2022-23	49.9	66.51	75.48	80.42	80.47	57.5	67.58	76.22	77.96	78.53	58.26	51.55

It is seen from the Table and graph that the energy consumption has been regularly increasing w.e.f. from August, 2021 till July, 2023, as the campus of gradually opened to students of the Institute after the COVID-19 pandemic had receded. The low of bill amount INR 33, 68,859 was recorded in August, 2021 and the high of the bill INR 80, 46, 444 was recorded in December, 2022.

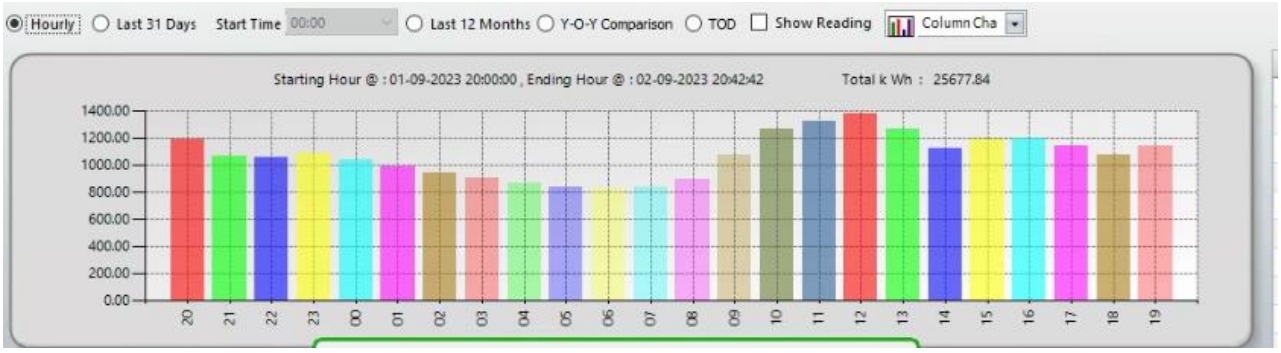
1.6 Load Curve

The variation of energy consumption for entire campus can be studied on hourly basis as well as daily basis. The load curves captured using the Energy Management System (EMS) (supplied by the L&T Electrical and automation Pvt. Ltd.) are useful. The variation in the energy supplied by the transformers (3 MVA and 2 MVA at 33 kV Sub-station) is captured hourly basis and also on daily basis.

A typical daily load curve for the 3 MVA transformer, supplying power to Institutional buildings, and for the 2 MVA transformer, supplying power to residential colony areas are shown in the Figure below:

Figure: A typical hourly load curve captured on 02-09-2023, showing variation of hourly energy consumption (kWh) at (i) 3 MVA Transformer, and (ii) at 2 MVA Transformer, at the 33 kV main sub-station.

(i). Hourly Load Curve for 3 MVA Transformer



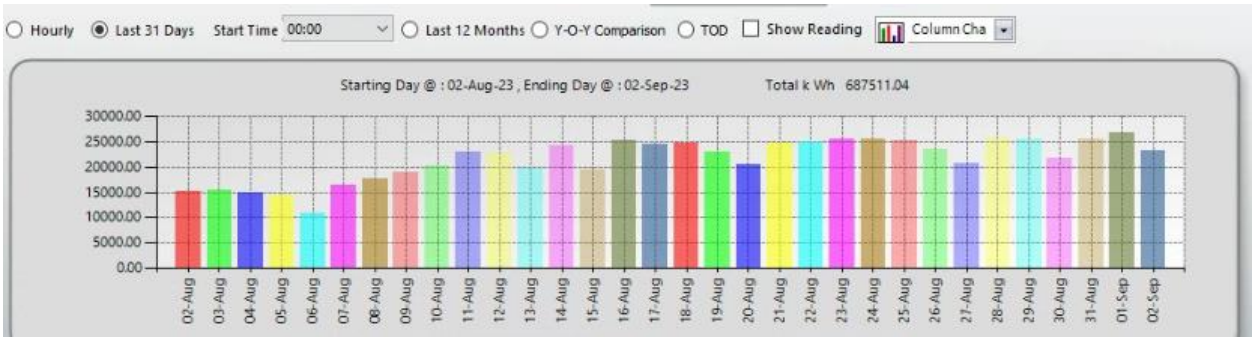
(ii). Hourly Load Curve for 2 MVA Transformer

It is seen from the load curve for the 3 MVA transformer (i), which supplies power to the Institutional buildings, that the energy consumption, i.e., load is higher during the daytime office-hours than during the night off-office hours, as expected. Also, it is seen from the Figure (ii) for the 2 MVA Transformer, which supplies power to the residential colony areas, that the energy consumption is higher during evening and night time (off-office hours) than during the day time.

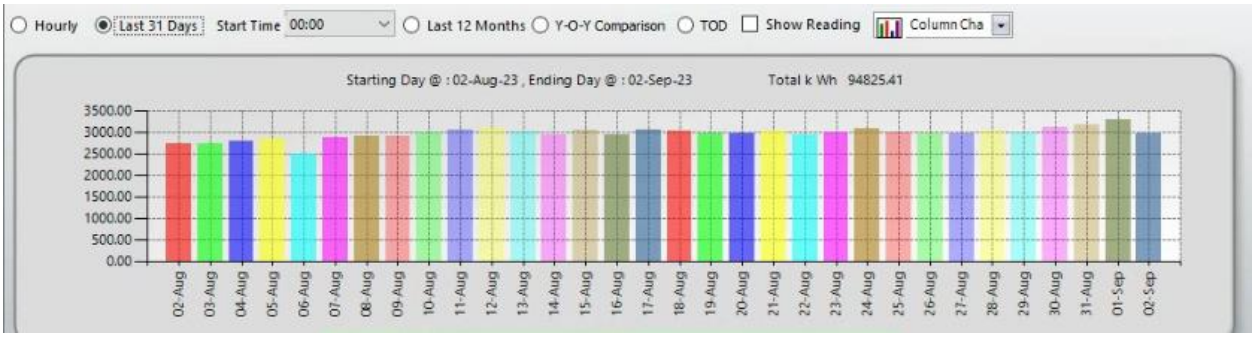
The variation of energy consumption per day is shown in the Figure below. can also be The load curve for 3MVA transformer and 2MVA transformer on a day basis is shown as below

A typical monthly load curve captured for a month from 02-08-2023 to 02-09-2023, showing variation of energy consumption (kWh) per day as recorded at (i) 3 MVA Transformer, and (ii) at 2 MVA Transformer, at the 33 kV main sub-station.

(i). Monthly Load Curve for 3 MVA Transformer



(ii). Monthly Load Curve for 2 MVA Transformer



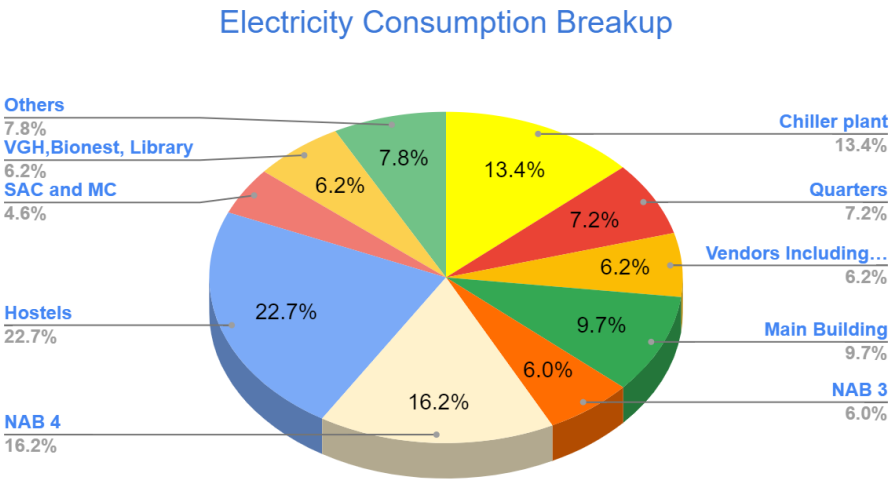
It is from the Figure (i) that during the month from 02-08-2023 to 02-09-2023, the energy consumption per day, was regularly increasing until 11th August, as the preparations for opening the Institute had started, and that the there was a step change in the energy consumption thereafter, as all activities on campus had resumed in full-fledged form.

It is seen from the Figure (ii) that during the same period, the energy consumption per day due to residential colony areas remained almost steady for the entire month, as the residential quarters were fully occupied during the month.

1.7 Electricity Consumption

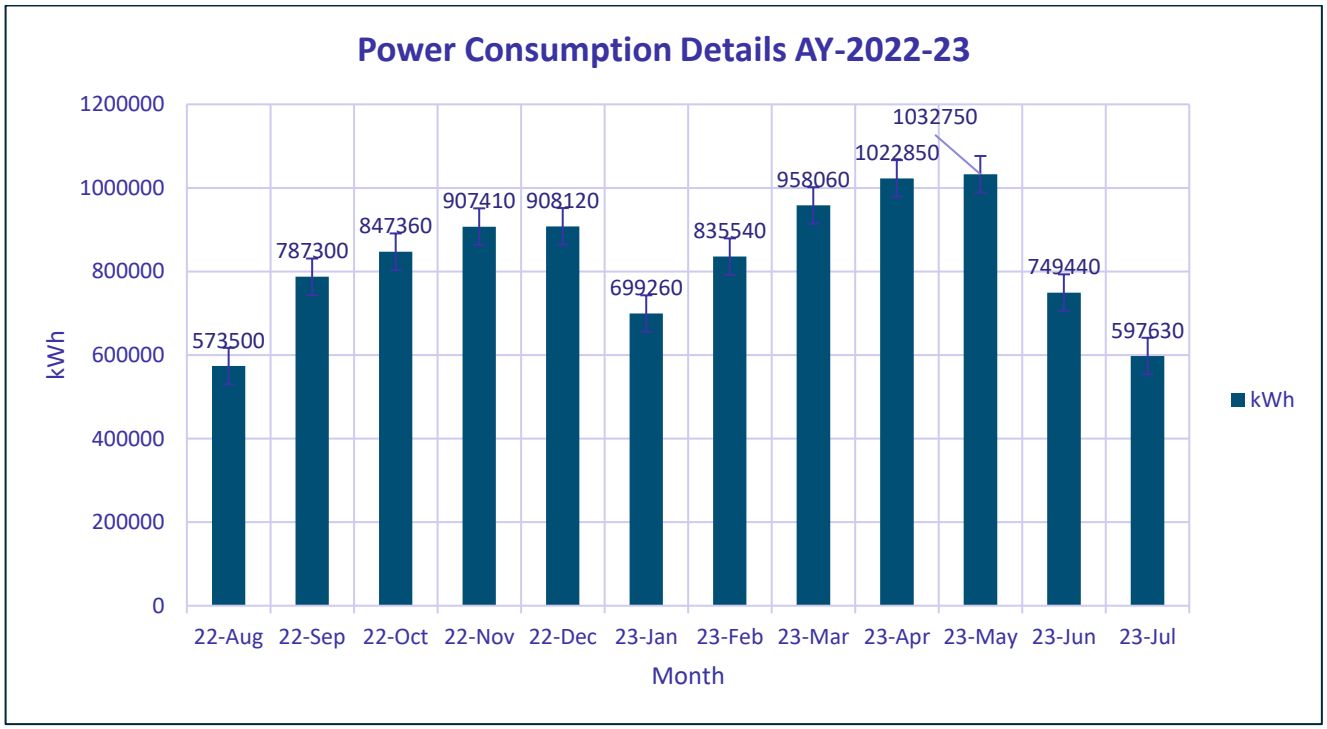
The estimated percentage share of different load centers to the total annual consumption recorded in the month (May-2023) is as shown in the Table & Figure below.

Area wise Electricity Consumption per Month (May-2023)										
Total kWh	Chiller plant	Quarters	Vendors Including all Mess	Main Building	NAB 3	NAB 4	Hostels	SAC & MC	VGH, BioNest, Library	Others
1022850	137400	74046	63614	98729.6	61827	165571.2	231704	47267	63489	79202

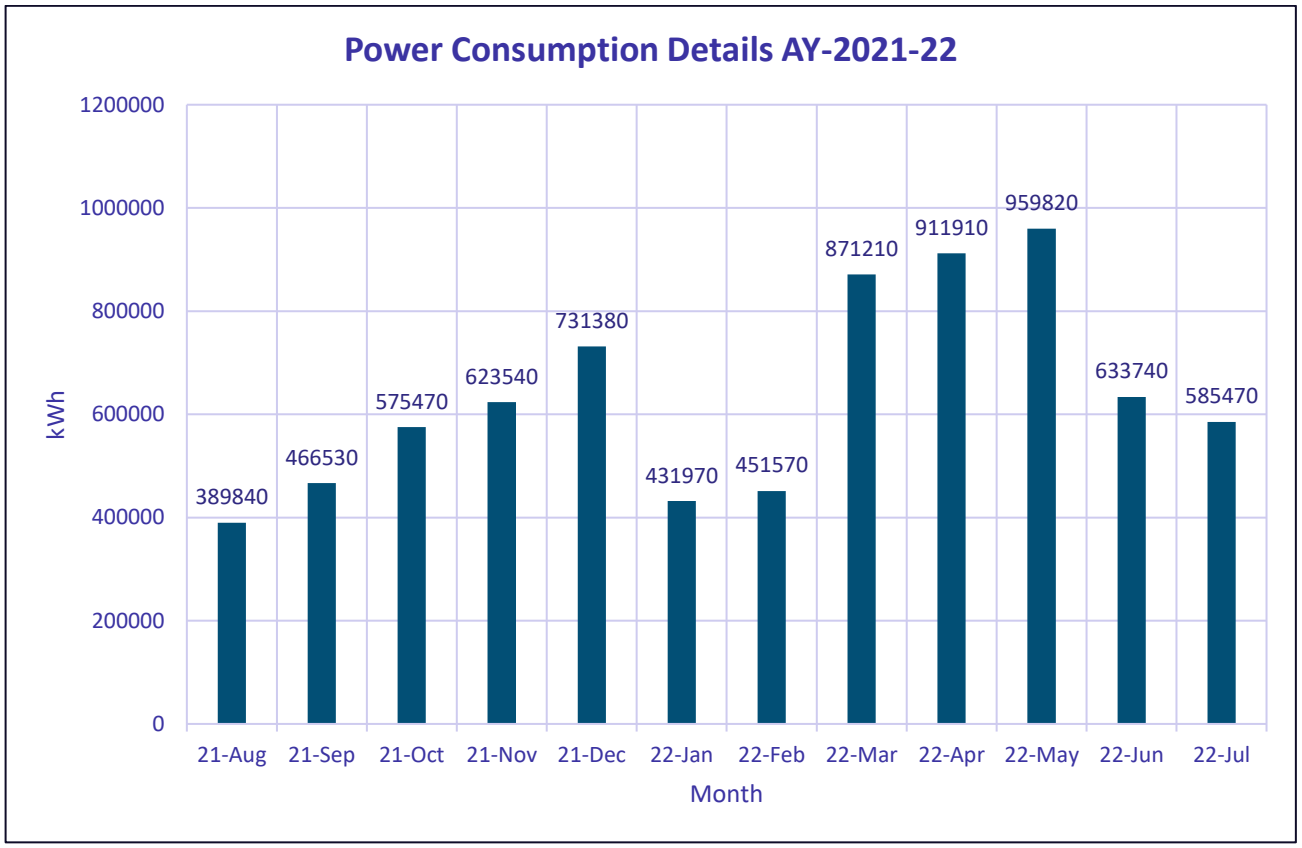


NAB: New Academic Building, SAC: Student Activity Center, MC: Medical Center, VGH: Visitors Guest House

The monthly variation of the electricity consumption is studied for the last two academic years.



Monthly variation of Electrical Power Consumption on the Campus for the AY 2022-23



Monthly variation of Electrical Power Consumption on the Campus for the AY 2022-23

It is seen from the Figures that the electricity consumption is regularly high during the period from mid-August to mid of December and also during January to May than during early part of August and later part of December; and again, during Summer months of June, July and early part of August. This is accounted for by the range of activities, festivities, and events conducted during the semesters, involving students, and employees of the Institute, guests and delegates participating in the conferences, etc.

The electrical energy consumption on campus is largely determined by the effective power factor maintained at the billing station. The variation of energy consumption, effective power factor and the corresponding bill amount over the period from August 2021 to July, 2023 is shown in the Table below.

Table: Monthly variation of the total energy consumption recorded at 33 kV and 11 kV sub-stations, corresponding computed power factor (Lagging) and the total bill paid over the period from August, 2021 to July, 2023.

Month	kWh	PF	GED Amount (Rs.)	GED Amount (Rs. L)
21-Aug, 2021	389840	0.9987	₹3,368,859.52	33.69
21-Sep, 2021	466530	0.9976	₹3,922,399.56	39.22
21-Oct, 2021	575470	0.9910	₹4,285,138.94	42.85
21-Nov, 2021	623540	0.9957	₹4,771,123.05	47.71
21-Dec, 2021	731380	0.9970	₹5,770,239.51	57.70
22-Jan, 2022	431970	0.9983	₹3,544,733.07	35.45
22-Feb, 2022	451570	0.9995	₹3,684,438.58	36.85
22-Mar, 2022	871210	0.9991	₹6,547,188.02	65.47
22-Apr, 2022	911910	0.9949	₹6,819,923.75	68.20
22-May, 2022	959820	0.9943	₹7,167,944.52	71.68
22-Jun, 2022	633740	0.9982	₹4,747,980.40	47.48
22-Jul, 2022	585470	0.9943	₹5,057,501.87	50.58
22-Aug, 2022	573500	0.9990	₹4,989,616.35	49.90
22-Sep, 2022	787300	0.9934	₹6,650,491.72	66.51
22-Oct, 2022	847360	0.9926	₹7,547,651.26	75.48
22-Nov, 2022	907410	0.9918	₹8,041,946.35	80.42
22-Dec, 2022	908120	0.9927	₹8,046,444.39	80.47
23-Jan, 2023	699260	0.9941	₹5,750,263.97	57.50
23-Feb, 2023	835540	0.9932	₹6,758,309.14	67.58
23-Mar, 2023	958060	0.9930	₹7,621,667.89	76.22
23-Apr, 2023	1022850	0.9936	₹7,795,712.96	77.96
23-May, 2023	1032750	0.9945	₹7,852,854.52	78.53
23-Jun, 2023	749440	0.9973	₹5,825,880.65	58.26
23-Jul, 2023	597630	0.9989	₹5,155,119.67	51.55

1.8 Diesel Consumption

Annual Diesel Consumption

Diesel is used to generate power with the help of Diesel Generators (DG). There are a total of 11 DG Sets on campus. The Average Diesel Consumption per month is 1292 liters during the year AY 2022-23. As per the records, the Diesel Consumption for the AY 2022-23 is 15,515 liters.

#	Diesel Generator Capacity	Location	Connected to
1	500 kVA	PCC2	Old Academic Building, Workshop
2	500 kVA	PCC2	Old Academic Building, Workshop
3	750 kVA	PCC2	Old Academic Building, Workshop
4	62.5 kVA	PUMP HOUSE	Water pumps
5	62.5 kVA	VGH	Guest house rooms and dining
6	35 kVA	MEDICAL CENTER	Medical Centre
7	750 kVA	PCC2A	New academic block
8	750 kVA	PCC2A	New academic block
9	250 kVA	PCC 5	New Tower Quarters
10	50 kVA	D SIDE HOSTEL	For D Type Hostel Corridors and common rooms
11	62.5 kVA	BIRAC BioNest	Labs and office rooms

1.9 Preventive Measures

For the purpose of check and control over the electrical energy consumption, diagnostic studies, surveys and reports are regularly conducted in the campus. These include electricity bill analysis, maintenance activities (preventive as well as break-down maintenance) of electrical equipment. Diagnostic Study of Distribution Panels and Overhead Lines using Thermal Image Analyzer.

Thermal Imaging

Infra-red thermography using Thermal Image analyzer (Fluke Make) of distribution panels and overhead lines infra-structure at PCC-2 and PCC-3 was carried out on 17-08-2023. The thermal image and the normal image captured for these equipment are as shown below:

Thermal images and normal images for equipment considered for diagnostic study of Capacitor Bank Feeder and Overhead Lines Two Pole Structure at PCC-2 and PCC-3 on 17 August, 2023. (i). Capacitor Bank (50 kVAR) Feeder at PCC-2, (ii) Capacitor Bank (15 kVAR) Feeder at PCC-2, (iii). Capacitor Bank (25 kVAR) Feeder at PCC-2.

<table>
<tr>
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<tr>
<td>(i). Thermal Image of Capacitor bank Feeder (7F1) (50 kVAR) at PCC-2</td>
<td>Normal Image of Capacitor Bank Feeder (7F1) (50 kVAR) at PCC-2</td>
</tr>
</table>

(ii). Thermal Image of Capacitor bank Feeder (8F6) (50 kVAR) at PCC-2

Normal Image of Capacitor Bank Feeder (8F6) (50 kVAR) at PCC-2

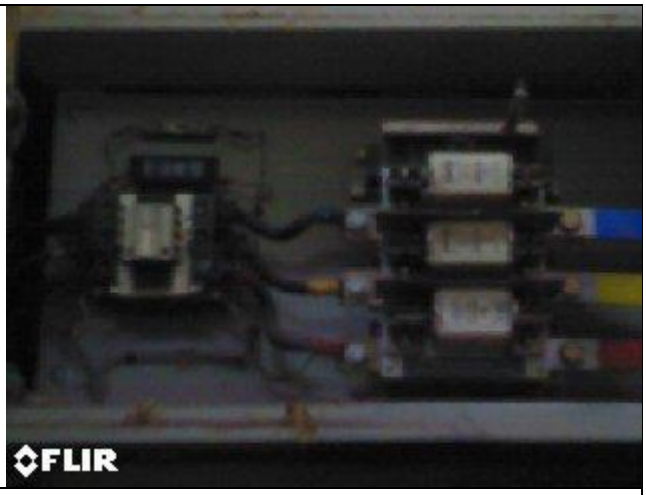
(iii). Thermal Image of Capacitor bank Feeder (8F1) (25 kVAR) at PCC-2

Normal Image of Capacitor Bank Feeder (8F1) (25 kVAR) at PCC-2

(iv). Thermal Image Busbar of PCC3 Panel

(v)Thermal Image of 2 Pole Structure at PCC2

	
(vi). Thermal Image of Capacitor bank Feeder (8F4) (15 kVAR) at PCC-2	Normal Image of Capacitor Bank Feeder (8F4) (15 kVAR) at PCC-2

	
(vii). Thermal Image of Capacitor bank Feeder (8F2) (25 kVAR) at PCC-2	Normal Image of Capacitor Bank Feeder (8F2) (25 kVAR) at PCC-2

The thermal IR images clearly show that the temperature of equipment studied were found to be in the range 35-60 °C. The equipment for which higher temperatures were recorded should be monitored further and corrective actions should be taken as may be required.

Harmonic Analysis

The power quality analysis was carried out with the help Power Quality Analyzer (Krykard Make, Model No. ALM-35) owned by Energy Auditors from L&T Electrical and Automations Pvt. Ltd, during 25 – 26th August, 2023. The objective of the analysis was to determine total harmonic distortion (THD) for supply voltage and current drawn at distribution transformer levels. Out of 11 transformers installed the measurements were carried out at 10 transformers in service. The measurements were carried out under two conditions: (i). with APFC bank switched ON , and (ii). with APFC Bank switched OFF, where applicable.

The measurements are recorded as in the Table below:

Table: Effect of APFC switched ON and switched OFF on Load Current (Amp), Current and Voltage Harmonic Distortion (THD_I &THD_V), Total harmonic distortion, True PF and DPF, True Power (kW) and Reactive Power (kVAR) demand

OBSERVATIONS:

Sl No	Feeder Name	Cap ON/OFF	Amps(max)	THD-I% (max)	THD-V% (max)	TDD%	True PF(avg)	DPF(avg)	KW (max)	KVAr demand (max)
1	3MVA Transformer 33KV HT reading	NIL	24.84	5.5	1.7	5.32	0.988	0.989	1277.32	200.56
2	2MVA Transformer 11KV HT reading	NIL	8.6	10.1	2.2	7.31	0.829	0.834	122.36	-76.66
3	750KVA PCC1 Incomer	ON	304	11	2.3	10.45	0.985	0.987	187.67	-81.94
4		OFF	281.6	5.8	1.4	5.06	0.968	0.970	179.45	43.87
5	1500KVA PCC2 Incomer	ON	582	8.9	1.5	6.64	0.988	0.990	395.84	24.42
6		OFF	588.5	9.2	1.4	7.21	0.996	0.998	375.74	20.89
7	1050KVA PCC3 Incomer	ON	447.36	8.4	1.7	7.06	0.991	0.994	273.07	-30.44
8		OFF	444.24	7.4	1.5	6.83	0.997	1	267.91	-7.3
9	750KVA PCC4 Incomer	ON	147.6	12.9	1.8	10	0.895	0.902	79.65	-27.34
10		OFF	111.6	13	1.7	10.82	0.933	0.941	64.18	2.37
11	1000KVA PCC5 Incomer	Not working	92.48	22.9	1.4	13.69	0.958	0.972	57.51	-2.86
12	1000KVA NAB3 LT Incomer	ON	321.28	31.3	2.8	28.89	0.954	0.993	211.38	25.69
13		OFF	442.24	30.2	4.7	29.38	0.950	0.992	294.31	38.06
14	1000KVA NAB4 LT Incomer	ON	411.52	9.5	1.4	9.11	0.327	0.965	96.2	28
15		OFF	405.44	9.4	1.4	8.85	0.943	0.947	268.57	93.25
16	1050KVA AC Plant Incomer	ON	747.5	14.2	1.3	4.81	0.926	0.929	494.85	198.87
17		OFF	818.9	5	0.7	4.54	0.924	0.926	535.98	217.77

Current harmonics (TDD%) should be less than 8% and Voltage harmonics should be less than 5% as per IEEE-519-2022 limits

As seen from the Table, it is observed that the corrective action is necessary for maintaining (THD)- I less than 8%, in compliance with the IEEE-519-2022 code, at certain locations, including at 2 MVA Transformer 11 kV HT, 750 kVA PCC1 Incomer, 1500 KVA PCC2 Incomer, 1000 KVA PCC3 Incomer, 750 KVA PCC4 Incomer, and 1000 KVA AC Plant Incomer. Also, it is observed that the THD-V (%) is well below the stipulated values of 5% as per the IEEE-519-2022code and therefore no corrective action is required.

On the basis of above observations, the corrective actions recommended for implementation on priority are stated in the Table: below.

Table: The recommended corrective measures for maintaining THD-I (%) less than 5% (IEEE-519-2022)

RECOMMENDATIONS:			
Location	**Detuned APFC rating**	**Active Harmonic Filter rating**	**Remarks**
750KVA PCC1 Incomer	14% detuned reactors with 300KVAr, 525V SHD APFC bank	Not required	
1500KVA PCC2 Incomer	Recalibrate/Retrofit APFC relay to fine tune PF	60 Amp 3 phase 4 wire AHF	AHF not mandatory since harmonics are just within limits but if installed harmonics will be further reduced and Power loss also will be less
1050KVA PCC3 Incomer	Recalibrate/Retrofit APFC relay to fine tune PF	Not required	
750KVA PCC4 Incomer	Recalibrate/Retrofit APFC relay to fine tune PF	30 Amp 3 phase 4 wire AHF	
1000KVA PCC5 Incomer		30 Amp 3 phase 4 wire AHF	
1000KVA NAB3 LT Incomer	7% detuned reactors + 100KVAr, 525V LTXL APFC banks	150 Amp 3 phase 4 wire AHF	Capacitors seems derated hence recommended new APFC bank, otherwise fauly Capacitors to be replaced to compensate KVAr demand
1000KVA NAB4 LT Incomer	7% detuned reactors + 100KVAr, 525V LTXL APFC banks	60 Amp 3 phase 4 wire AHF	Capacitors seems derated hence recommended new APFC bank, otherwise faulty Capacitors to be replaced to compensate KVAr demand
1050KVA AC Plant Incomer	7% detuned reactors + 250KVAr, 525V LTXL APFC banks	Not required	Capacitors are derated hence recommended to install new APFC bank

Separate report with details is in Annexure (Separate file).

1.10 Energy Efficiency Improvement Initiatives

On the basis of in-house routine, survey and diagnostic reports, a number of energy conservations have been implemented in a phase-wise manner. These are listed in the Table below:

Table: ECMs implemented for Electrical Energy Efficiency Improvement on Campus.

#	Energy Conservation Measure	Energy Savings (kWh/INR) per Month	Scope for Efficiency Improvement
1	Installation of Limit Switches to control the operation of Exhaust Fans in 120 washrooms in students' hostels	5,706	Balance 800 Nos limit switches to be installed.
2	Installation of Timer enabled ON/OFF control switches in Street Lights and Lights in Public Areas in Multi-storeyed Residential Quarters	1250	Timer installed for All Street Lights and Multi-Storeyed Residential Quarters.
3	Phase-wise replacement of TFL with LED lights	11,520	Balance 70% LED lights needs to be replaced
4	Phase-wise replacement of 200 Nos. of Induction Motor Fans with BLDC motor fans in students' hostels.	2376	Balance 4800 nos. of Fans to be replaced by BLDC fans.
5	Installation of 10 Nos. of Occupancy Sensor students hostel washrooms. In NAB area.	480	Balance 376 Nos of Occupancy sensor to be installed.
6	Solar PV Roof Top Systems for captive power utilization, installed system capacity 170.85 kWp	18,240	Balance 375kWp Roof top solar PV to be installed.

1.11 Solar Power

The solar systems have been installed on campus since August 2009, for different applications. The phase-wise development of Solar PV systems is as given below:

Date of Commissioning	Systems on Campus	Application
1/8/2009	Hybrid (Solar PV + Wind) Stand Alone	Street Lighting, Indoor Lighting at Medical Center
8/2/2014	Solar PV at PCC3, Grid Interactive	Street Lighting
18-08-2018	Solar PV at PCC1, Grid Interactive	Street Lighting
2/12/2019	Solar PV at PCC4, Grid Interactive	Street Lighting
1/3/2022	Solar PV at PCC2, Stand Alone	Street Lighting
20-06-2022	Solar PV at A Wing, On Grid	Feeding power to Grid
19-06-2023	Solar PV at C Mess, On Grid	Feeding power to Grid

As of present, there are seven solar PV systems roof-top systems installed over the roofs of Institute buildings, PCCs and one of the Students Messes on Campus. The technical specifications of these systems are listed in the Table below:

Table: Technical Specifications of the Solar PV Roof-top Systems installed on Campus

	Installed Capacity	Panel type	Panel Capacity	Number of Panels	Panel Directions
100kW at A Wing	100 kW	Monocrystalline	540 Wp	186	South East, South West, North West
50kW at C Mess	50 kW	Monocrystalline	535 Wp	94	South East
3.6kW at PCC1	3.6 kW	Polycrystalline	75 Wp	48	South
6kW at PCC2	6 kW	Polycrystalline	335 Wp	18	South West
4kW at PCC3	6.75 kW	Polycrystalline	250 Wp	27	South West
4.5kW at PCC4	4.5 kW	Polycrystalline	300 Wp	15	South East

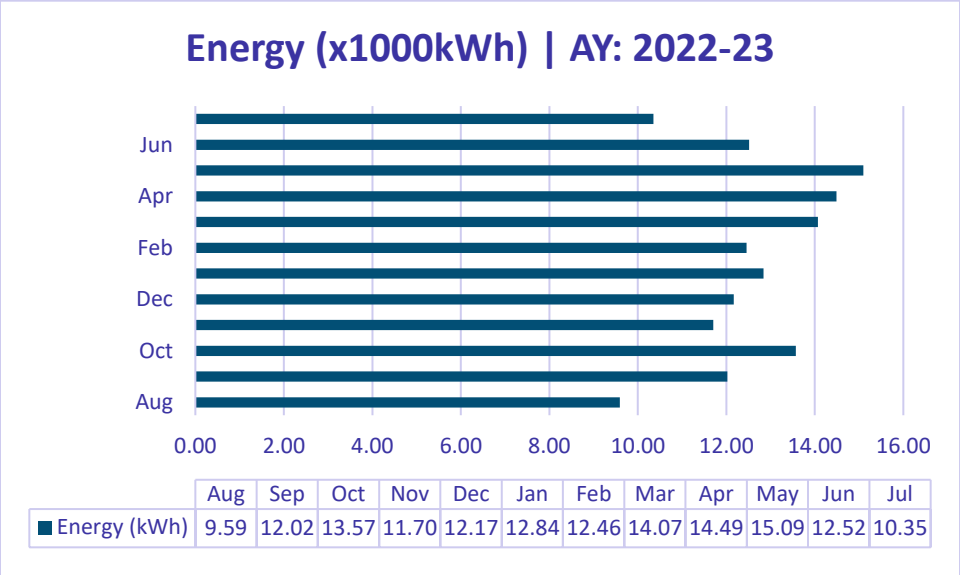
The systems view of the solar PV systems installed is shown below:

Figure: View of Solar PV Systems on the Campus: (i). System on the Roof of C-Mess, (ii). System on the Roof of PCC-2, (iii). System on the A-Wind on the Institute Building, (iv). System on the roof of PCC-3, (v). Solar PV Street Light in Children park, (vi) System on the Roof of PCC-1.

The aggregate generation capacity installed on campus is 170.85 kWp, out of which 100 kWp is accounted for by a Grid-tied Solar PV system on roof of A-Wing of Institute Building and 50 kWp is accounted for by a system installed over roof of C-Mess for students. One of the roof-top systems having capacity 6 kWp installed at PCC-2 is a Stand Alone. Remaining three roof-top systems, installed over roofs of the PCC-1, PCC-3 and PCC-4, have total generation capacity of 14.85 kWp and operate in grid-interactive (hybrid) mode. Also, there are 58 Nos. of Stand-alone Solar Street Lights (12 W), deployed for street-lighting and roof-mounted 89 Nos. of Solar Water Heating Systems (SWHS) installed over the twenty-two students' hostels on campus. Each of the SWHS systems has a booster heater of 3 kW rating.

The energy yield of the systems installed is monitored routinely. The recorded electrical energy yield per month and the equivalent monetary savings for a 100 kWp solar PV roof-top system during the academic year August, 2022 to July, 2023 is presented in the graph below:

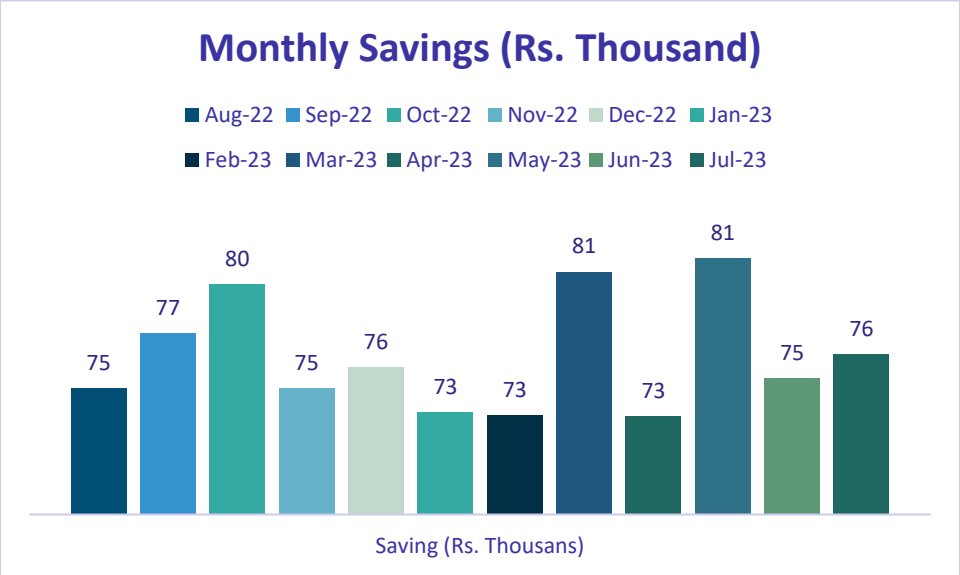
1.12 Monthly Generation of Solar Energy



	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Energy (kWh)	9.59	12.02	13.57	11.70	12.17	12.84	12.46	14.07	14.49	15.09	12.52	10.35

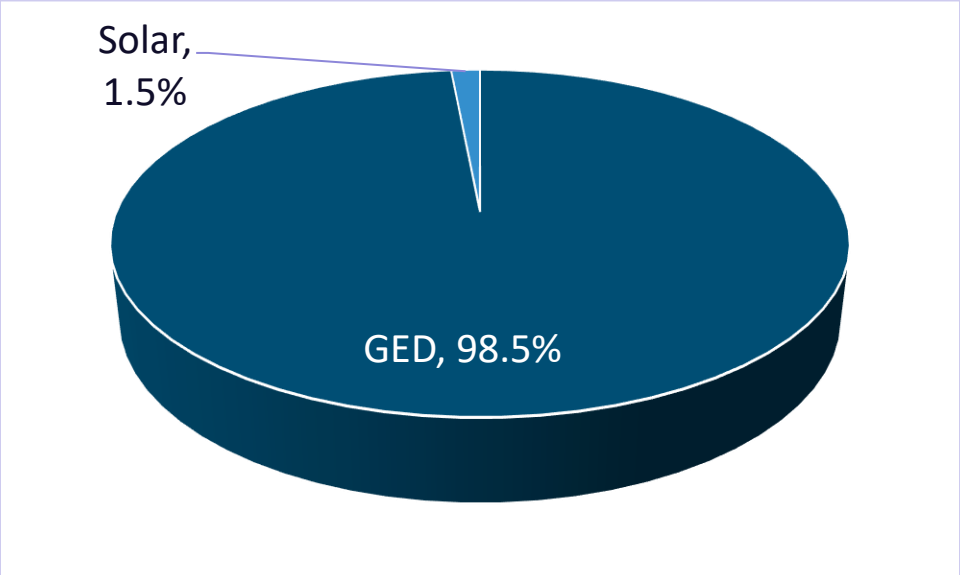
Monthly energy yield from the Solar PV 100 kWp

1.13 Monthly Savings



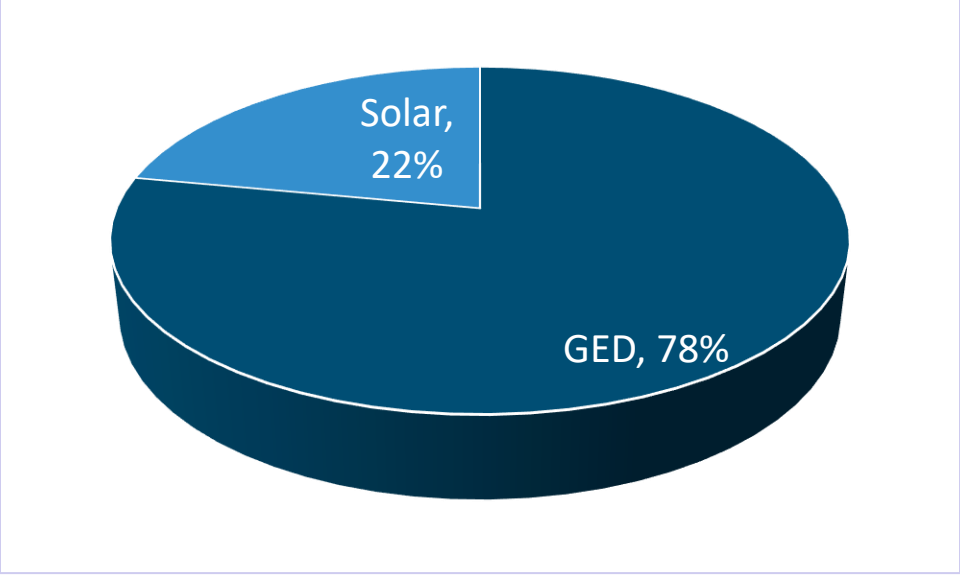
1.14 Grid Electricity Vs Solar Power Generation

BITS Pilani, K K Birla Goa Campus falls in the category of a large consumer of electricity. The grid electricity accounts for larger portion of electricity consumed and the solar electricity generated on the campus accounts for about 1.5% of total electricity consumption. The percent share of grid electricity and solar electricity on annual basis is shown in the Figure below:



Percent contribution of solar electricity generated to total electricity consumption

However, after the installation of 1 MWp (opex model), the percent share of grid electricity and solar electricity on annual basis will be changed to 78% and 22%, respectively, from Dec-2023 on-wards.



1.15 Electrical Team

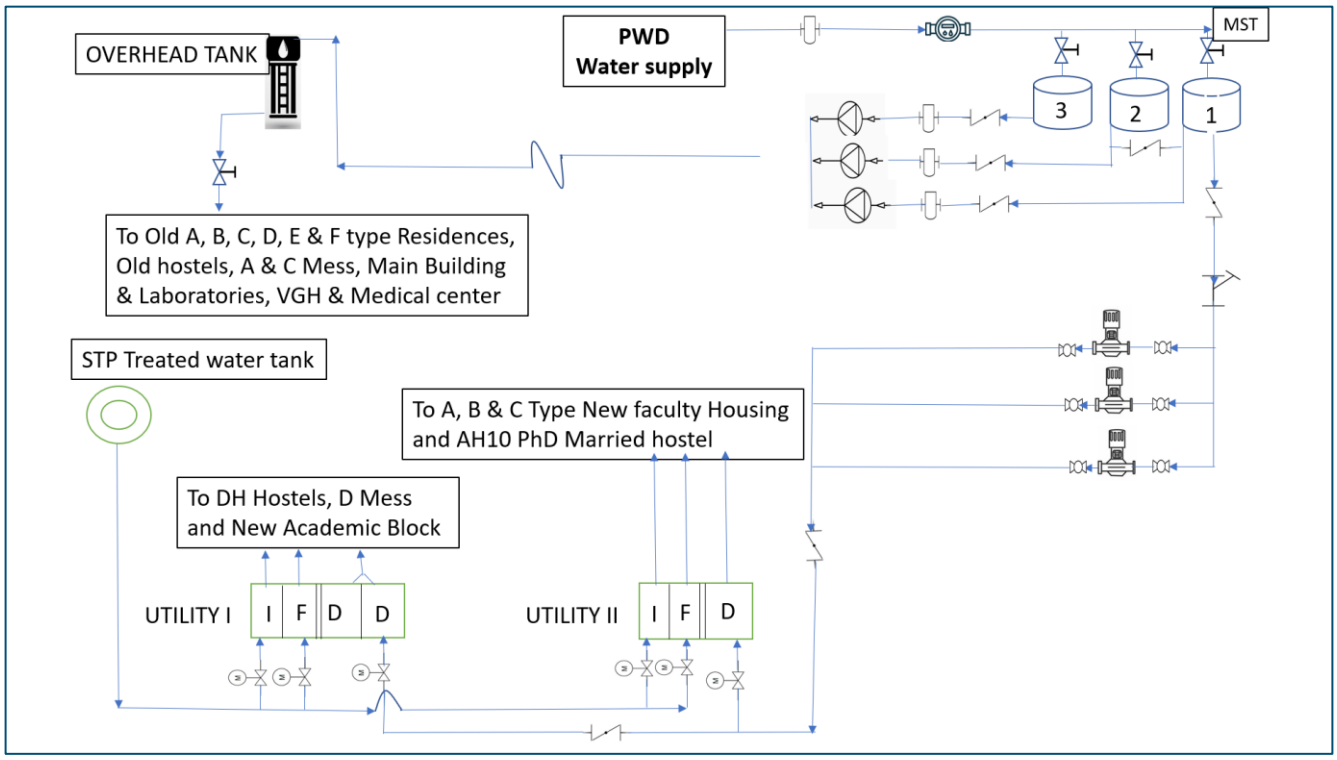
6 staff on roll and 10 on contract

1.16 Performance of Pumps, Blowers and Motors

Following sections cover performance of pumps, blowers and motors

1.17 Flow of Water Supply

Following layout shows the water supply to campus residents. Water is received from the PWD.



Centrifugal water transfer Pump

Inline strainer

Gate Valve

Butterfly Valve

Ball Valve

Motorized Valve

Water Meter

Vertical multistage transfer Pump

MST Main Storage Tank

D Domestic water Tank

F Flush water Tank

I Irrigation water Tank

1.18 Pump House

At Pump house, there are total 03 number pumps are provided to transfer the water from Pump house to the Overhead tank. These are manufactured by Kirloskar brothers Ltd centrifugal pumps. Generally, one pump runs at a time to transfer the water from Main storage tank to the overhead tanks. The average running hours of the pumps is 9 to 10 hrs.

1.19 Overhead Tank Transfer Pumps

Performance Analysis of Pumping System at Pump House				
Description	Units	Domestic Pump–I	Domestic Pump–II	Domestic Pump–III
Design Parameters | Kirloskar Brothers Limited (KBL)				
Make & Model	--	KBL | DB 50/20	KBL | DB 50/20	KBL | DB 50/20
Flow rate	m^3/hr	60	60	60
Head	m	56	56	56
Speed	rpm	2900	2900	2900
Motor rating	kW	18.5	18.5	18.5
Operating Parameters				
Flow Rate	m^3/hr	50	50	50
Total head Developed	m	30	30	30
Motor Input Power	kW	16.40	15.43	15.60
Motor efficiency	%	88.5	88.5	88.5
Pump Efficiency	%	24.92	26.49	26.20
Overall efficiency	%	22.06	23.44	23.19

Observations and recommendations

- From the above table it is observed that the overall efficiency is around 23% which is satisfactory.
- Out of three water transfer pumps one pump runs at a time with no throttling at the discharge. two pumps remain in stand-by mode.
- All the three pumps are controlled manually and runs at full load.
- The discharge pressure and flow rate of all the three pumps is satisfactory.
- The routine maintenance and replacement of the wear and tear parts is taken up from time to time for the smooth operations of the pumps.
- Although the pumps are almost 20 years old but working satisfactory. Presently the pumps are operating at minimal performance and may be replaced with high efficiency Pumps.

1.20 Hydropneumatics Transfer Pumps

Apart from these overhead transfer pumps, there is a one set of pumps of Wilo make is also provided at pump house to transfer the water from Main storage tanks to the Utility I & II. The pump set consists of three multistage vertical pumps.

A VR control system is provided by Wilo for the smooth operations of Domestic pumps. The VR controlling system is an automatically pressure boosting systems with variable frequency drives and works in conjunctions with the pressure transducers.

Wilo Transfer Pumps

Performance Analysis of Pumping System at Pump House				
Description	Units	Transfer Pump–I	Transfer Pump–II	Transfer Pump–III
Design Parameters				
Make & Model	--	Wilo | MVI3204	Wilo | MVI3204	Wilo | MVI3204
Flow rate	m^3/hr	32	32	32
Head	m	220	220	220
Speed	rpm	2950	2950	2950
Motor rating	kW	7.5	7.5	7.5

Operating Parameters				
Flow Rate	m^3/hr	55	55	55
Total head Developed	m	5.0	5.0	5.0
Motor Input Power	kW	9.18	8.26	7.91
Motor efficiency	%	88.2	88.2	88.2
Pump Efficiency	%	8.16	9.07	9.47
Overall efficiency	%	7.20	8.00	8.36
*Pump and tank inlet are at same level				

Observations and recommendations

- From the performance table we can see that these pumps are running with very low overall efficiency (between 7 to 8%) which is due to the low delivery head.
- These pumps give excellent flow rate and provided with VR control system. This control system consists Variable frequency drives providing seamless operation of the pumps.
- In the Auto mode operation initially all the three Pumps runs but continuous operation of all pumps depends upon the water requirement in the Utilities.
- The distance between the Pump house and the Utility I is around 2.1 Kms, water may be transferred from the Pump house to the Utility I & II by gravity using the dynamic head of the water as the source of the water transfer is located at relatively higher elevation.
- Although the pumps are running at very low efficiency but as delivery head is low (installed in 2020) may continue to remain in operations.

1.21 Utility – I Pumps

At Utility I, total 03 Pump sets are provided for the domestic, flush and irrigation purposes. These pumps cater the domestic water requirement for the New DH Hostels, D mess and new academic Block. The domestic and flush water consists of 03 pumps in one set whereas the irrigation pump set is provided with 02 Pumps. The Domestic water pump and flush water pumps are controlled by the EC control system and the irrigation water transfer pumps are provided with VR control system which switch on and off pumps as per the requirement and along with certain protections.

Utility-I Domestic Pumps

Utility-I Flush Pumps

Utility-I Garden Pumps

Description	Unit	Domestic Pump No. 1	Domestic Pump No 2	Domestic Pump No.3	Flush Pump No. 1	Flush Pump No.2	Flush Pump No.3	Irrigation Pump No. 1	Irrigation Pump No.2
Design Parameters | Make: WILO Pumps									
Model	--	MVI1607	MVI1607	MVI1607	MVI806	MVI806	MVI806	MVI404	MVI404
Flow rate	m^3/hr	16	16	16	8	8	8	4	4
Head	m	240	240	240	230	230	230	210	210
Speed	rpm	2900	2900	2900	2840	2840	2840	2840	2840
Motor rating	kW	5.5	5.5	5.5	2.2	2.2	2.2	1.1	1.1

Operating Parameters									
Flow rate	m^3/hr	15.2	15.2	15.2	7.6	7.6	7.6	3.8	3.8
Total head developed	m	25	25	25	25	25	25	5	5
Motor I/P Power	kW	2.74	2.51	2.98	2.67	2.15	2.17	0.97	1.07
Motor efficiency	%	87.2	87.2	87.2	83.2	83.2	83.2	80	80
Pump efficiency	%	37.79	41.25	34.74	19.39	24.08	23.85	5.33	4.83
Overall efficiency	%	32.95	35.97	30.30	16.13	20.04	19.85	4.27	3.87

Observations and Recommendations

- It is observed that the efficiency of these pumps lies between (4 to 32%). As per the OEM for the glandless pumps, overall efficiency between 5% to 54% makes a pump highly efficient.
- The domestic and flush water pumps are provided EC-L control system which individually switch on and switch off the pumps as per the requirements.
- In the Auto mode operation initially all the three pumps run but any of the pump may changeover to stand-by mode as per the water requirement in the New academic Block and hostels.
- These pumps operate flawlessly as routine checks are performed with the technical support from the authorized service providers.
- The pumps were installed in 2019 and need to be operated as per the technical instructions of the OEM.

1.22 Utility – II Pumps

Similar to Utility I, total 03 Pump sets are provided for the domestic, flush and irrigation purposes. These pumps cater the domestic and flush water requirement for the New faculty housing (A, B & C Type) and PhD married accommodation (AH-10 Hostel). The domestic and flush water consists of 03 pumps each in one set whereas the irrigation pump set is provided with 02 Pumps. The Domestic water pump and irrigation pumps are controlled by the VR control system which switch on and off pumps as per the requirement and along with certain protections. The flush water pumps are provided with EC-L PLC based control system.

UTILITY II DOMESTIC PUMPS

UTILITY II FLUSH PUMPS

UTILITY II GARDEN PUMPS

Description	Unit	Domestic Pump 1	Domestic Pump 2	Domestic Pump 3	Flush Pump 1	Flush Pump 2	Flush Pump 3	Irrigation Pump 1	Irrigation Pump N2
Design Parameters | Make: WILO Pumps									
Make	--	Wilo Pumps	Wilo Pumps	Wilo Pumps	Wilo Pumps	Wilo Pumps	Wilo Pumps	Wilo Pumps	Wilo Pumps
Model	--	MVI1606	MVI1606	MVI1606	MVI807	MVI807	MVI807	MVI404	MVI404
Flow rate	m^3/hr	16	16	16	8	8	8	4	4
Head	m	240	240	240	230	230	230	210	210
Speed	rpm	2950	2950	2950	2950	2950	2950	2950	2950
Motor rating	kW	4.0	4.0	4.0	3.0	3.0	3.0	1.1	1.1

Operating Parameters									
Flow rate	m^3/hr	15.2	15.2	15.2	7.6	7.6	7.6	3.8	3.8
Total head developed	m	29	29	29	29	29	29	9	9
Motor Input Power	kW	4.88	3.98	3.96	2.51	2.96	2.95	0.96	1.14
Motor efficiency	%	85.8	85.8	85.8	85.0	85.0	85.0	80.0	80.0
Pump efficiency	%	24.61	30.18	30.33	23.92	20.29	20.35	9.70	8.17
Overall efficiency	%	21.12	25.89	26.03	20.34	17.25	17.31	7.77	6.54

Observations and recommendations

- A similar set of pumps are installed at utility II as in Utility I.
- we can observe that the efficiency of these pumps lies between (7 to 26%) which shows that these pumps are highly efficient pumps as claimed by the OEM, M/s Wilo Pumps.
- The flush water pumps are provided EC-L control system which individually switch on or off the pumps as per the requirements.
- The pumps were installed in 2020 and need to be operated as per the technical instructions of the OEM.

1.23 Twin Lobe air Blowers

Two Sewage plants are provided at the campus to treat the received raw sewage from the residences, hostels, mess, Laboratories and other waste water sources. The capacity of each treatment plan is 300 KLD. One Airvak make 67 WC Air blower provided at the equivalization tank for the aeriation and E67 air blower is provided at the SBR (Sequential biological reactor) tank for the aeration. The new 300 KLD SBR is provided with 610 AC Airvak make twin lob air blowers for the aeration of SBR tank.

Air blower 67WC

Air blower E 67C

Air blower 610AC

Performance Analysis of Air blowers at STP Premises				
Description	Units	67 WC BLOWER	E 67 BLOWER	610 AC BLOWER
Design Parameters				
Make	--	AIRVAK	EVEREST	AIRVAK
Flow @0.8 kgf/cm²	m³/hr	427	500	700
Static Pressure	mm WC	8000	6000	5000
Motor Rating	kW	18.5	18.5	18.5
Fan Speed	rpm	1475	1475	1480

Operating Parameters				
Static pressure at fan Inlet	mm WC	-300	-200	-200
Static pressure at fan outlet	mm WC	8000	6000	5000
Fan static pressure	mm WC	8200	6200	5200
Inlet air temperature	°C	26	26	26
Air density	kg/m³	1.24	1.24	1.24
Velocity	m/sec	6.31	3.90	5.77
Cross section area of duct	m²	0.018	0.032	0.032
Quantity	m³/hr	409	450	665
Input Power	kW	18.5	18.5	18.5
Static efficiency of the fan	%	49.12	40.54	49.92

Observations and recommendations

- The Prime mover and the Twin lob blowers are running satisfactorily with sufficient discharge air pressure for aeration.
- The static efficiency of the fan is normal as per the number of years in service.
- Equalization tank may be provided with a stand by air blower for the Aeration of the raw sewage.

1.24 Motor Loading Percentage of various locations

Feeder	Rated kW	Efficiency	V	I	P.F.	P	% Loading
COND WPP-02	40	92.5	412	39.5	0.89	25.09	83.69
COND WPP-03	18.5	90.6	415	25.5	0.90	16.50	89.17
CT Fan Motor-03	7.5	80.2	410	17.9	0.88	11.19	99.87
PCH W PP-02	11.0	89.0	415	17.1	0.91	11.18	99.87
PCH W PP-03	9.3	88.0	415	13.5	0.92	8.93	95.99
SCW PP-03	22.5	92.4	415	20.0	0.89	12.79	56.86
SCW PP-03	7.5	92.0	415	5.8	0.90	3.75	50.03
STP Blower 67 WC	18.5	82.0	415	30.5	0.83	18.20	98.36
STP Blower E67	18.5	88.0	415	29.5	0.83	17.60	95.13
STP Blower 610AC	18.5	87.0	415	30.8	0.83	18.37	99.32

Observations and recommendations:

Mostly motors are designed to run at 50 to 100% of load. Prime movers of the various Pumps and Cooling Towers of AC Plants and STP air blowers were checked for percentage loading. It is evident from the table that motors are suitably loaded as per their ratings. Loading percentage of the SCW (Secondary chilled water pumps) is low as they are connected with the variable frequency drives. The current drawn by each motor is also with in the limit of rated current of the respective motors. It is recommended to replace a motor if the motor is rewound twice or drawing excess current without any additional mechanical frictions.

1.25 Long- & Short-Term Plan with Estimated Budget

ENERGY		
Item	**Cost Rs. L**	**Remarks**
Use of Limit switches to control the operation of exhaust fans in hostel washrooms and Academic Buildings	2.00	Limit switches will switch On the Exhaust fan only when the door is closed. Approx. Energy savings of Rs. 2.00 Lakhs / Month.
Replacement of DOL to Star-Delta Starters	5.00	This will reduce the starting current of the motor and also the Demand. Approx Energy Savings of Rs. 0.10 Lakhs/month
APFC capacitor banks for replacing de-rated capacitors	5.00	This will improve the power factor. Approx Energy Savings of Rs. 0.10 lakhs/month.
Corrective Maintenance for eliminating hot-spots in the Bus-bars	----	Improve Power Availability and Reliability
Use of Occupancy Sensors in all the washrooms of Hostels and Academic Buildings (270 in Hostels, 106 in Academic Buildings)	9.50	Lights in washrooms can be controlled through the occupancy sensors. Energy Savings of Rs. 1.00 Lakh/month
Upgradation distribution panels at four PCCs for modernization of safety devices ACBs and MCCBs	10.00	Improve Power Availability and Reliability
Replacement of DOL starters to VFDs	20.00	The starting current will be reduced. Energy Savings of Rs. 1.00 Lakhs/month
Use of smart meters across the campus	35.00	At present the power consumed by different entities is not measured and also the billing for power consumption for quarters and Vendors is done manually
Use of energy efficient LED lights in hostels, quarters, and Academic buildings	50.00	Present fluorescent lights and CFLs lights consume more energy. Approx. Energy savings of Rs. 3.00 Lakhs / Month
Underground Cabling for HT distribution on campus for minimizing power outage and diesel consumption	100.00	Improve Power Availability and Reliability

Use of BLDC fans in hostel rooms	160.00	Induction motor-based ceiling fans consume more energy compared to BLDC ceiling Fans. Approx. Energy Savings Rs. 6.00 Lakhs / Month
Grid Tied Roof Top Solar On D mess, C wing, and CC, VGH, PCC2A, and PCC5	170.00	375 kWp Solar PV capacity. Energy Savings of Rs.4 lakhs/month.
Retrofitting of existing six DG sets, reducing emissions for legal compliance	200.00	Legal Compliance. Less environmental impact.
1 MWp On Grid Solar PV Power plant (Capex Model)	500.00	The capital cost can be recovered within 3 & ½ years. Approx. Energy Savings of Rs. 9.50 Lakhs/ month
Total Environment Capex	**1266.50**	**Rs. 12.67 Cr**

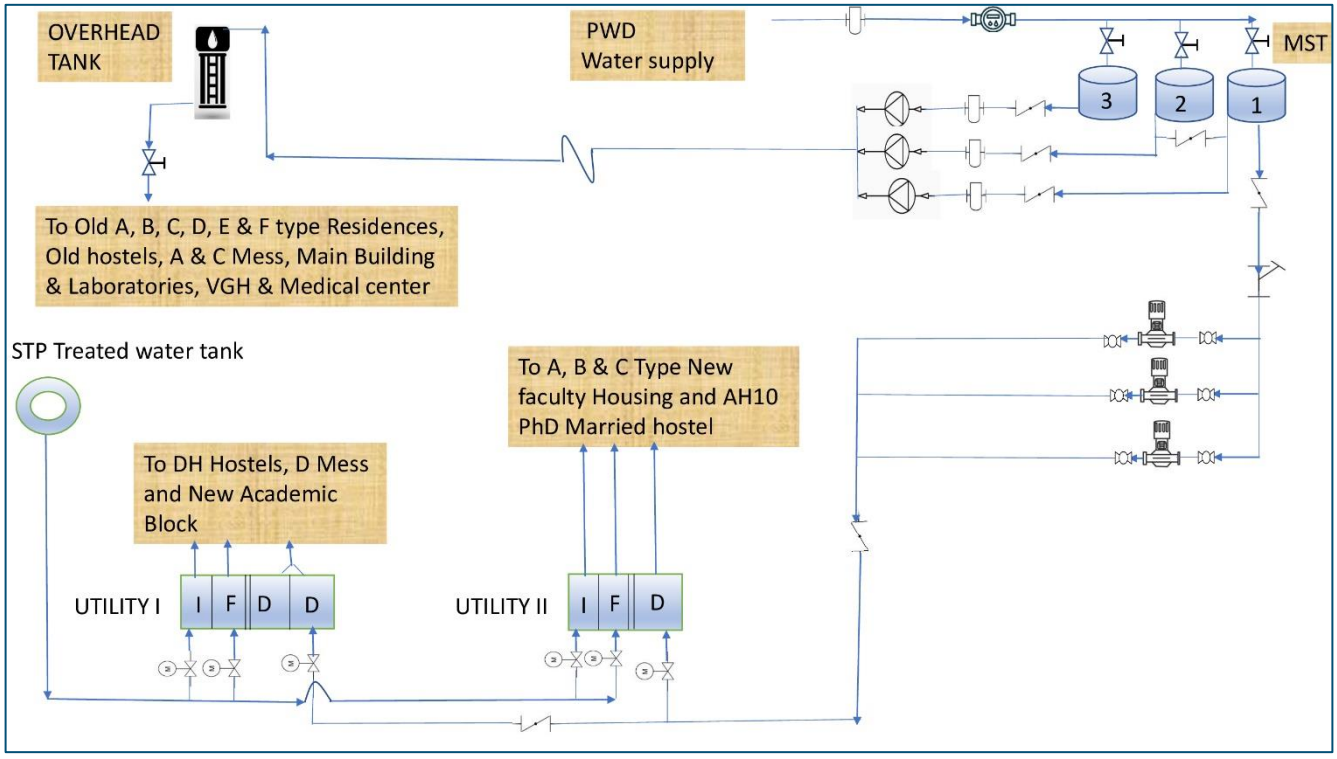
ENVIRONMENT

(Water, Waste, Air and Carbon Footprint)

2. ENVIRONMENT (Water, Waste, Air, Carbon Footprint)

2.1 Water Supply System Layout

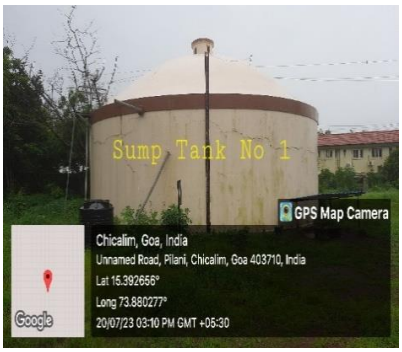
Campus is spread across 6,75,500 Sq-m area. Total number of residents is 5,778 that include students, faculty, non-teaching staff and their family members. The total water requirement for the campus is approximately 8,00,000 liters per day (LPD) or 800 cubic meter per day. Primary sources of drinking water are PWD and water tankers. The same water also used for the academic laboratories and AC plant. Sewage treated water is used for gardening and other domestic purposes. The campus water supply system layout is shown below.



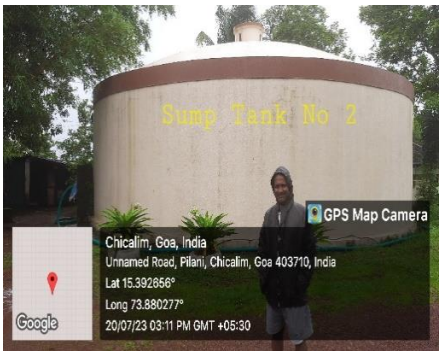
There are three main water storage tanks (MST) inside the campus. The capacity of each storage tank is 4.5 lakhs liters. PWD water supply is received at three storage tanks from which the water is transferred to the overhead tank (capacity 1.5 Lakhs Liter). Subsequently water from the overhead tank is distributed to old quarters A, B, C, D E & F types, main academic building and old hostels, AH1 to AH9 and CH1 to CH7.

Water from one storage tank is also transferred to various tanks in utility-I and utility-II sections. Further from the utility section-I the water is distributed to new hostels: DH1, DH2, DH3, DH4, DH5 & DH6 and new academic block D. From the utility-II section the water is distributed to new faculty quarters (Towers) A, B, C and PhD married hostel.

Each utility section consists of domestic, flush and irrigation tanks.



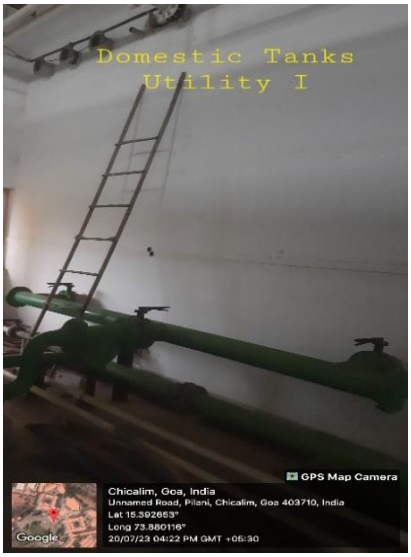
Sump–Tank (Capacity: 4.5 L Liter)



Sump Tank–II (Capacity: 4.5 L Liter)

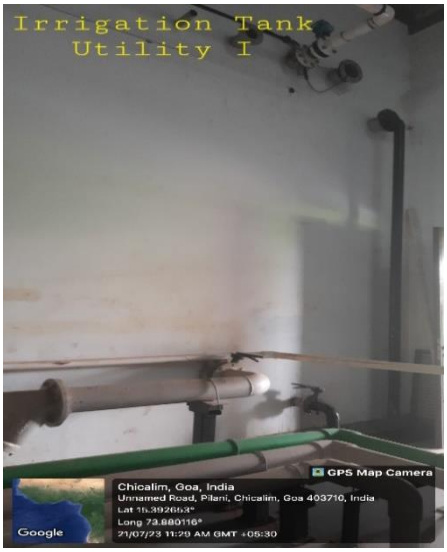
Sump Tank–III (Capacity: 4.5 L Liter)

Overhead Tank (Capacity: 1.5 L Liter)



Domestic Tank Utility–I

Flush Tank Utility–I



Irrigation Tank Utility–I

Domestic Tank Utility–II

Flush Tank Utility–II

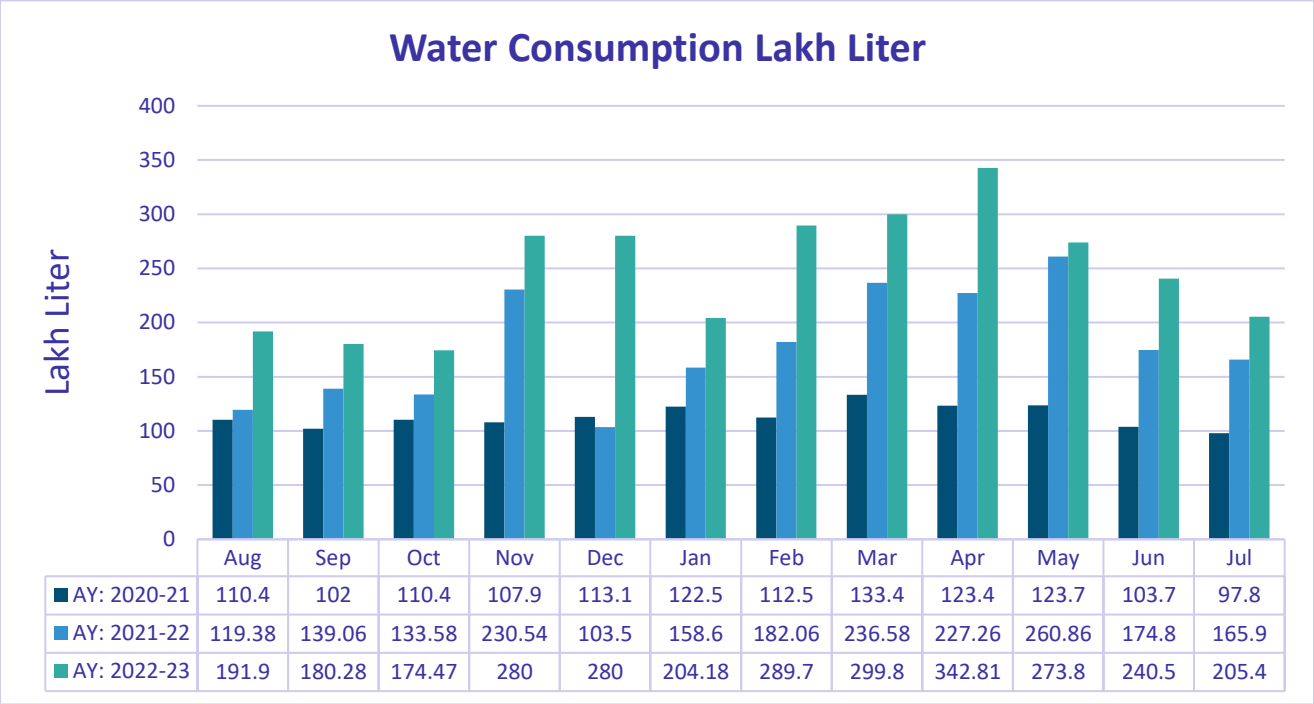
Irrigation Tank Utility–II

Following Table shows summary of capacity of various Tanks

Tank	Capacity (Liter in L)	Location	Water	Used for
Overhead Tank	1.50	Near 33 kVA	PWD	Old residence quarters and old hostels
Storage Tank–I	4.50	Near F Type Quarters	PWD	Old and new residences and hostels
Storage Tank–II	4.50	Near F Type Quarters	PWD	Old and new residences and hostels
Storage Tank–III	4.50	Near F Type Quarters	PWD	Old and new residences and hostels
Domestic Tank Utility–I	2.60	Behind PCC-2	PWD	For DH Hostels and new academic block (D) area
Flush Tank Utility–I	1.30	Behind PCC-2	STP	
Irrigation Tank Utility–I	1.00	Behind PCC-2	STP	
Domestic Tank Utility–II	1.32	Opposite to B3 Tower	PWD	New residences and Gardening area
Flush Tank Utility–II	0.66	Opposite to B3 Tower	PWD	
Irrigation Tank Utility–II	0.97	Opposite to B3 Tower	PWD	

2.2 Consumption of Water

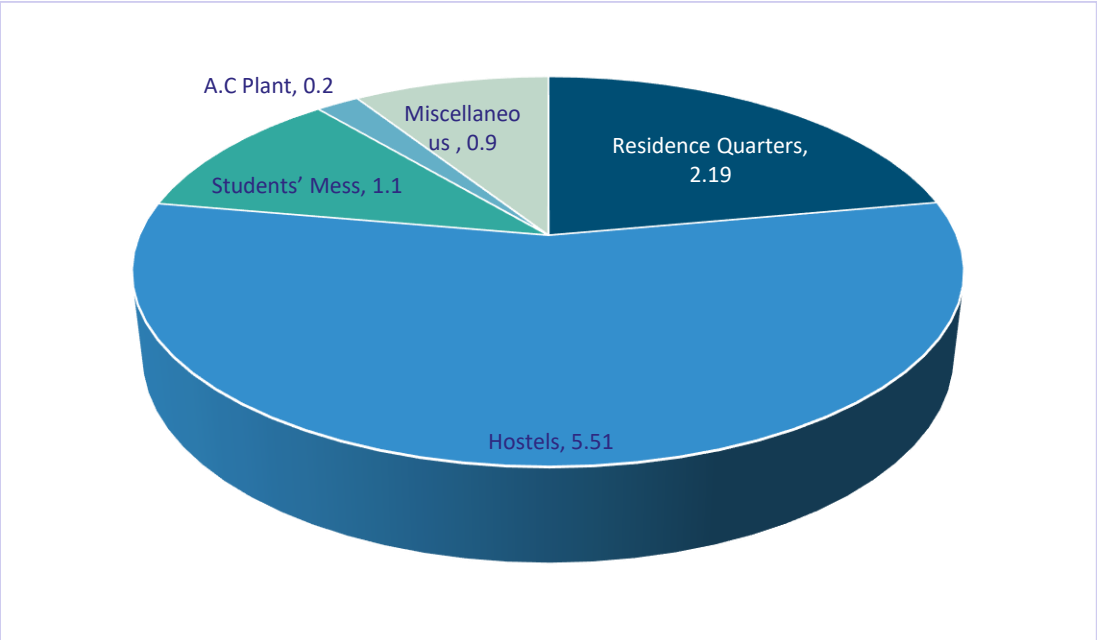
Fresh water is primarily used for drinking in residences and hostels. It is allso used for academic laboratories, AC plant, laundry, mess cooking's, domestic purpose and vendor outlets. The consumption patterns of fresh water for last 3 years is provided in the graph below.



	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
AY: 2020-21	110.4	102	110.4	107.9	113.1	122.5	112.5	133.4	123.4	123.7	103.7	97.8
AY: 2021-22	119.38	139.06	133.58	230.54	103.5	158.6	182.06	236.58	227.26	260.86	174.8	165.9
AY: 2022-23	191.9	180.28	174.47	280	280	204.18	289.7	299.8	342.81	273.8	240.5	205.4

The Total water consumption details in various areas like residence quarters, students hostels & messes, AC plant and miscellaneous are provided in Table 2 and Figure 6. The total water consumption in students' hostels is provided in Table below.

Location	Use Lakh Liter per Day	Remarks
Residence Quarters	2.19	429 Quarters | ~510 LPD per Family
Hostels	5.51	22 Hostels | ~125 LPD per Student
Students' Mess	1.10	3 Messes | ~3,666 LPD per Mess
A.C Plant	0.20	650 TR Central AC Plant
Miscellaneous	0.90	SAC, VGH, Snacks and other food outlets
TOTAL	9.9	STP water is used for flushing in D Hostels and New academic block



Water (PWD + STP) consumption Lakh Liter per Day (Total 9.9 L per Day)

Following Table shows hostel-wise water consumption in students' hostels considering ~125 LPD per student.

#	Hostel	Rooms	Capacity	No of Students	Water Consumption (Liter)
1	AH1	186	184	176	22000
2	AH2	186	184	178	22250
3	AH3	186	184	178	22250
4	AH4	186	184	176	22000
5	AH5	186	185	175	21875
6	AH6	186	184	179	22375
7	AH7	186	185	177	22125
8	AH8	186	185	178	22250
9	AH9	214	214	212	26500
10	CH1	247	245	233	29125
11	CH2	122	121	102	12750
12	CH3	122	121	114	14250
13	CH4	247	245	236	29500
14	CH5/6	242	239	228	28500
15	CH7	75	150	135	16875
16	DH1	100	200	190	23750
17	DH2	100	200	196	24500
18	DH3	100	200	196	24500
19	DH4	100	200	196	24500
20	DH5	319	319	162	20250
21	DH6	206	206	183	22875
	Total	**3682**	**4134**	**3800**	**475000**

Capacity of Hostel water tanks (Capacity in Liters)					
Hostel	Tank capacity per shaft	No. of shafts	Domestic tank water capacity	Flush water tank capacity	Total water capacity
CH-1	4000	5	NA	NA	20000
CH-2	4000	4	NA	NA	16000
CH-3	4000	4	NA	NA	16000
CH-4	4000	5	NA	NA	20000
CH-5	4000	5	NA	NA	20000
CH-6	4000	2	NA	NA	8000
CH-7	NA	NA	20500	10500	31000
AH-1	4000	4	NA	NA	16000
AH-2	4000	4	NA	NA	16000
AH-3	4000	4	NA	NA	16000
AH-4	4000	4	NA	NA	16000
AH-5	4000	4	NA	NA	16000
AH-6	4000	4	NA	NA	16000
AH-7	4000	4	NA	NA	16000
AH-8	4000	4	NA	NA	16000
AH-9	NA	NA	31100	8000	39100
DH-1	NA	NA	18000	9000	27000
DH-2	NA	NA	18000	9000	27000
DH-3	NA	NA	18000	9000	27000
DH-4	NA	NA	18000	9000	27000
DH-5	NA	NA	30500	1500	32000
DH-6	NA	NA	21500	13200	34700

2.3 Water Saving Techniques and Checks

- Water level controller valves are installed both the utility sections, across the DH hostels and the new faculty housings for preventing overflows.
- For continuous monitoring of discharge pressure, hydropneumatics systems, in various tanks of Utility-I and utility-II sections, are installed.
- Water faucets are installed at all wash basins across the academic building and new students' hostels. The same is proposed for the old hostels.
- Frequents rounds by Maintenance assistants during pumping and normal water supply helps in identifying the water leakages and water pressure drop.
- Main building and other areas are manned 24x7 by the securities staff and any water wastage is reported to the concerned authorities.
- Drip irrigation and sprinkler systems for watering the plants / gardens is implemented across the campus.
- Awareness about water savings and environmental protection is being created among the community of the campus by circulating e-mails to the all-campus residents, by organizing the workshops and celebrating environment day.

2.4 Generation of Wastewater

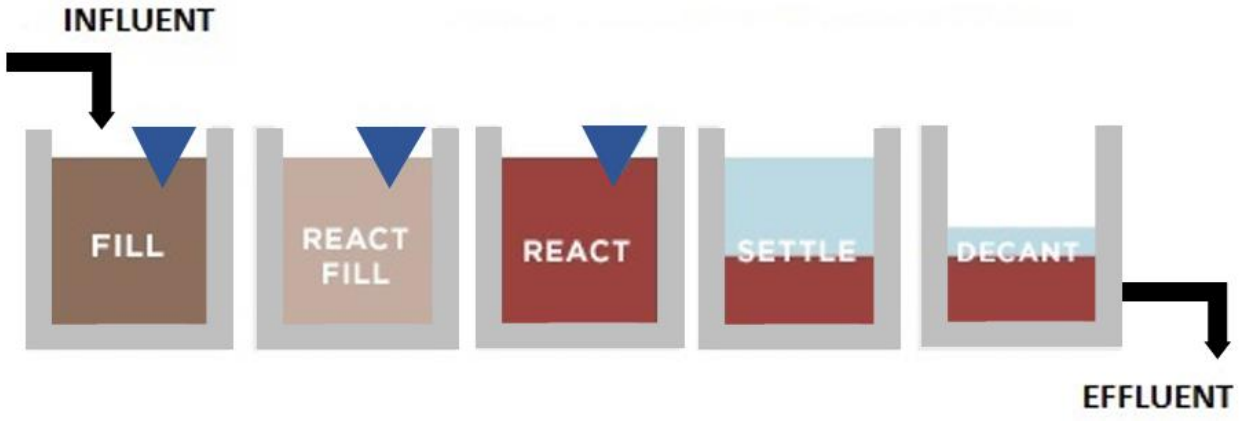
Total wastewater generated is around 90% of the water consumed. The major sources of wastewaters are sewage from residence quarters, hostels, hostel messes and vendor outlets. All the generated wastewater is treated in sewage treatment plant (STP) located behind the main academic building. The capacity of the STP is 900 KLD. Below photos show of equalization tank of treatment plant.

The sewage treatment plant is working on the principle of the sequential batch reactor (SBR) technology. The SBR process is a modified activated sludge process that uses aerobic microorganisms to eliminate the organic pollutants contained in wastewater. The SBR process works in sequences of batch processes scientifically designed to overcome problems associated with old-fashioned continuous processes. SBR can be operated in 2 to 4 cycles per day, depending on the quantity of wastewater present, making it advantageous in tolerating flow rate variations.

SBR tank system

2.5 Water Treatment Process

The SBR process as shown below is completed in four parts namely, filling or charging, react or aeration, settling and decanting.



SBR process flow diagram

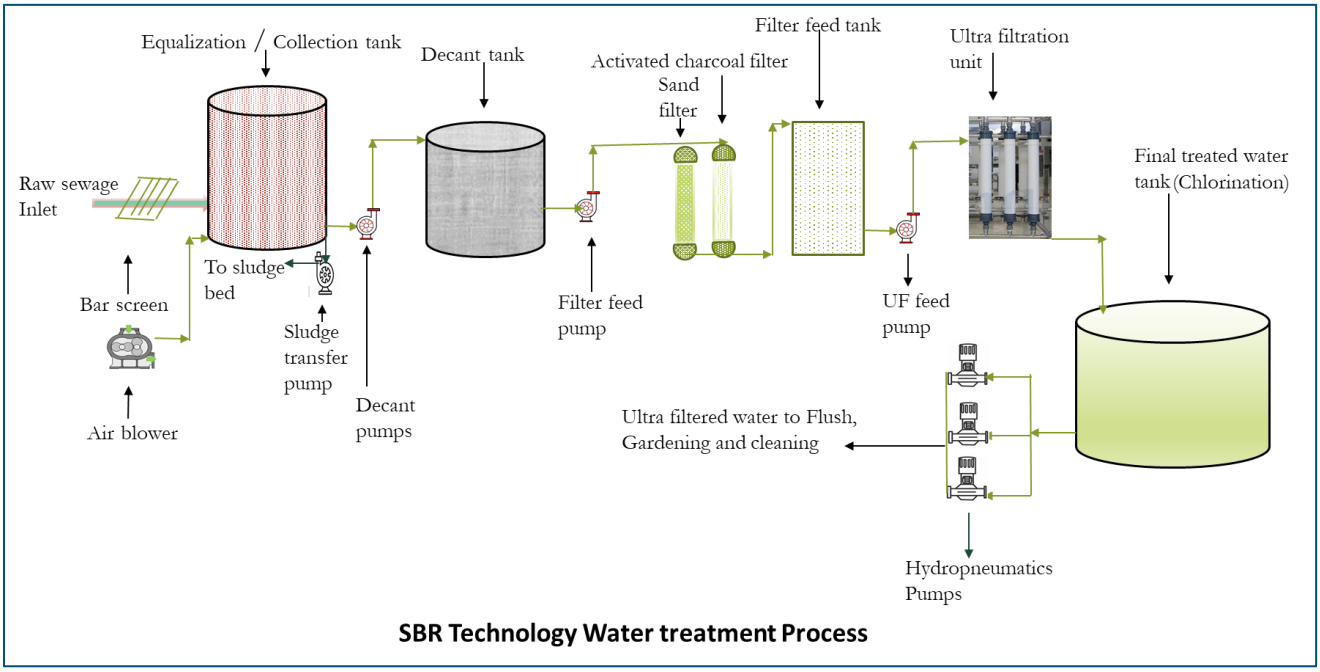
1. Charging: From the collection tank the water is fed to the SBR tank through the feed pumps and aeration remains continue with the Twin lob air blowers. This phase is called charging.

2. Aeration: The actual biological cleaning by microorganisms now takes place in the SBR tank. Short aeration and rest phases alternate in a controlled cleaning process. The so-called activated sludge can now develop with millions of microorganisms and clean the water thoroughly.

3. Settling: This is also called rest phase. After aeration rest phase follows, during this the live sludge sinks to the bottom of the system. This allows a clarified water zone to form at the top of the SBR tank.

4. Decanting: During decant phase, the water from the SBR tank (not more than 60% of the surface water) is transferred to the decant tank for further treatment in the various filters.

A typical block diagram for the campus SBR system is shown below



SBR Technology Water treatment Process

After completion of the sequential batch reactor process the Decant water is pumped through the sand and activated charcoal filters and post filtration the water is received in the filter feed tank. A sand filter is one of the important parts of any water filtration system. A combination of sand is used with different particle sizes. The sand filter size will depend on the flow rate of the liquid. Sand filters are usually placed in starting of the water filtration process, and are followed by activated carbon filters. Activated carbon filters play a very crucial role in the process of water purification. The Carbon filters remove chlorine, volatile organic compounds, odors, and unpleasant tastes from water. They contain activated carbon as the filter media which is extremely porous and have a large surface area. Impurities get absorbed into the activated carbon upon passing through; heavy metals are removed once they come in contact with this filter material. Much cleaner water leaves the activated charcoal filters.

Sand and activated charcoal Filter No. 1

Sand and activated charcoal Filter No. 2

Further the filtered water is collected in the filter tank which is again pumped through the Ultra filtration unit before receiving in the final treated water tank. The ultra-filtration completely performs the removal of micro granular particles, germs and pathogenic microbes.
The ultrafiltration membranes installed at sewage treatment plant is shown in the below photograph.

Ultrafiltration Membrane Unit

After the ultrafiltration water is received in the final treated water tank. From here hydropneumatics system is fitted to transfer the water to Utility 1& 2 for flushing and gardening purposes. From utilities water is supplied to the gardens by the gardening system through various outlet taps water is drawn for the gardening purposes.

The detail analysis of treated water is done every month and parameters analyzed are the BOD, COD, TSS, pH, TDS, Oil and Grease. The treated water quality complies all the guidelines of Goa State Pollution Control Board (GSPCB). The detail report on water quality analysis of treated water is shown below.

2.6 Test Reports

GADARK LAB PVT. LTD.

INDUSTRIAL ANALYSTS & CONSULTANTS

LAB.: H-54, Additional M.I.D.C. Kudal, Taluka - Kudal, District - Sindhudurg - 416 525.
Tel. : (02362) 223519 • E-mail : info@gadark.in • Website : www.gadark.in

OFF.: 15, Hindustan Kohinoor Industrial Complex, L.B.S. Marg, Vikhroli (West), Mumbai - 83.
Tel.: (022) 2577 7069 / 2577 7070 / 2085 0091 • +91 93213 12367

TEST REPORT

Doc.No: GLPL/QF/7.8/01

Test Report No.	GW/E/23/06095	T.R. Date:	19/06/2023
Customer Name and Address	**M/s. BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE SUREY NO. 189/1 (PLOT P4), 189/1 (PLOT P2), 190/1, 191/1,2 & 3,192/1, 193/1, 229/1, 230/1,232/1,233/1, 234/1, 2 & 3, 235/1 & 3, 241/1 & 243/1 SANCOALE, MORMUGOA, GOA**		
Letter Ref/Date	As per Dated 14/06/2023		
Lab Reference No.	GW/E/23/06095	Page No.	1 of 1
Sampling Done On	14/06/2023	Sample Received on	14/06/2023
Sample Collected By	Mr.Shirishkumar Rane	Analysis Period	14/06/2023 To 19/06/2023
Sample Description	STP Outlet Water Sample, 2000 ml in Plastic Bottle + Glass Bottle		

ANALYSIS REPORTS:

Parameters	Units	Test Result	*Limits	Methods
pH	---	7.13	5.5 To 9.0	APHA (23rd Edition) 4500 H+
COD	mg/ltr	36	<50.00	APHA (23rd Edition) 5220 B
BOD 3 days 27°C	mg/ltr	7.65	<10.00	IS 3025 (Part 44) : 1993
Total Suspended Solids at 105°C	mg/ltr	11	<20.00	APHA (23rd Edition) 2540 D
Oil & Grease	mg/ltr	<0.1	<10.00	APHA (23rd Edition) 5520 B

***Limits :** As per GSPCB Consent No. 12/2022-PCB/1183593/R0009188

End

For **GADARK LAB PVT. LTD.**

AUTHORISED SIGNATORY
[SANTOSH V. ZULPE]

CHECKED BY

Note:
1. Results relate only to the sample/s tested, only in case of samples submitted by customer & not drawn by GLPL.
2. Test Report shall not be reproduced except in full, without written approval of the laboratory.
3. Samples will be preserved for a period 15 days from the delivery of Test Report.
4. Customer complaint register is available at laboratory.
5. Calibration details of the equipments used in monitoring and/or analysis is back side of analysis report.

Report on water quality analysis of treated water for June 2023

GADARK LAB PVT. LTD.

INDUSTRIAL ANALYSTS & CONSULTANTS

LAB.: H-54, Additional M.I.D.C. Kudal, Taluka - Kudal, District - Sindhudurg - 416 525.
Tel. : (02362) 223519 • E-mail : info@gadark.in • Website : www.gadark.in

OFF.: 15, Hindustan Kohinoor Industrial Complex, L.B.S. Marg, Vikhroli (West), Mumbai - 83.
Tel.: (022) 2577 7069 / 2577 7070 / 2085 0091 • +91 93213 12367

TEST REPORT

Doc.No: GLPL/QF/7.8/01

Test Report No.	GW/E/23/06096	T.R. Date:	19/06/2023
Customer Name and Address	**M/s. BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE SUREY NO. 189/1 (PLOT P4), 189/1 (PLOT P2), 190/1, 191/1,2 & 3,192/1, 193/1, 229/1, 230/1,232/1,233/1, 234/1, 2 & 3, 235/1 & 3, 241/1 & 243/1 SANCOALE, MORMUGOA, GOA**		
Letter Ref/Date	As per Dated 14/06/2023		
Lab Reference No.	GW/E/23/06096	Page No.	1 of 1
Sampling Done On	14/06/2023	Sample Received on	14/06/2023
Sample Collected By	Mr.Shirishkumar Rane	Analysis Period	14/06/2023 To 19/06/2023
Sample Description	STP Inlet Water Sample, 2000 ml in Plastic Bottle + Glass Bottle		

ANALYSIS REPORTS:

Parameters	Units	Test Result	Methods
pH	---	7.35	APHA (23rd Edition) 4500 H^+
COD	mg/ltr	432	APHA (23rd Edition) 5220 B
BOD 3 days 27°C	mg/ltr	149.85	IS 3025 (Part 44) : 1993
Total Suspended Solids at 105°C	mg/ltr	126	APHA (23rd Edition) 2540 D
Oil & Grease	mg/ltr	9.8	APHA (23rd Edition) 5520 B

End

For **GADARK LAB PVT. LTD.**

AUTHORISED SIGNATORY
[SANTOSH V. ZULPE]

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Note:
1. Results relate only to the sample/s tested, only in case of samples submitted by customer & not drawn by GLPL.
2. Test Report shall not be reproduced except in full, without written approval of the laboratory.
3. Samples will be preserved for a period 15 days from the delivery of Test Report.
4. Customer complaint register is available at laboratory.
5. Calibration details of the equipments used in monitoring and/or analysis is back side of analysis report.

Report on STP inlet water quality analysis for June 2023

GADARK LAB PVT. LTD.

INDUSTRIAL ANALYSTS & CONSULTANTS

LAB.: H-54, Additional M.I.D.C. Kudal, Taluka - Kudal, District - Sindhudurg - 416 525.
Tel. : (02362) 223519 • E-mail : info@gadark.in • Website : www.gadark.in

OFF.: 15, Hindustan Kohinoor Industrial Complex, L.B.S. Marg, Vikhroli (West), Mumbai - 83.
Tel.: (022) 2577 7069 / 2577 7070 / 2085 0091 • +91 93213 12367

TEST REPORT

Doc.No: GLPL/QF/7.8/01

Test Report No.	GW/E/23/06097	T.R. Date:	19/06/2023
Customer Name and Address	**M/s. BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE SUREY NO. 189/1 (PLOT P4), 189/1 (PLOT P2), 190/1, 191/1,2 & 3,192/1, 193/1, 229/1, 230/1,232/1,233/1, 234/1, 2 & 3, 235/1 & 3, 241/1 & 243/1 SANCOALE, MORMUGOA, GOA**		
Letter Ref/Date	As per Dated 14/06/2023		
Lab Reference No.	GW/E/23/06097	Page No.	1 of 1
Sampling Done On	14/06/2023	Sample Received on	14/06/2023
Sample Collected By	Mr.Shirishkumar Rane	Analysis Period	14/06/2023 To 19/06/2023
Sample Description	STP Outlet Water Sample, 200 ml in Glass Bottle		

ANALYSIS REPORTS:

Parameters	Units	Test Result	*Limits	Methods
Fecal coliforms at 44.5°C for 24 hrs.	Org/100 ml	25	100	APHA (23rdEdition) 9221-E

***Limits :** As per GSPCB Consent No. 12/2022-PCB/1183593/R0009188

End

For **GADARK LAB PVT. LTD.**

AUTHORISED SIGNATORY
[SANTOSH V. ZULPE]

CHECKED BY

Note:
1. Results relate only to the sample/s tested, only in case of samples submitted by customer & not drawn by GLPL.
2. Test Report shall not be reproduced except in full, without written approval of the laboratory.
3. Samples will be preserved for a period 15 days from the delivery of Test Report.
4. Customer complaint register is available at laboratory.

Report on fecal coliforms of STP outlet water quality analysis for June 2023

2.7 Treated STP Water

Treated water from STP is used for gardening, cleaning and other domestic purpose. Total quantity of treated water is around 6.40 Lakh liters per day. Around 4.5 Lakh liters of treated water is used for gardening and around 1.9 Lakh liters is used for cleaning purpose.

2.8 Wastewater from academic laboratories

The wastewater is also generated from academic laboratories in particular Biological Science, Chemistry and Chemical labs. Most of the chemicals used in these academic laboratories are organic in nature and are biodegradable. The volume and concentrations of such used chemicals are very less compared to volume of total wastewater generated leading very high dilution. Very few inorganic chemicals are used in large quantity like calcium carbonate in Chemical Engineering laboratories. Calcium carbonate is used in slurry form which is collected and transported to concrete settling tank built near one of the Chemical Engineering laboratories.

2.9 Disposal/discard of expired chemicals and hazardous

Disposal/discard of expired chemicals and hazardous chemicals is planned to be done through authorized vendor certified by Goa State regulation body. The acid and alkaline waste solutions are neutralized before leaving in the drain. Similarly, the segregation of chemicals at the source is also being practiced.

Waste

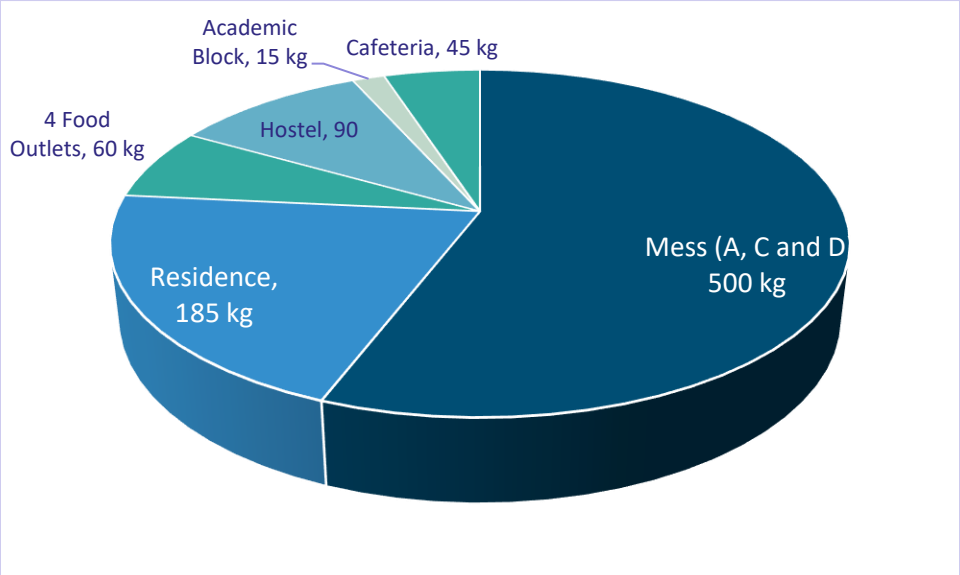
2.10 Waste collection details

The waste management of the campus is outsourced to the agency Goa Health Monitoring Services (GHMS), Goa. The agency has required compliance documents. The details of total waste collected per day is given below.

Type of Waste	Tones per day
Dry	~0.2
Wet	~0.7
Total	~0.9

2.11 Sources of Waste Generation

Approximate Average waste generated per day in kg					
#	Area	Population Density	Wet (kg)	Dry (kg)	Total (kg)
1	Mess (A, C, D) 2 meals	~9000 students	450	50	500
2	Residence	1003 (429 families)	150	35	185
3	5 Food Outlets	~650 customers	20	40	60
4	Hostel	2675	15	75	90
5	Academic Block	~500	10	5	15
6	Cafeteria	~400 customers	30	15	45
	Total Quantum of waste generated		675	220	895



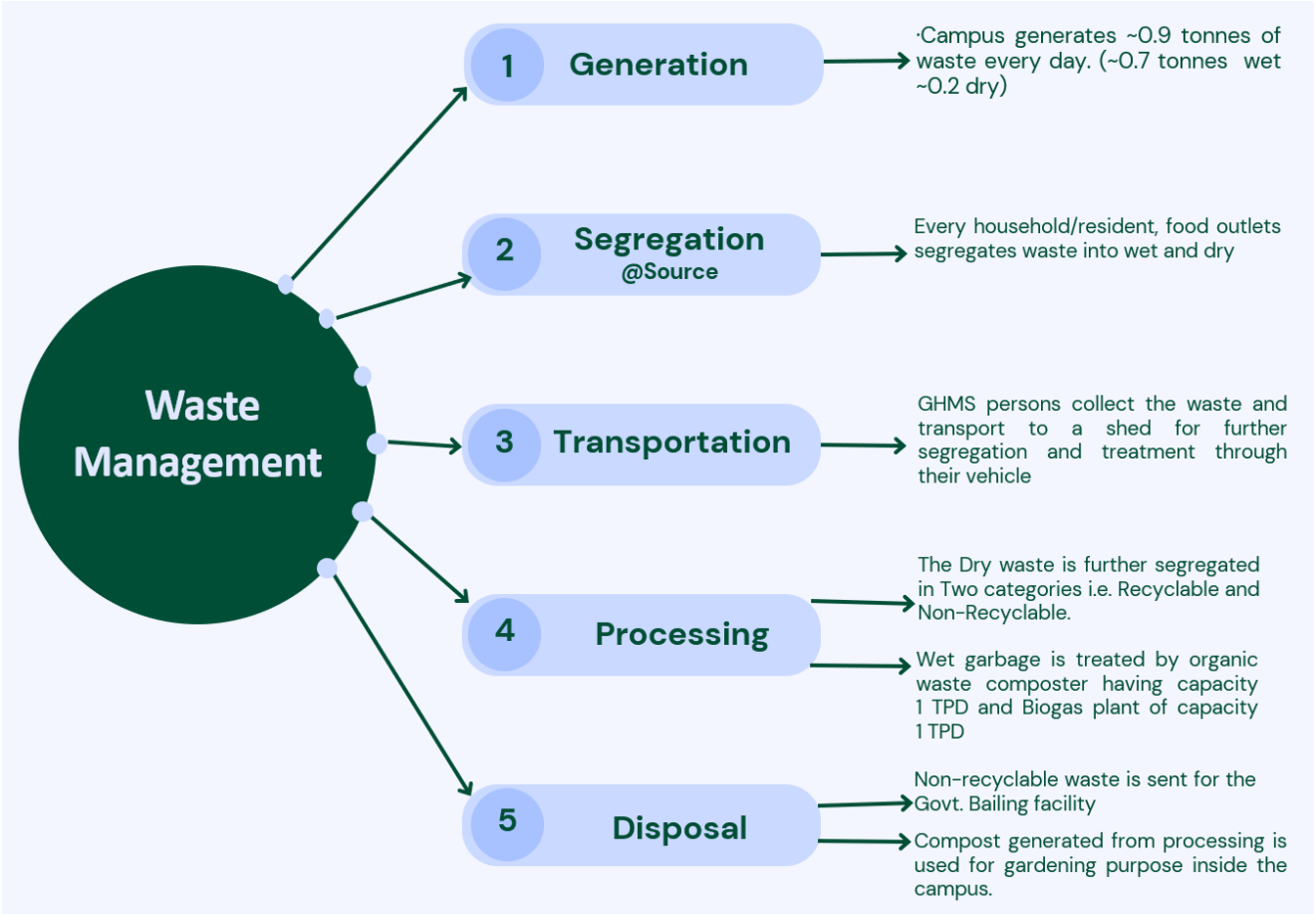
Waste Generation Total (kg)

2.12 Colour Coded Dustbins

Four colour coded dustbins are provided across the campus for the various types of collection as shown below:

28 Nos	121 Nos	2 Nos	12 Nos
Total bins across the campus placed in hostels, residence quarters, academic blocks, shopping complex, medical centre and common areas			

2.13 Waste Management Process



2.14 Solid Waste Management Process

- The daily waste collected from the color-coded dust bin points placed in different locations like Administration Blocks, Hostel Blocks, Residential areas, Canteens (Mess) and commercial outlets is transported to segregation yard for the finer segregation prior to sending to authorized recyclers.
- Awareness for waste segregation is done within the campus through emails with waste segregation posters carrying necessary information are sent to the residents.
- Campus clean drive is observed on regular basis to minimize the spread of dry waste.
- Further the waste is segregated into dry, weight, e-waste and sanitary wastes. The details are mentioned below

Dry Waste

- The segregated dry waste collected from the campus is transported to the segregation yard.
- The dry waste is further segregated into recyclable and non-recyclable. The non-recyclable waste is sent for the bailing facility to the Pollution Board authorized recyclers.

Wet Waste

- Wet waste collected from the campus is treated in Organic waste composter of capacity 1 TPD and biogas plant.
- The compost generated is used for gardening purpose within the campus.

e-Waste

- Designated area in the in-house waste management shed is demarcated for interim storage of E-Waste. The discarded e-wastes from all the blocks in the campus is sent to the interim storage room, and stored there until it is sent to Pollution Board appointed e-waste authorized recyclers. The residents of campus sometimes handover this waste to the regular waste collectors.

Sanitary Waste

- Currently the collection and disposal of sanitary waste is handled by GHMS as a interim arrangement, however this campus is in progress of procurement of equipment's for onsite scientific disposal of sanitary waste.

Hazardous Waste

- Hazardous waste such as oil generated from DG sets is collected as when it is generated and it is handed over to authorized collection agency

Door to door collection

Transportation of the waste

Segregation yard

Organic Waste Composter

2.15 e-mail communication to the students, faculty and staff

Swachh Bharat Abhiyan

BITS PILANI GOA CAMPUS

Waste Segregation Guide
कचरा व्यवस्थापन मार्गदर्शक

WET WASTE ओला कचरा

- Vegetable peels, Fruit peels
- Rotten fruits and vegetables
- Leftover food
- Used tea / tea bags
- Used coffee ground,
- Coconut fiber & shells
- Egg shells
- Mango kernel & any seed
- Used garlands / dry flowers
- Spoiled spices
- Floor sweeping dust
- Meat & non-veg remains
- Expired bread, biscuits and other food items
- Hairs
- Garden shrubs

DRY WASTE सुखा कचरा

- Plastic covers / Bags
- Newspapers
- Card boards
- Styrofoam
- Aluminum foils
- Broken stationery like used pens pencil sharpener
- Chips/Eatables Tetra packs, covers, boxes
- Chocolate wrappers
- Used insect repellant bottles
- Containers/Sachets (shampoo, creams, Cosmetic, Toothpaste, Floor cleaners)
- Used razor / razor blades
- Ghee / oil packets / cans
- Unusable shoes, tooth brush
- PET bottles
- Broken plastic items
- Cotton/ tissue papers/Napkins used for Non medical purpose
- Destroyed old cushions/brooms/ Leather, Rexene, rubber

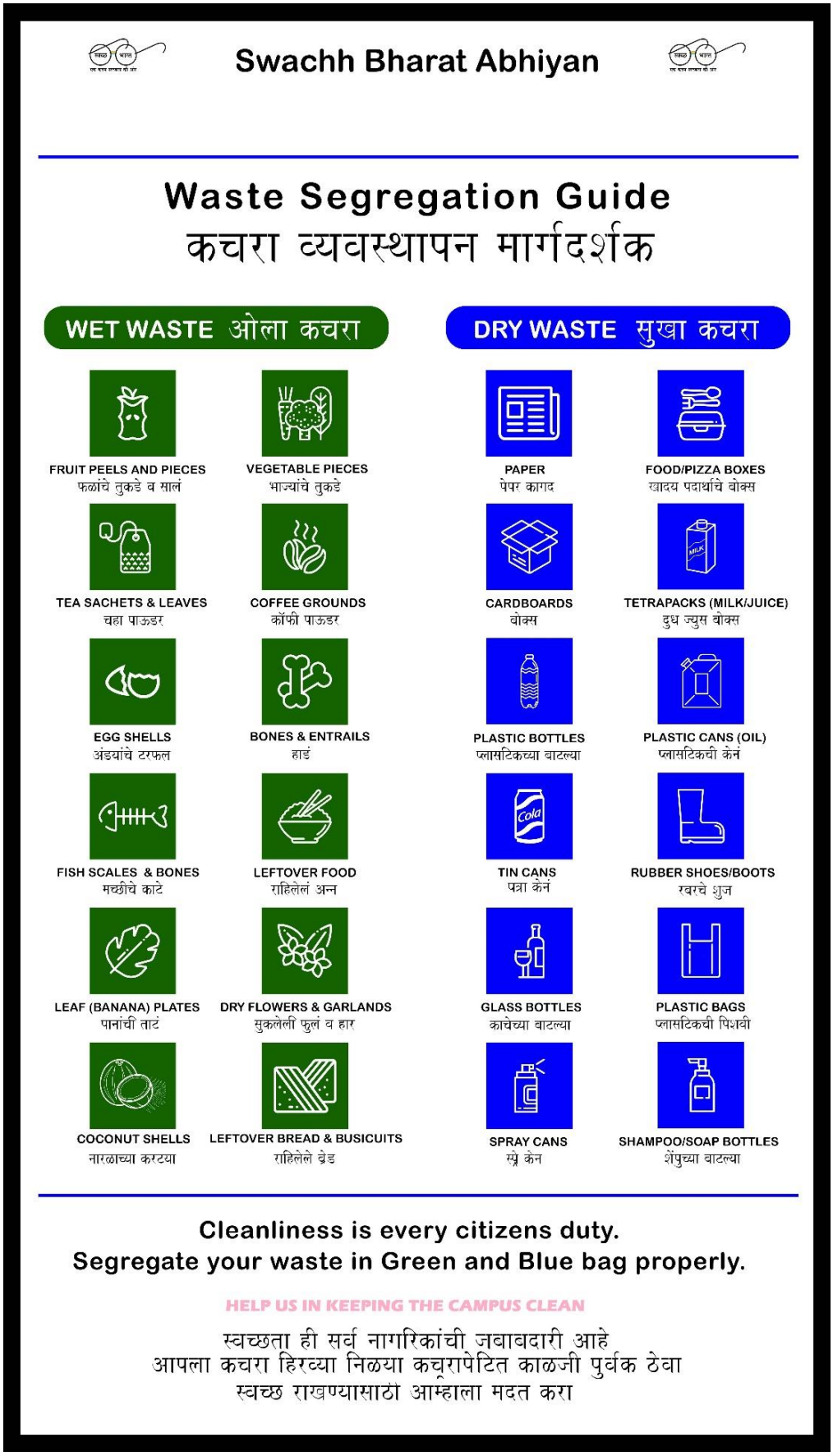
Cleanliness is every citizens duty.
Segregate your waste in Green and Blue bag properly.

स्वच्छता ही सर्व नागरिकांची जबाबदारी आहे
आपला कचरा हिरव्या निळया कचरापेटित काळजी पुर्वक ठेवा

REDUCE-REUSE-RECYCLE

A GHMS & BITS PILANI GOA INITIATIVE

2.15 e-mail communication to the students, faculty and staff



2.16 Biomedical Waste

- The campus has onsite Medical Centre (non-bedded). Average daily footfall is 70-75 patients, with minor medical procedures conducted on OPD level. The medical center generates 1-2 Kgs of Biomedical waste on a daily basis across all 4 categories (Yellow-Red-White-Blue).
- Color coded HDPE bins with biomedical waste bags are provided for segregation, separate bins with lid are made available for interim storage of Biomedical waste.
- As per the provisions mentioned in the biomedical waste management and handling rules, an agreement is done with the Goa State Pollution Control Board authorized agency. The details of category wise biomedical waste generated are shown below.

Contaminated waste (Recyclable) / Plastic Solid Waste: Waste generated from disposal items tubbing's, catheters, IV sets without needles, Syringes (without needles and fixed needle syringes), materials used for cannulation, cartridges, tips, urine bags, droppers, non-glass vacutainers with their needles cut, vials, centrifuge tubes, dosing syringes, Gloves, bottles, intravenous tubes and sets. urine bags.

Glassware: Broken or discarded and contaminated glassware

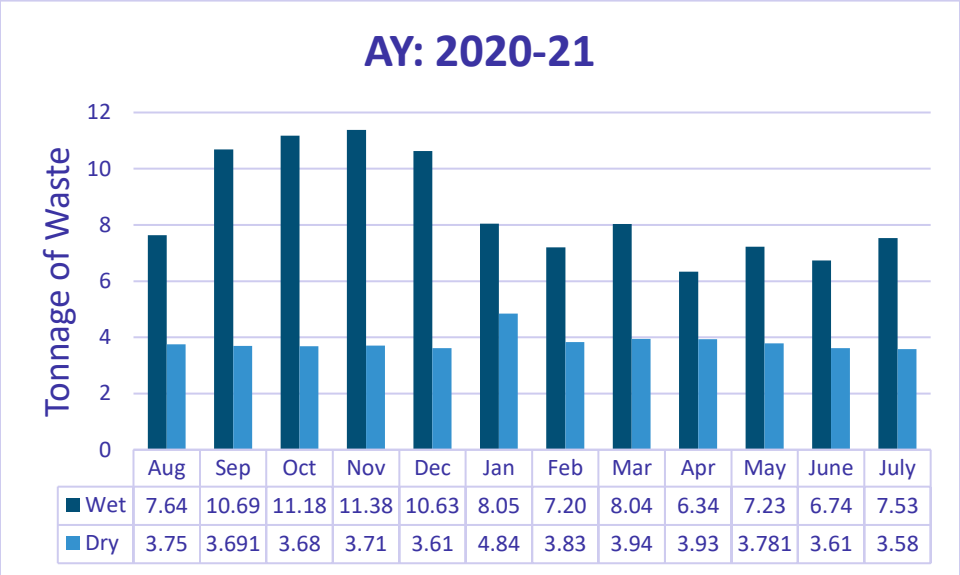
Waste Sharps including metals: Needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades

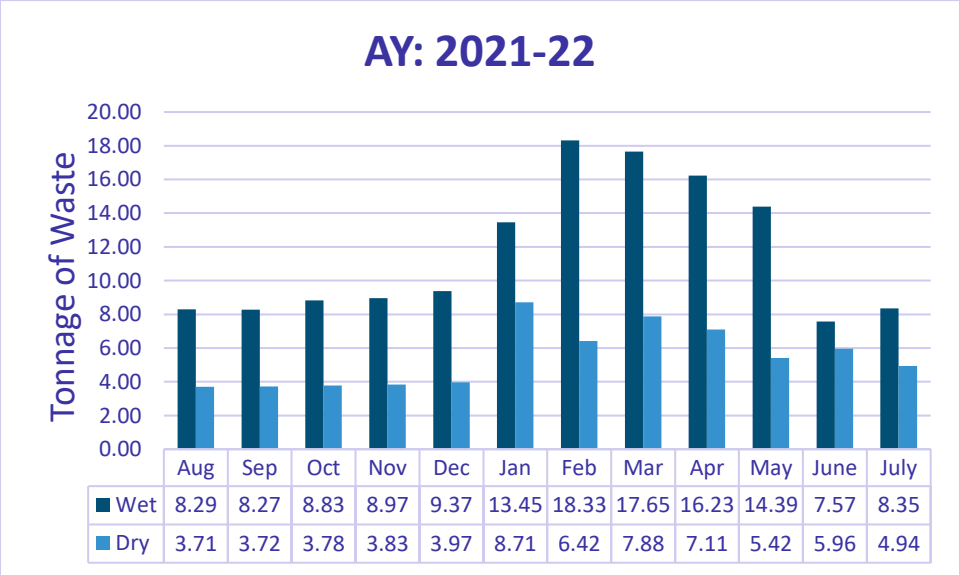
Solied Waste (Non-Plastic Solid Waste): including cotton, dressings, soiled plaster casts, lines, beddings, swabs, mops, sanitary pads, paper, tissue paper, bandages, tongue depressors, head caps, adhesive tapes, masks and any non-plastic items that are contaminated with biological fluids.

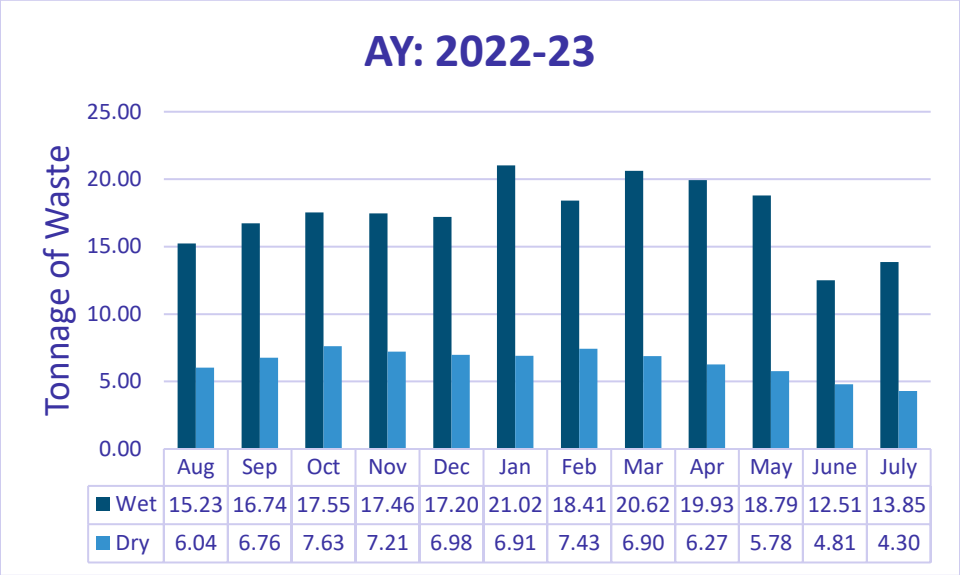
Average Biomedical waste generation for Medical Centre located in campus			
Red	Blue	White	Yellow
15 kg per month	3 kg per month	9 kg per month	28.5 kg per month

Solid Waste Data for the last 3 Academic years			
Academic Year	AY: 2020–21 (Tones)	AY: 2021–22 (Tones)	AY: 2022–23 (Tones)
Dry Waste	45.95	65.45	81.00
Wet Waste	102.63	139.00	209.20
e-Waste	0	0.073	5.11
Hazardous Waste	350 Ltr Oil	0	380 Ltr Oil

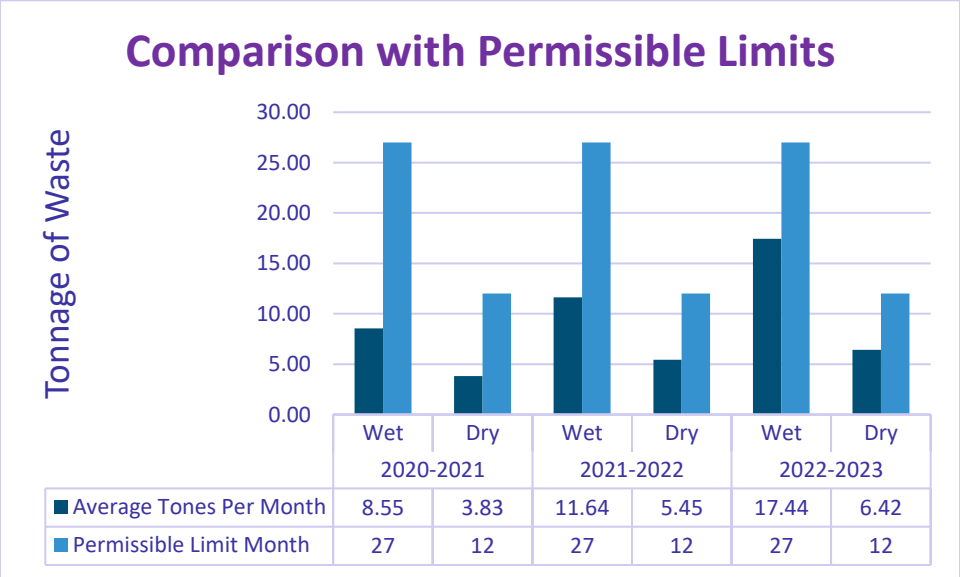
Following 3 column graphs show tonnage of wet and dry waste generated during the last three academic years: AY: 2020–21, AY: 2021–22 and AY: 2022–23 in the campus.







As per the chart shown below the waste generated per month is well below the given limits for the campus.



Following Table shows compost generated using an installed organic waste composter within premises.

Academic Year	AY: 2020–21	AY: 2021–22	AY: 2022–23
Wet Waste (Tone)	102.64	139.70	209.20
Compost generated (Tone)	10.26	13.97	20.92

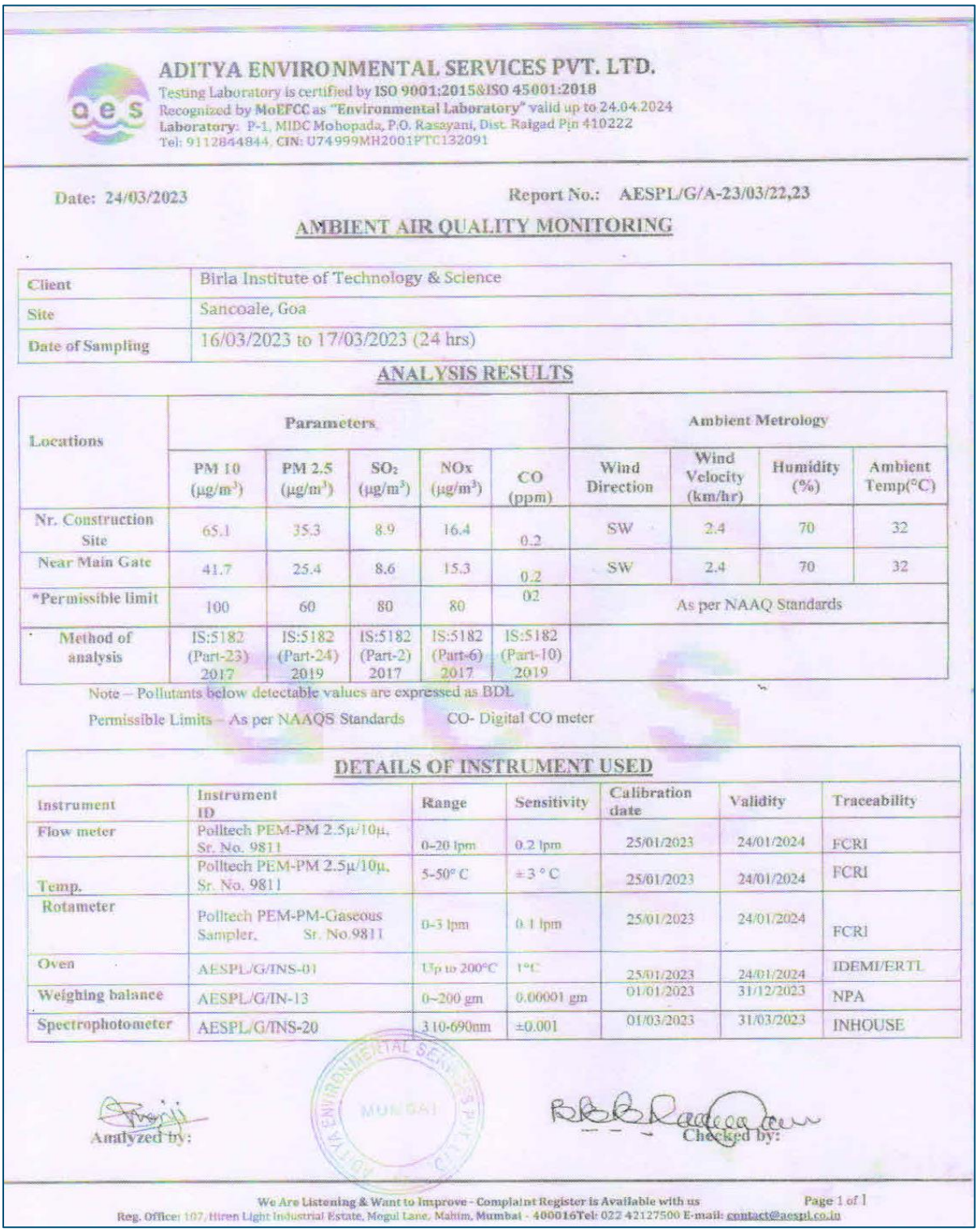
- The generated compost is used as manure in In-House Garden and Green Cover
- GWMC Bailing Facility-Verna, Authorized Recyclers recycles the dry waste in Murmogoa Taluka

2.17 Biogas Plant

Campus has a horizontal plug flow reactor which can process up to 1 ton of organic waste per day. This was installed in November-2010 and is functioning since then. This was used to process one-ton organic waste per day for couple of years and was supplying biogas to cafeteria nearby. Currently the loading is decreased to 300 – 500 kg per day and the biogas generated is flared.

Air

Ambient air quality of the campus was recorded by the certifying agency M/S Aditya Environmental Services Pvt Ltd during 16-Mar, 2023 to 17-Mar, 2023. The test certificate is shown below. The air quality was recorded at the main gate and construction site. The required parameters are within the limits as observed from the report.



ADITYA ENVIRONMENTAL SERVICES PVT. LTD.

Testing Laboratory is certified by ISO 9001:2015&ISO 45001:2018
Recognized by MoEFCC as "Environmental Laboratory" valid up to 24.04.2024
Laboratory: P-1, MIDC Mohopada, P.O. Rasayani, Dist. Raigad Pin 410222
Tel: 9112844844, CIN: U74999MH2001PTC132091

Date: 24/03/2023 Report No.: AESPL/G/A-23/03/22,23

AMBIENT AIR QUALITY MONITORING

Client	Birla Institute of Technology & Science
Site	Sancoale, Goa
Date of Sampling	16/03/2023 to 17/03/2023 (24 hrs)

ANALYSIS RESULTS

Locations	Parameters					Ambient Metrology			
	PM 10 (µg/m³)	PM 2.5 (µg/m³)	SO_2 (µg/m³)	NOx (µg/m³)	CO (ppm)	Wind Direction	Wind Velocity (km/hr)	Humidity (%)	Ambient Temp(°C)
Nr. Construction Site	65.1	35.3	8.9	16.4	0.2	SW	2.4	70	32
Near Main Gate	41.7	25.4	8.6	15.3	0.2	SW	2.4	70	32
*Permissible limit	100	60	80	80	02	As per NAAQ Standards			
Method of analysis	IS:5182 (Part-23) 2017	IS:5182 (Part-24) 2019	IS:5182 (Part-2) 2017	IS:5182 (Part-6) 2017	IS:5182 (Part-10) 2019				

Note – Pollutants below detectable values are expressed as BDL

Permissible Limits – As per NAAQS Standards CO- Digital CO meter

DETAILS OF INSTRUMENT USED

Instrument	Instrument ID	Range	Sensitivity	Calibration date	Validity	Traceability
Flow meter	Polltech PEM-PM 2.5µ/10µ, Sr. No. 9811	0-20 lpm	0.2 lpm	25/01/2023	24/01/2024	FCRI
Temp.	Polltech PEM-PM 2.5µ/10µ, Sr. No. 9811	5-50° C	± 3 ° C	25/01/2023	24/01/2024	FCRI
Rotameter	Polltech PEM-PM-Gaseous Sampler, Sr. No.9811	0-3 lpm	0.1 lpm	25/01/2023	24/01/2024	FCRI
Oven	AESPL/G/INS-01	Up to 200°C	1°C	25/01/2023	24/01/2024	IDEMI/ERTL
Weighing balance	AESPL/G/IN-13	0-200 gm	0.00001 gm	01/01/2023	31/12/2023	NPA
Spectrophotometer	AESPL/G/INS-20	310-690nm	±0.001	01/03/2023	31/03/2023	INHOUSE

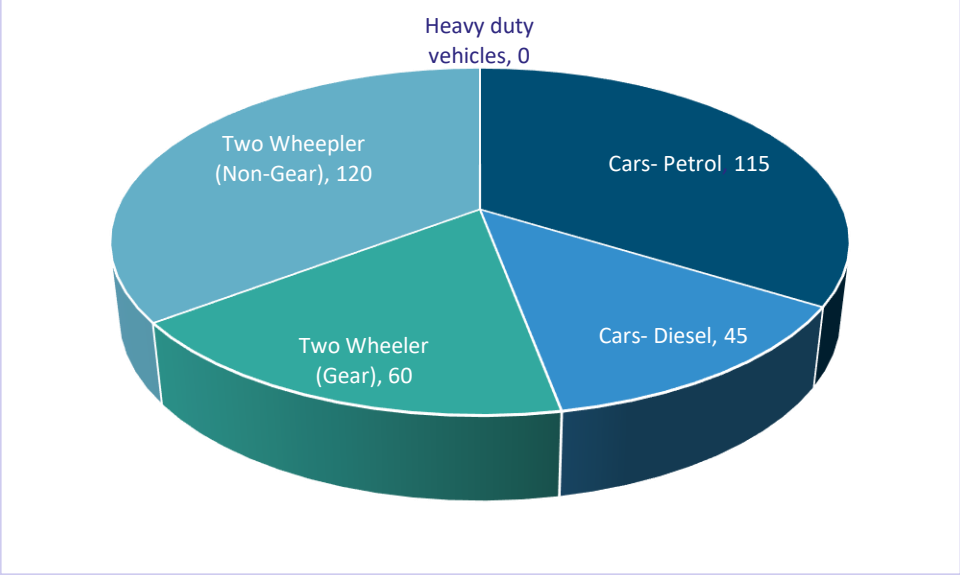
Analyzed by: Checked by:

We Are Listening & Want to Improve - Complaint Register is Available with us Page 1 of 1
Reg. Office: 107, Hiren Light Industrial Estate, Mogul Lane, Mahim, Mumbai - 400016 Tel: 022 42127500 E-mail: contact@aespl.co.in

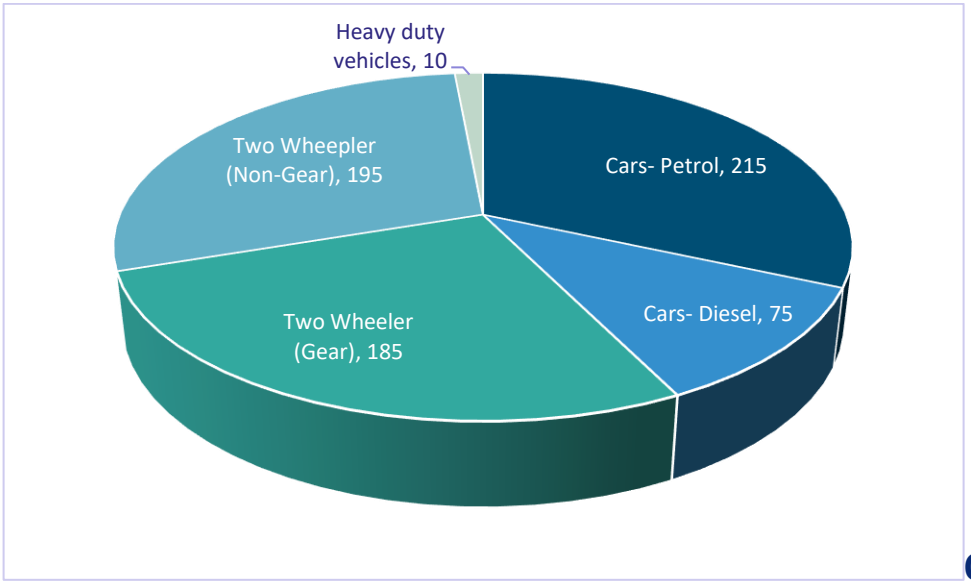
Carbon Footprint

Following Table shows movement of outside and inside vehicles inside the campus per day which adds to carbon footprint.

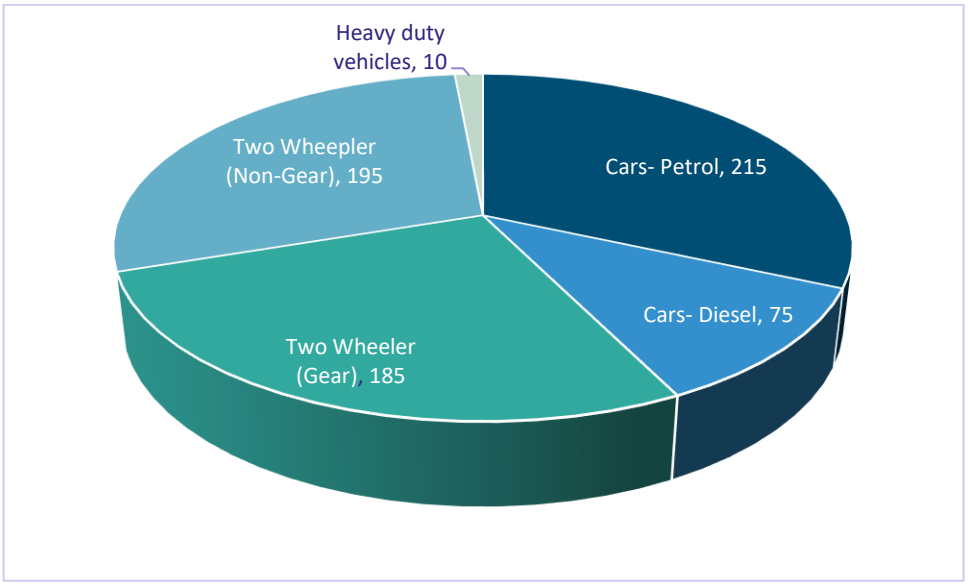
Average Vehicle Movement in the campus per Day			
	Inside Vehicles	Outside Vehicles	Total Vehicles
Cars- Petrol	115	100	215
Cars- Diesel	45	30	75
Two Wheeler (Gear)	60	125	185
Two Wheeler (Non-Gear)	120	75	195
Heavy duty vehicles	00	10	10
Total	340	340	680
Versus			
Bicycles	14	01	15



Inside Vehicles



Outside Vehicles



Total Vehicles

Quantitative and qualitative analysis is required to know the other sources apart from vehicles for the carbon footprints and quantitative analysis.

1.18 Recommendations

Difficult to know exact quantity of water in the Storage Tanks	
Issues Observed	Difficult to understand exact quantity of water with the existing level indicators in the main storage tanks
Recommendation	**Replacing the existing level indicators in the main storage tanks** with digital level indicators
Accidental Water Wastage	
Issues Observed	In case no water in the wash basins, the tap remains open and the water is wasted
Recommendation	**Replacing existing faucets with new auto-close faucets** to reduce accidental water wastage
Difficult to know exact quantity of fresh water and treated water in hostels	
Issues Observed	Difficult to understand exact quantity of water in fresh water and wastewater pipe circuits
Recommendation	**Digital flow meters** to be installed at appropriate locations in fresh water and wastewater pipe circuits
Sanitary Waste	
Issues Observed	Adhoc arrangement for the disposal for sanitary waste in place
Recommendation	Agreement may be done with the authorized sanitary waste collection agency for effective treatment/disposal.
Littering across the Campus	
Issues Observed	Littering of road side waste around the campus
Recommendation	Boards indicating No dumping message may be placed in campus area.
Lab Waste (Bio Sci., Chemistry and Chemical Engg.)	
Issues Observed	Presently the big dustbins are located per floor. Items like glassware require immediate disposal.

Recommendation	Small dustbins may be provided in each of these labs.
e-Waste Bins	
Issues Observed	Across the campus only 2 e-waste bins are there
Recommendation	Each academic block (A, B, C, D and E) one e-waste bin may be provided
Disposal/Discard of expired chemicals and hazardous chemicals	
Issues Observed	Disposal/Discard of expired chemicals and hazardous chemicals from Bio, Chemistry and Chemical Engineering Lab
Recommendation	is planned to be done through authorized vendors certified by Goa State regulation body (MoU is in progress)
Recycling of Waste Papers	
Issues Observed	Presently the used papers from office and answer sheets either go waste or sold out at cheap rate.
Recommendation	Recycling of such papers may be done inhouse using a semiautomatic handmade paper waste recycling machine
Baling Machine	
Issues Observed	Volume of stock of papers and cardboards takes a huge space
Recommendation	Baling machine can help to compress the stock in the yard
Segregation at Shed	
Issues Observed	Presently there is a manual segregation at the shed which is highly laborious and unsafe
Recommendation	Conveyer belt may be used for the segregation
Expansion of Shed	
Issues Observed	With increase in campus strength the amount of Garbage is increasing day by day, segregation yard may fall short
Recommendation	Phase wise expansion is recommended
Reduce Carbon Footprint	

Issues Observed	Number of vehicle movement inside the campus is very high.
Recommendation	Commute distance within 2 kms cycles need to be promoted for faculty and on-campus non-teaching staff members. Electrical vehicle is recommended for the internal transfer

2.19 Teams

Water & Air-conditioning On Roll and Outsourced Staff

Housekeeping Outsourced Staff

Waste Management Staff

2.20 Expenditure (Outsourced Agency)

#	Financial Year	Expenditure (Rs.) L
1	2022 – 23	28.06
2	2021 – 22	20.16
3	2020 – 21	19.03

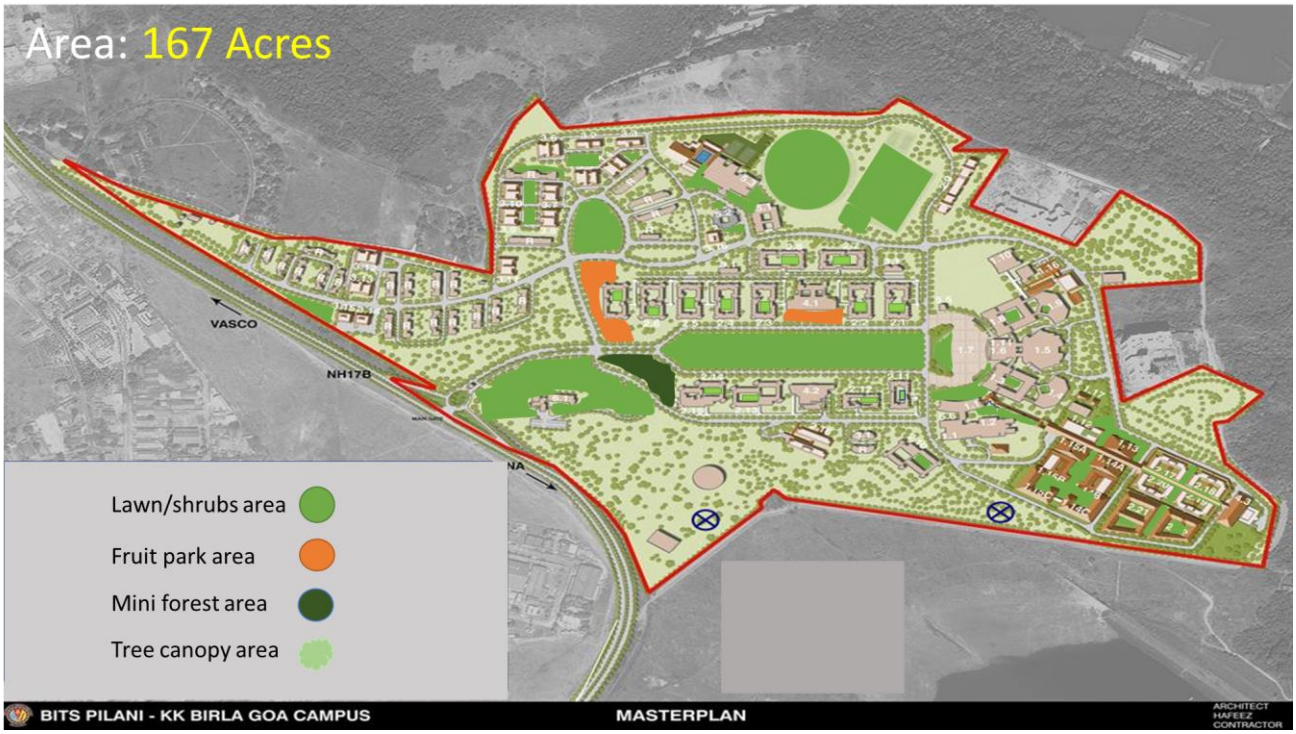
2.21 Long- and Short-Term Plan with Estimated Budget

ENVIRONMENT			
#	Item	Cost Rs. L	Remarks
1	Digital level indicators	3.00	Replacement of the existing level indicators
2	Auto-close faucets	3.25	Washbasins of Hostels and Academic blocks
3	Digital flow meters	7.00	Fresh water and wastewater pipe circuits
4	Littering across the campus	0.10	Boards indicating No dumping message may be placed in campus area.
5	Small dustbins in Bio, Chemistry and Chemical labs.	0.10	For broken glassware items
6	e-waste bins	0.10	Each academic block (A, B, C, D and E) one e-waste bin
7	Recycling machine (500 kg) of papers	2.00	Semiautomatic machine in the yard
8	Bailing machine	6.00	To compress the volume of stock of papers and cardboards in the yard
9	Conveyor belt	8.00	Effective waste segregation
10	Phase wise expansion of Yard	90.00	Rs. 0.30 L x 3 Phases
	Total Environment Capex	**111.55**	**Rs. 1.12 Cr**

GREEN

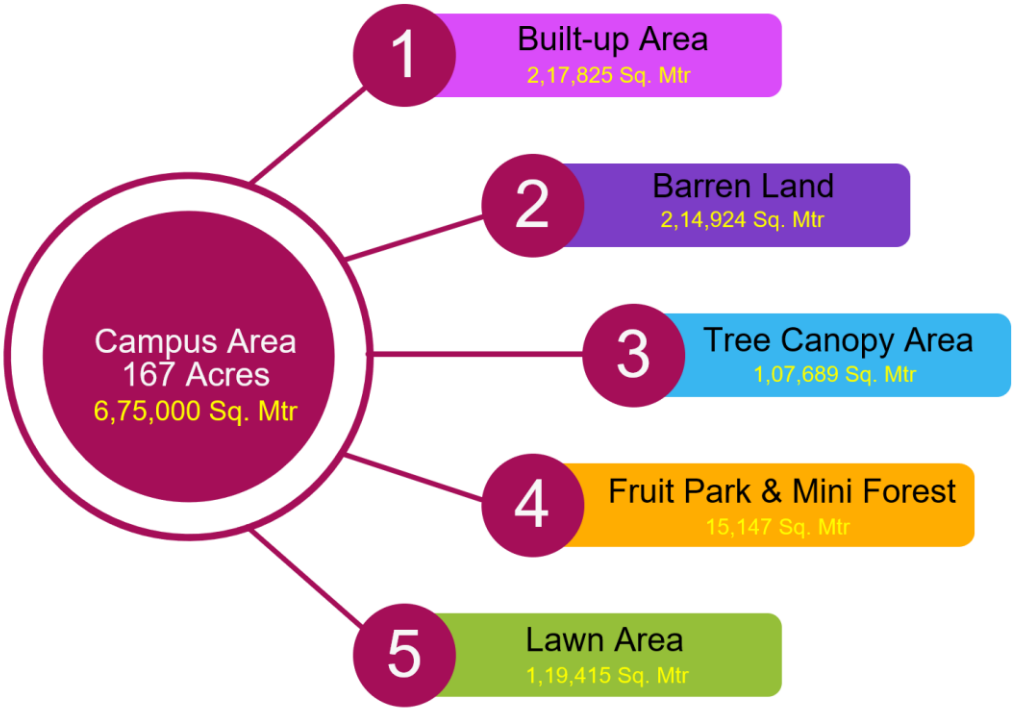
3. Green

3.1 Green Coverage

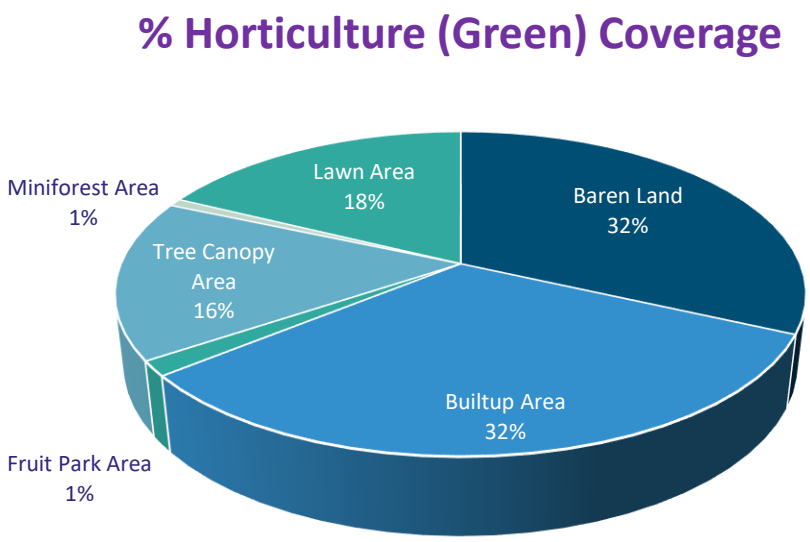


3.2 Classification of Campus Area

The campus area is divided into 5 major sections

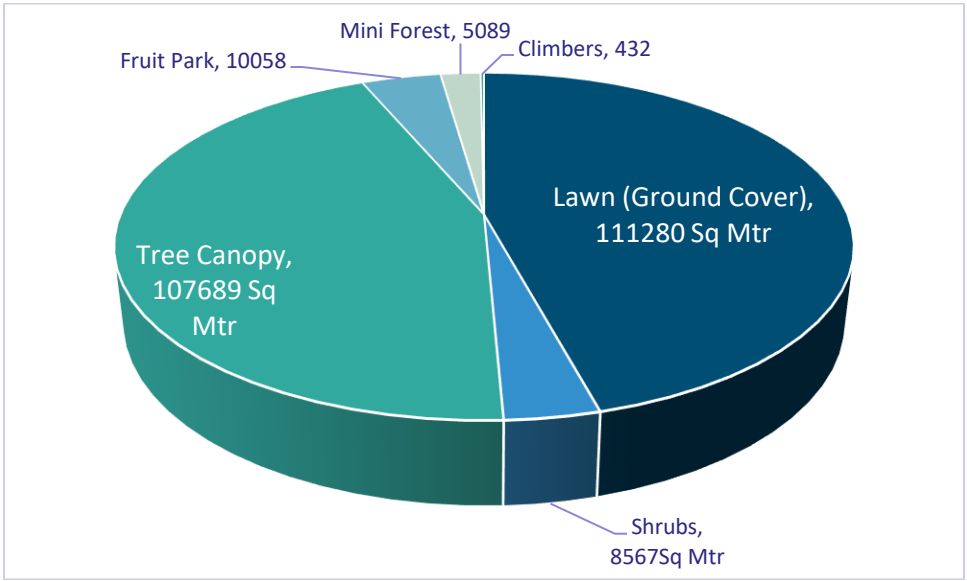


The horticulture coverage amounts to be 36%.



Further details of the horticulture (green) coverage is given below.

#	Description	Numbers	Area (Sq. Mtr)
1	Lawn (Ground Cover)	NA	111280
2	Shrubs	85	8567
3	Tree Canopy	81	107689
4	Fruit Park	NA	10058
5	Mini Forest	NA	5089
6	Climbers	11	432
	Total		243115



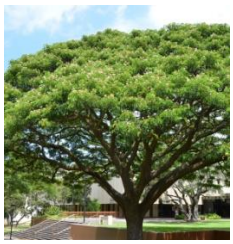
3.3 Trees

Sr no	Picture	Common name	Botanical Name	Species of Tree	Total
1		Golden Bamboo	Phyllostachys aurea	Ornamental	442
2		Buddha belly Bamboo	Bambusa ventricosa	Ornamental	13
3		Green Bamboo	Bambusa vulgaris	Ornamental	34
4		Indian elm	Holoptelea integrifolia)	Medicinal	6
5		Shivling cannonball tree	Couroupita guianensis	Medicinal	5
6		Elephant Apple	Dillenia indica	Medicinal	6

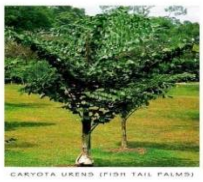
7		Neem	Azadirachta indica	Medicinal	75
8		Amaltas	casiya fistula	Medicinal	112
9		soursop	Annona muricata	Medicinal	2
10		laxmi taru	Simarouba glauca	Medicinal	2
11		Avocado	Persea americana	Medicinal	3
12		Putranjiva	Putranjiva roxburghi	Medicinal	3
13		Sheesham/Indian rosewood	Dalbergia sissoo	Medicinal	33

14		Amla	Phyllanthus emblica	Medicinal	51
15		Drum stick	Moringa oleifera	Medicinal	39
16		Indian charcol /cherry	Trema orientalis	Medicinal	454
17		kumbhi	Careya arborea	Medicinal	32
18		kokum	Garcinia indica	Medicinal	5
19		Ashoka	Polyalthia longifolia	Medicinal	57

20		Belpatra	Aegle marmelos	Medicinal	11
21		kaji/kassi	Bridelia retusa	Medicinal	11
22		Milk tree	Manilkara hexandra	Medicinal	2
23		Allspice	Pimenta dioica	Medicinal	1
24		Tamarind	Tamarindus indica	Medicinal	71
25		Haldu	Adina cordifolia	Medicinal	2
26		African tulip tree	Spathodea campanulata	Tropical/ Flowering	230

27		Sausage tree	kigelia pinnata	Tropical/ Flowering	31
28		Pride of India	Lagerstroemia speciosa	Tropical/ Flowering	3
29		Pink shower	Cassi Javanica	Tropical/ Flowering	23
30		Rain tree	Samanea saman	Tropical/ Flowering	158
31		Bottel brush	Callistemon Citrinus	Tropical/ Flowering	37
32		Plumeriya/ frangipani	Plumeriya Alba	Flowering Tree	91
33		Red Frangipani	Plumeria rubra	Flowering Tree	77

34		Mother of cocoa	Gliricidia	Flowering Tree	9
35		Yellow bells	Tecoma stans	Flowering Tree	51
36		Michelia Champaka	Magnolia champaca	Flowering Tree	10
37		Parijata	Nyctanthes arbor-tristis	Flowering Tree	8
38		Cordia	Cordia sebestena	Flowering Tree	6
39		Gulmohar tree	Delonix regia	Ornamental tree	178
40		Royal palms	Roystonea regia	Ornamental palm	17

41		Foxtail Palm	Wodyetia bifurcata	Ornamental palm	40
42		Fish tail palm	Caryota urens	Ornamental palm	17
43		Coconut	Cocos nucifera	Tropical Palm	66
44		Brush cherry	Syzyguim australe	Fruit	1
45		Jackfroot	Artocarpus heterophyllus	Fruit	60
46		Guava	Psidium guajava	Fruit	58
47		Cashew tree	Anacardium occidentale	Fruit	45

48		Mango	Mangifera indica	Fruit	221
49		Sapota/Chikoo	Manilkara zapota	Fruit	15
50		Fig/Anjeer	Ficus carica	Fruit	3
51		Custerd apple	Annona reticulata	Fruit	21
52		Bilimbi/ Bimbli	Averrhoa bilimbi	Fruit	2
53		Lemon	Citrus × limon	Fruit	8
54		Java apple/ water apple	Syzygium samarangense	Fruit	4

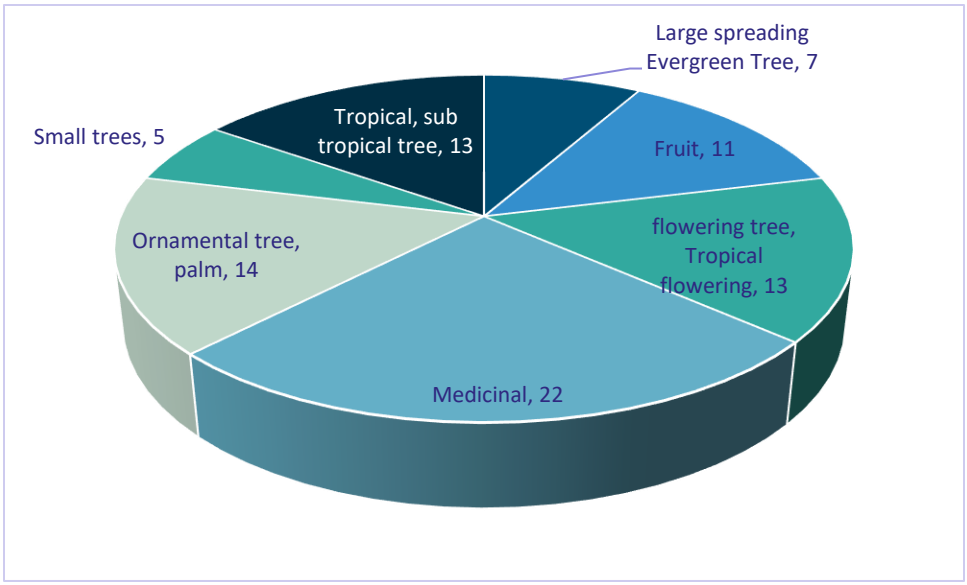
55		Blackwood acacia	Acacia melanoxylon	Evergreen Tree	85
56		Reetha/Indian soapnut	Sapindus mukorossi	Evergreen Tree	12
57		Lofty Fig	Ficus altissima	Evergreen Tree	3
58		Christmas tree	Araucaria columnaris	Evergreen Tree	4
59		Alstonia	Alstonia scholaris	Tropical tree	101
60		Kadam	Neolamarckia cadamba	Tropical tree	18
61		Silk Cotton Tree	Bombax ceiba	Tropical tree	86

62		wild fig	Ficus racemosa	Tropical tree	84
63		Indian Almond	Terminalia catappa	Tropical tree	28
64		Karunja/ indian beech tree	Pongamia pinnata	Tropical tree	66
65		Jamun	Syzygium cumini	Tropical tree	60
66		Casuarina	Casuarina equisetifolia	Tropical tree	99
67		Kaniar	Bauhinia purpurea	Tropical tree	55
68		Arjun Tree	Terminala arjuna	Tropical tree	4

69		Spanish cherry	Mimusops elengi	Ornamental	7
70		Indian coral tree	Erythrina indica	Ornamental	2
71		sandpaper tree	Ficus exasperata	Ornamental	19
72		Moya tree/Indian ash tree	Lanneacoromandelic a	Ornamental	360
73		Octopus Tree	Bracia actinophylla	Ornamental	3
74		curry leaves tree	Murraya koenigii	subtropical tree	26

75		Indian Jujube /Ber	Ziziphus mauritiana	subtropical tree	39
76		Peltophorum/yellow flame tree	Peltophorum pterocarpum	ornamental tree	141
77		Teek tree	Tectona grandis	ornamental tree	17
78		Bnayan tree	Ficus benghalensis	Large spreading Evergreen Tree	17
79		Ficus (nuda+blackiana)	Ficus blackiana	Large spreading Evergreen Tree	124
80		Peepal tree	Ficus religiosa	Large spreading Evergreen Tree	13
81		Acacia leucocephala/wild tamarind	Leucaena leucocephala	Small tree	24

82		Thevetia /Mexican oleander	Cascabela thevetia	Small tree	17
83		Babool/wild tamarind	Vachellia nilotica	Small tree	2
84		cassia semia	Senna siamea	Small tree	41
85		pisonia alba	Ceodes umbellifera	Small tree	16
Total					4535



3.4 Shrubs

Description					
sr no	Picture	Commen Name	Botanical Name	Type of plant	Quantity
1		yellow allamanda	Allamanda cathartica	Flowering plant	5502
2		crinum lily	Crinum asiaticum	Flowering plant	305
3		Plumbago	Plumbago auriculata	Flowering plant	2165
4		Angelonia	Angelonia grandiflora	Flowering plant	1093
5		Tanburgia	Thunbergia erecta	Flowering plant	2405
6		Thevetia Peruviana	Cascabela thevetia	Flowering plant	879

7		Cat's tail	Achalypha hispida	Flowering plant	96
8		Tabernaemontana variegata	Tabernaemontana variegata	Flowering plant	218
9		Megaskepasma	Megaskepasma erythrochlamys	Flowering plant	75
10		Sleeping hibiscus	Malvaviscus arboreus	Flowering plant	348
11		Hanging Heliconia	Heliconia rostrata	Flowering plant	20
12		Tecoma	Tecoma capensis	Flowering plant	30
13		Jasmin	Jasminum sambac	Flowering plant	75

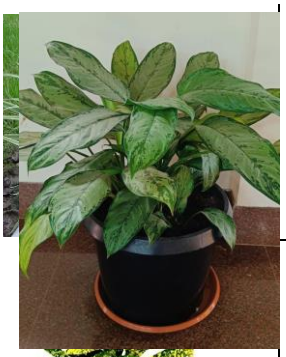
14		Bougainvillea plant	Bougainvillea	Flowering plant	1407
15		Jatropha	Jatropha integerrima	Flowering plant	29
16		spider lily	Hymenocallis littoralis	Flowering plant	12541
17		Ixora plant	Ixora coccinea	Flowering plant	480
18		Heliconia golden torch	Heliconia psittacorum	Flowering plant	3732
19		Heliconia lady diana	Heliconia Psittacorum	Flowering plant	2700
20		Red ginger	Alpinia purpurata	Flowering plant	90

21		Eranthemum golden	Pseuderanthemum	Flowering plant	330
22		Gardenia	Gardenia jasminoides	Flowering plant	10
23		Peacock Flower	Cisalpinia Yellow	Flowering plant	3
24		Cisalpinia	Caesalpinia pulcherrima	Flowering plant	11
25		Canna variegated	Canna indica	Flowering plant	1200
26		Canna Red	Canna indica	Flowering plant	2035

27		Canna yellow	Canna indica	Flowering plant	1179
28		Oleander	Nerium oleander	Flowering plant	3
29		Torchlight Bougainvillea	Bougainvillea	Flowering plant	445
30		Russelia	Russelia	Flowering plant	160
31		Acalifa pendula	Acalifa pendula	Flowering plant	800
32		Murraya	Murraya paniculata	Flowering plant	2

33		Yellow bells	Tecoma stans	Flowering plant	353
34		Mini Tagar varicata	Tabernaemontana divaricata	Flowering plant	498
35		Mini Tagar green	Tabernaemontana divaricata	Flowering plant	5268
36		Cassia biflora	Cassia biflora	Flowering plant	3
37		Rose	Rosa	Flowering plant	13
38		Lantana purple	Lantana montevidensis	Flowering plant	50

39		peace lily	Spathiphyllum	flowering plant	3075
40		Crossandra	Crossandra	flowering plant	1348
41		Chinees croton	Excoecaria cochinchinensis	Shrubs	2
42		Shell Ginge	Alpinia zerumbet	Shrubs	200
43		Acalypha	Acalypha rosea	Shrubs	4434
44		Fountain grass	Pennisetum alopecuroides	Ornamental grass	5672

45		Dianella	Dianella tasmanica Variegata	Shrubs	2191
46		Croton plant	Codiaeum variegatum	Shrubs	157
47		Acalypha	Acalypha godseffiana	Shrubs	382
48		Duranta golden	Duranta golden	Shrubs	4591
49		Pedilanthus	Pedilanthus tithymaloides	Shrubs	360
50		Tuja/Morpankhi	Platycladus orientalis	Shrubs	10
51		Bamboo grass	Pogonatherum crinitum	Shrubs	1500

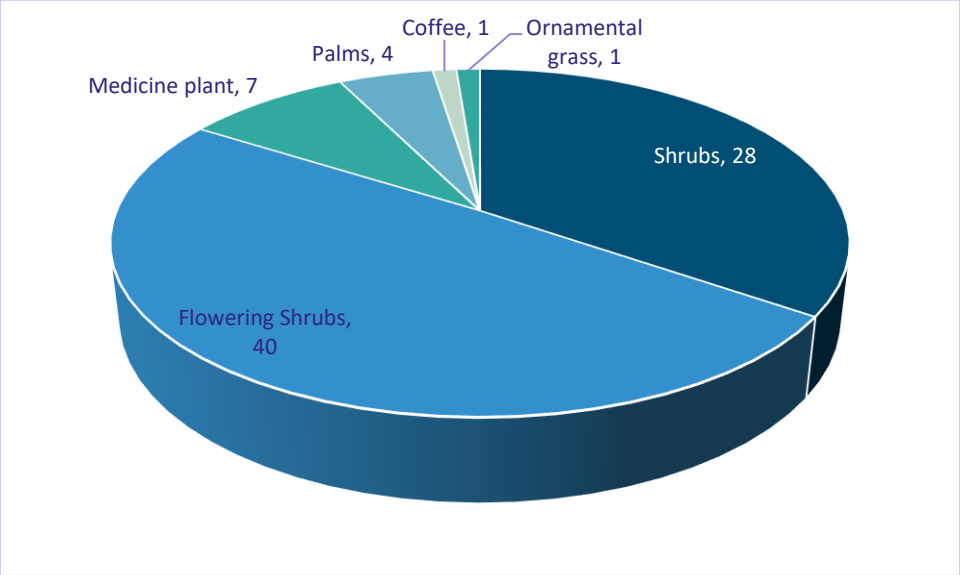
52		Rhoeo	Tradescantia spathacea	Shrubs	2200
53		Raphis palm	Rhapis excelsa	Palm	1221
54		Areca palm	Dypsis lutescens	Palm	361
55		Red palm	Cyrtostachys renda	Palm	110
56		cycas palm	Cycas revoluta	Palm	22
57		Alternanthera	Alternanthera dentata	Shrubs	1000
58		snake plant	Sansevieria	Shrubs	360

59		Pendanus dwarf	Pandanus veitchii	Shrubs	4169
60		Pseuderanthemum variegated	Pseuderanthemum	Shrubs	22
61		Pendanus varigated	Pandanus tectorius	Shrubs	4
62		Asparagus fern	Asparagus setaceus	Shrubs	50
63		Duranta green	Duranta	Shrubs	1
64		Bamboo Variegated	Bambusa	Shrubs	5
65		xanadu	Thaumatophyllum xanadu	Shrubs	8

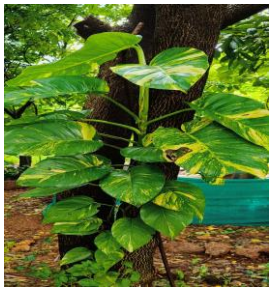
66		Henna/Mehendi	Lawsonia Inermis	Shrubs	400
67		Inerme	Inerme	Shrubs	65
68		Dracaena	Dracaena Colorama	Shrubs	16
69		Dracaena	Dracaena mahatma	Shrubs	10
70		Dracaena	Dracaena Colorama	Shrubs	1324
71		Hamelia	Hamelia paten	Shrubs	50

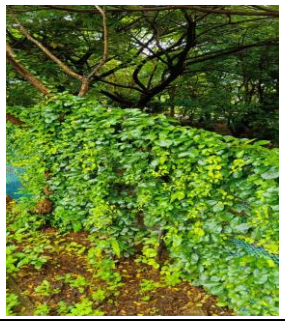
72		Alocasia	Alocasia macrorrhiza	Shrubs	180
73		Aglaonema	Aglaonema	Shrubs	400
74		Hibiscus plant	Hibiscus	Medicine plant	2301
75		Saona	Lagerstroemia indica	Medicine plant	12
76		vinca rosea	Catharanthus roseus	Medicine plant	800
77		Tulsi	Ocimum tenuiflorum	Medicine plant	60

78		Jinger	Alpinia galanga	Medicine plant	10
79		lemon grass	Cymbopogon	Medicine plant	23
80		Alovera	Alovera	Medicine plant	15
81		Coffee	Coffea	Coffee	4
				Total	85678

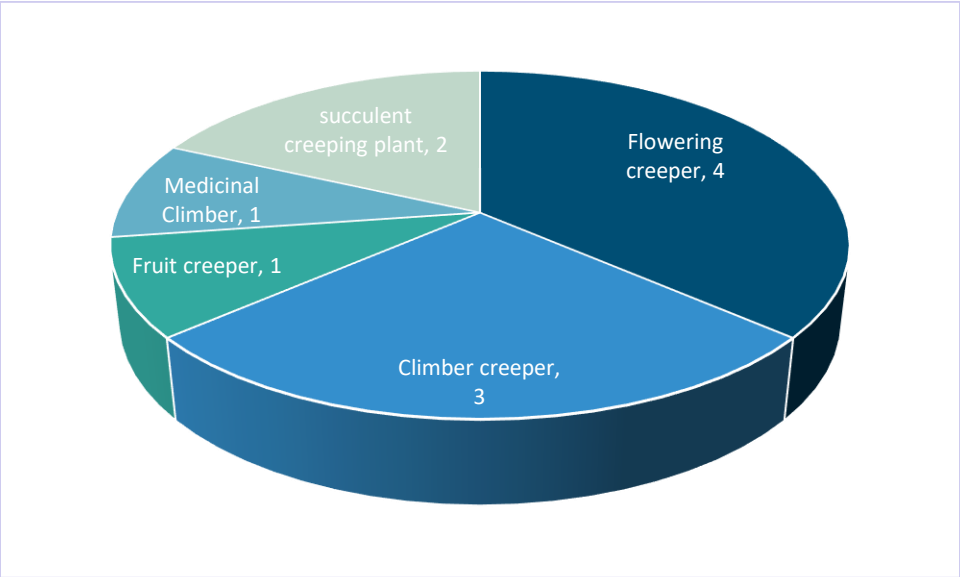


3.5 Climbers

Description					
sr. no	Picture	Commen Name	Botanical Name	Type of plant	Total
1		Rangoon Creeper	Combretum indicum	Flowering creeper	81
2		Money plant	Epipremnum aureum	Climber	4

3		jasmine	Jasminum officinale	Flowering creeper	1
4		Thunbergia Mysore trumpetvine	Thunbergia mysorensis	Flowering creeper	2
5		cat's claw	Dolichandra unguis-cati	Flowering creeper	1
6		Passion fruit	Passiflora edulis	Fruit creeper	2
7		monstera	Rhaphidophora tetrasperma	Creeper Climber	2

8		Ficus repens climbing fig	Ficus pumila	Creeper Climber	125
9		Turtle vine	Callisia repens	succulent creeping plant	100
10		Black pepper	piper nigrum	Medicinal Climber	2
11		Baby Tears	Soleirolia soleirolii	succulent creeping plant	55
Total					375

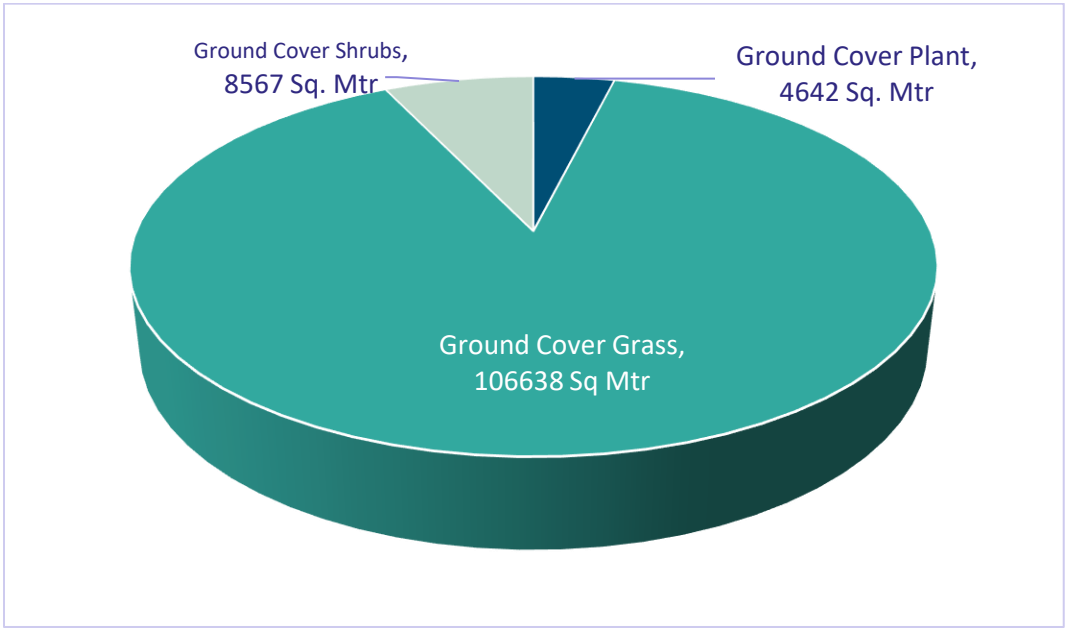


3.6 Ground Cover

Description					
sr no	Picture	Commen Name	Botanical Name	Type of lawn	Tot Sq. Mtr
1		Vadelia plant	Sphagneticola trilobata	Ground Cover Plant	2267
2		Bermuda Grass	Cynodon dactylon	Ground Cover grass	102391
3		Red ivy	Hemigraphis alternata	Ground Cover Plant	256

4		wandering Jew	Tradescantia zebrina	Ground Cover Plant	20
5		Asparagus fern		Ground Cover Plant	114
6		Dianella	Dianella tasmanica Variegata	Ground Cover Plant	1823
7		Fern	Nephrolepis biserrata	Ground Cover Plant	86
8		Paspalum	Paspalum Notatum	Ground Cover grass	4072

9		Mexican Grass		Ground Cover grass	175
10		Sansevieria	Sansevieria	Ground Cover Plant	11
11		xanadu	Philodendron xanadu	Ground Cover Plant	65
				Total	111280



3.7 Miniforest

Small portion of barren land is converted into a forest model.

3.8 Recommendations

Short Term Goals

Introduce **Community Vegetable Garden** to prepare the land

This initiative is planned as an immersive project that will empower students with hands-on experience in the realm of sustainable agricultural practices. The project unfolds with the initial step of land preparation, involving the planting of Sunn hemp—a rapid-growth plant known for its exceptional capacity to enhance soil organic matter through its nitrogen-fixing prowess.

Proposed Location: Land stretching opposite to C5 tower towards C3 tower- adjacent to the Compound wall.

Develop a **Medicinal Garden**

Planned to develop the Herbal Garden under the development scheme of the State Medicinal Plants Board Goa under National Medicinal Plants Board, Delhi to sensitize the usage of medicinal plants based on indigenous knowledge. Under this scheme we will get guidance as well as Rs 3 Lakh per ha. financial support in establishment of herbal garden and Rs 60000 per annum for maintenance for 4 years.

Proposed Location Identified: Near Children's Park Opposite to C type Residences.

List all different tree varieties and display the common name

Student Involvement and awareness

Organizing Green challenges-

Conducting Quizzes, Workshops and Training Programs (per year)

Long Term Goals

Develop a **Butterfly Garden**

Creating a butterfly garden on campus holds significant ecological and educational importance. It becomes a living testament to the importance of nurturing biodiversity, fostering educational growth, and promoting conservation ethics among the campus community and beyond. Students can engage in activities such as planting, monitoring butterfly populations, and studying the interdependence between plants and pollinators.

Proposed Location: Land stretching behind Playground on both sides of the road.

Develop a few locations with **Green Cover** in a phase wise manner

3.9 Horticulture Team

3.10 Fertilizers & Pesticides

#	Fertilizers	
1	Pesticides	Chlorpyriphos
2	Fungicide	KCARE (Systemic and contact fungicide)
3	Fertilizers	Organic composts from food waste, sediments from water recycling, leaves compost, cow dung

3.11 Expenditure (Outsourced Agency + Fertilizers) per annum

#	Financial Year	Expenditure (Rs.) L
1	2022 – 23	134.00
2	2021 – 22	100.00
3	2020 – 21	86.00

3.12 Long- and Short-Term Plan with Estimated Budget

GREEN			
#	Item	Cost Rs. L	Remarks
1	Introduce Community Vegetable Garden to prepare the land	0.20	Inspire residents to develop at their premises
2	Develop a Medicinal Garden	Nil	Under the development scheme of state medicinal plants Goa
3	List all different tree varieties and display the common name	0.10	Create a knowledge
4	Student Involvement and awareness	0.25	Culture of clean & green campus
5	Organizing Green challenge	0.20	Culture of clean & green campus
6	Conducting Quizzes, Workshops and Training Programs (per year)	0.15	Culture of clean & green campus
7	Develop a Butterfly Garden	3.00	ecological and educational importance
8	Develop a few locations with **Green Cover** in a phase wise manner***	500.00	Reduce carbon footprint
	Total Green Capex	**504**	**Rs. 5.04 Cr**

#8: Green Cover in a Phase wise manner

***Green cover /Horticulture development				
#	Location	Unit	Qty	Estimated Budget (Rs.)
1	AH-10 to Utility (Between Road & Compound Wall)	Sqm	13,091	19,636,500
2	Around AH-01 & PCC-03	Sqm	5,168	7,752,000
3	Medicinal Park Naer (Childrens park)	Sqm	2,445	3,667,500
4	CC Backside	Sqm	1,485	2,227,500
5	Animal, Green House & Chemistry Lab Surrouding Area	Sqm	2,463	3,694,500
6	C3, C4 & C5 along side from Laundry (Between Road & Compound Wall)	Sqm	2,163	3,244,500
7	Backside of CSIF lab to C wing (Along the GS)	Sqm	2,078	3,117,000
8	CH-01 corner to NAB 4C (Around PCC-01)	Sqm	2,030	3,045,000
9	Either side of Road (NAB 3B & DH-05)	Sqm	1,057	1,585,500
10	DH-05 & 06 Area either side of road (Compound Wall)	Sqm	1,781	2,671,500
	TOTAL AREA & EXPENDITURE	Sqm	33,761	50,641,500

3.13 Best Practices

Promoting a green environment involves adopting a range of sustainable practices that contribute to the well-being of our planet. Here are some of the best practices followed in the campus:

1. Environmental Day –June 5 and Vanmahotsav | July 1-7, 2023

In the year 2023, environmental day and the annual tree plantation festival are being commemorated through the planting of 200 trees from 9 distinct species. These trees have been generously donated by the Forest Department of Goa as part of their ongoing efforts to promote environmental conservation and sustainable ecosystems.

2. Water Day: Hollant Beach Cleanup | Mar 18, 2023

In recognition of Water Day, the Eco Club conducted a beach cleaning initiative on the 18th of March, 2023, aimed at fostering consciousness about safeguarding marine ecosystems. A total of 26 students took part in this beach cleanup, resulting in the retrieval of approximately 16 kg of plastic waste from the shoreline.

3. Campus Bird Count project | 17th - 20th February, 2023

- The Ecoclub organized a series of birdwalks from 17-20th February as part of the Great Backyard Birdcount (GBBC). This event was conducted to introduce students to birdwatching and also to create awareness on the biodiversity in our campus.
- Around 25 people participated in the birdwalks. This event helped us to form a bird watching community on campus named "Swallows".
- Birds including Indian Roller, Copperhead Barbet, Ashy Prinia, Swallows, Sunbirds, Green bee-eater were spotted. During this period the team spotted more than 50 species of birds in campus.

Indian Roller

Asian Green bee eater

4. Campus Phenology Network Project | April 1, 2023 – present for a year

Campus Phenology Network is an ongoing Citizen-Science National Project on Tree phenology undertaken by the help of SeasonWatch Organisation. It hopes to draw conclusions from measuring the effects of climate and weather on the fruiting and flowering patterns of trees for a period of one year. We have a team of students and community members who are monitoring trees every week by observing the pattern in leaves, flowers and fruits etc. This team currently monitors more than 100 trees on our campus.

5. Conservation Activities

Our team successfully transplanted two trees, one Peepal tree of 13 years old and one Mango tree of 5 years old. The process begins by delicately excavating the tree's root system, ensuring minimal disturbance to its intricate network. Once the roots are exposed, the tree is gently lifted and transported to its new site, where a properly prepared hole awaits. Presently, both transplanted trees display robust growth and vibrant health.

Peepal tree and Mango tree during transplantation

6. Reduce, Reuse, Recycle, Refuse

Our community embrace the four R's in our daily life. We minimize waste by reducing consumption, reusing items whenever possible, and recycling materials like paper, plastics, glass, tyres, and metals. Our segregated waste materials are sent for recycling. We create awareness on the importance of refusing single-use plastics. We have a garden area developed on the theme of these four R's.

Circle planter made of eco bricks and construction remains Tire seater

7. Composting

Six leave compost bins are placed at 6 different points. Two big compost pits are there to collect garden waste, one in Mini forest and one near AH-9. All wet waste generated in the campus are converted into compost. Sediments from STP water treatment are also used as compost. Community members also make compost at homes. Garden waste is also added in the barren land to make the soil fertile near AH 3

Leaf compost

Harvesting compost from garden waste

Landmark made using construction waste

8. Water Conservation

Our campus compliance system operates 24/7, efficiently addressing any water mismanagement. We have implemented automatically closing valves for all tanks to reduce wastage due to overflow. Our Waste Water treatment facility significantly reduces the dependence on municipal water sources. There are 5 ground pits to recharge the ground. However, the campus is in process to take services from a geo-consultant to search for place for a water reservoir.

9. Trainings and Workshops

Educate and Advocate: Trainings and workshops are organized to create awareness about environmental issues by conducting community cleanups and encourage others to adopt green practices.

10. Make your own Paper Bag – Workshop | Nov 30, 222

The Ecoclub organized a paper bag making workshop on November 30, 2022. This was an initiative taken in order to reduce the plastic waste. Students were taught to make paper bags using old magazines and posters.

11. Home-composting workshop by Green Champions: Earth Day | Apr 21, 2023

To commemorate Earth Day, Green Champions organized a compost-making workshop on April 21st, 2023. This hands-on workshop was conducted by Prof. Meenal Kowshik and Dr. Saranya G. Nair and taught the benefits of making own organic compost.

12. Campaigns

Beat the Plastic Campaign | June 20, 2023

- The Beat Plastic Pollution campaign aimed to raise awareness about plastic pollution among students and educate them about the importance of adopting sustainable practices in their daily lives.
- A survey form has also been floated as part of the campaign to gauge their responses regarding this.
- The campaign discussed about plastic waste management and involved a group painting session where students were encouraged to use their creativity to design and paint old plastic bottles to promote the concept of reusing plastic bottles.







13. Clean Drive | Jan 14, 2023

14. Tree Plantation by Students | Jul 31, 2019

15. Brain Storming Session | Aug 1, 2023

BITS Pilani Goa hosted day Long G20 events focused on the theme of Climate Change

BITS Pilani, K K Birla Goa Campus organized day long G20 events; these events comprised of a Y20 brainstorming session on 'Climate Change and Disaster Risk' in Goa in the first half of the day, and the 69th G20 University Connect Event in the afternoon. Both these events (Y20 and G20 University Connect) were supported by RIS, an autonomous think tank of the Ministry of External Affairs, on behalf of the Ministry of Youth Affairs and Sports, and the Ministry of External Affairs, Govt. of India, respectively. An interactive quiz competition was conducted by Prof. Rajiv Kumar Chaturvedi, Associate Professor, BITS Goa and Dr. Ramesh Kumar MR, Former Chief Scientist, NIO

Y20 Brainstorming session at BITS Pilani Goa highlighted Climate Change and Disaster Risk in Goa

16. International Coastal Cleanup Day | Sep 17, 2022

K K Birla Goa campus students from Nirmaan organization joined International Coastal Cleanup Day on 17th September 2022 conveying the message " Swachh Sagar, Surakshit Sagar. During the beach clean ups, students interact with the public and create awareness about plastic waste management. Campaigns and interactions are done through Social media platforms.

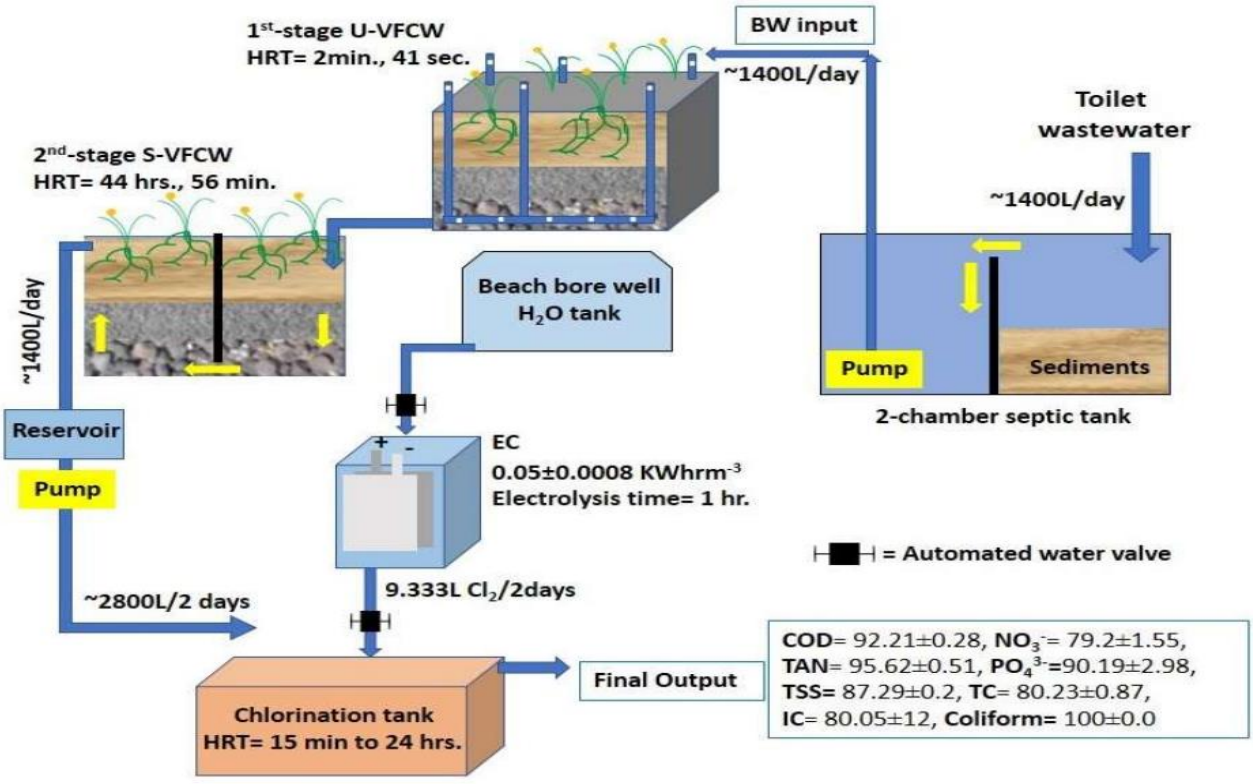
17. Curdi Visit | May 14, 2023

35 people including students and faculty members visited the Curdi village, Sanguem, Goa. After the construction of Salaulim dam in 1986, Curdi village got submerged in water. It remains in water for 11 months and in the month of May, when water receeds the villagers come together to celebrate the lost land. This visit gave an insight on how nature and landscape changes due to human activities.

18. Empowered Septic Tank

Empowered Septic tank for 4 people at BITS Laundry and 100 people public toilet at Bogmalo Panchayat –- Hybrid of Vertical Flow Constructed wetland and Electrochemical system

Public toilet with decentralized integrated treatment system at Bogmalo beach, Goa-India(a) Changing room, (b) Female toilet c) Handicap toilet (d) Electro-chlorinator room (EC) (e)Male toilet (f) Male urinal, (g&h) Fresh water tank (i)Toilet keeper, (j) 1st stage unsaturated- vertical flow constructed wetland (U- VFCW) (k) 2nd stage saturated- vertical flow constructed wetland (SVFCW)



3.14 Green Conservation Aspect in the Curriculum

01

BIO G525 | ENVIR BIOTECH & WASTE MANAGEMENT

HD | Applications of biotechnology to the management of environmental problems and pollution control

02

BITS F225 | ENVIRONMENTAL STUDIES

2nd Year FD | Study of environment, human population, and industrialization; natural resources and the impact of man-made activities on them

03

BIO G241 | ECOLOGY & ENVIRONMENTAL SCIENCE

2 Year | FD | The objective is to make the students aware of the various segments of our environment and the impact of pollution on the ecosystem.

04

CHE F411 | ENVIRONMENTAL POLLUTION & CONTROL

4th Year FD | Sampling, analysis and modelling of control methods for air & water pollutants

05

CHE G513 | ENVIRONMENTAL MANAGEMENT SYSTEMS

HD| Introduction to air and water pollutants, solid wastes; sampling and analysis techniques and impact of these on environment

06

CHEM G521 | ENVIRONMENTAL CHEMISTRY

HD | Study of Energy-flows and supplies including fossil fuels, nuclear energy, nuclear waste disposal, renewable energy.

07

EE G501 | ENVIRONMENTAL SAMPLING & ANALYTICAL METHODS

HD | Principles of sample collection and data analysis, Interpretation of data in environmental monitoring

08

GS F212 | ENVIRONMENT DEVELOPMENTAL & CLIMATE CHANGE

2nd Year FD |General Studies | Specific topics on environment, development and climate change

3.15 Sustainable Development Goals

Ensure Sustainable Development Goals through following recommendations

Green Credits

Incentivize using green strategies in laboratory practices through recognition/awards or some other form of benefit.
Additional funding support if any green practice needs additional infrastructure. While the specific strategies are to be framed with the different departments.

General Recommendations

Zero waste events:

Conducting zero waste events on campus requires careful planning, coordination, and the active participation of event organizers, attendees, and campus stakeholders.

Efforts should be made to transform all gatherings and conference meetings into zero-waste events. This objective can be achieved by implementing sustainable practices such as utilizing reusable cutlery, avoiding the use of disposable plastics, and guaranteeing the availability of Aqua guard facilities in close proximity to the event venues.

Partnership & Collaborations

Collaborate with local government, non-profit organizations and business to share resources, knowledge and best practices.

Monitoring, Reporting and Communicating

Regularly monitor and report progress towards 'net zero' goals (Zero Waste, Zero Water Wastage, Zero Energy Wastage, etc.)

Under Energy, Environment and Green: Establish key performance indicators (KPIs) to track energy consumption, waste generation and emissions.

Share progress updates with the campus community and stakeholders to ensure transparency and accountability through a quarterly EEG Newsletter (separate e-mail ID for eeg@goa.bits-pilani.ac.in)

Carbon offsetting and sequestration: Calculate the institution's carbon footprint and set targets for emission reductions.

4. Long- & Short-Term Plans with Estimated Budget

ESTIMATED CAPITAL EXPENDITURE (Rs. Cr.)			
ENERGY	ENVIRONMENT	GREEN	TOTAL
12.67	1.12	5.04	18.83
ESTIMATED OPERATING EXPENDITURE (Rs. L.)			
ENERGY	ENVIRONMENT	GREEN	TOTAL
----	1.45	----	1.45

Details

ENERGY			
#	Item	Cost Rs. L	Remarks
1	Use of Limit switches to control the operation of exhaust fans in hostel washrooms and Academic Buildings	2.00	Limit switches will switch On the Exhaust fan only when the door is closed. Approx. Energy savings of Rs.2 Lakhs / Month.
2	Replacement of DOL to Star-Delta Starters	5.00	This will reduce the starting current of the motor and also the Demand. Approx Energy Savings of Rs.0.10 Lakhs/month
3	APFC capacitor banks for replacing de-rated capacitors	5.00	This will improve the power factor. Approx Energy Savings of Rs.0.10 lakhs/month.
4	Corrective Maintenance for eliminating hot-spots in the Bus-bars	----	Improve Power Availability and Reliability
5	Use of Occupancy Sensors in all the washrooms of Hostels and Academic Buildings (270 in Hostels, 106 in Academic Buildings)	9.50	Lights in washrooms can be controlled through the occupancy sensors. Energy Savings of Rs.1 Lakh/month

6	Upgradation distribution panels at four PCCs for modernization of safety devices ACBs and MCCBs	10.00	Improve Power Availability and Reliability
7	Replacement of DOL starters to VFDs	20.00	The starting current will be reduced. Energy Savings of Rs.1 Lakhs/month
8	Use of smart meters across the campus	35.00	At present the power consumed by different entities is not measured and also the billing for power consumption for quarters and Vendors is done manually
9	Use of energy efficient LED lights in hostels, quarters, and Academic buildings	50.00	Present fluorescent lights and CFLs lights consume more energy. Approx. Energy savings of Rs. 3 Lakhs / Month
10	Underground Cabling for HT distribution on campus for minimizing power outage and diesel consumption	100.00	Improve Power Availability and Reliability
11	Use of BLDC fans in hostel rooms	160.00	Induction motor-based ceiling fans consume more energy compared to BLDC ceiling Fans. Approx. Energy Savings Rs. 6 Lakhs / Month
12	Grid Tied Roof Top Solar On D mess, C wing, and CC, VGH, PCC2A, and PCC5	170.00	375 kWp Solar PV capacity. Energy Savings of Rs.4 lakhs/month.
13	Retrofitting of existing six DG sets, reducing emissions for legal compliance	200.00	Legal Compliance. Less environmental impact.
14	1 MWp On Grid Solar PV Power plant (Capex Model)	500.00	The capital cost can be recovered within 3 & ½ years. Approx. Energy Savings of Rs. 9.5 Lakhs/ month
	Total Environment Capex	**1266.50**	**Rs. 12.67 Cr**

ENVIRONMENT			
#	Item	Cost Rs. L	Remarks
1	Digital level indicators	3.00	Replacement of the existing level indicators
2	Auto-close faucets	3.25	Washbasins of Hostels and Academic blocks
3	Digital flow meters	7.00	Fresh water and wastewater pipe circuits
4	Littering across the campus	0.10	Boards indicating No dumping message may be placed in campus area.
5	Small dustbins in Bio, Chemistry and Chemical labs.	0.10	For broken glassware items
6	e-waste bins	0.10	Each academic block (A, B, C, D and E) one e-waste bin
7	Recycling machine (500 kg) of papers	2.00	Semiautomatic machine in the yard
8	Bailing machine	6.00	To compress the volume of stock of papers and cardboards in the yard
9	Conveyor belt	8.00	Effective waste segregation
10	Phase wise expansion of Yard	90.00	Rs. 0.30 L x 3 Phases
	Total Environment Capex	**111.55**	**Rs. 1.12 Cr**
11	Sanitary waste	0.45 Per annum	Agreement may be done with the authorized sanitary waste collection agency for effective treatment/disposal.
12	Disposal/discard of expired chemicals and hazardous chemicals	1.00 Per annum	Planned to be done through authorized vendors certified by Goa State regulation body
	Total Environment Opex	**1.45**	**Rs. 0.45 L per annum**

GREEN			
#	Item	Cost Rs. L	Remarks
1	Introduce Community Vegetable Garden to prepare the land	0.20	Inspire residents to develop at their premises
2	Develop a Medicinal Garden	Nil	Inspire residents to develop at their premises
3	List all different tree varieties and display the common name- Rs 5000	0.10	Create a knowledge
4	Student Involvement and awareness- Rs 25000	0.25	Culture of clean & green campus
5	Organizing Green challenges-	0.20	Culture of clean & green campus
6	Conducting Quizzes, Workshops and Training Programs (per year)	0.15	Culture of clean & green campus
7	Develop a Butterfly Garden	3.00	ecological and educational importance
8	Develop a few locations with Green Cover in a phase wise manner	500.00	Reduce carbon footprint
	Total Green Capex	**504**	**Rs. 5.04 Cr**

Committee & Invitee Members

M K DESHMUKH

RANJIT PATIL

S D MANJARE

PRADEEPKUMAR SOW

A K PATIL

KAUSHIK PHALDESAI

SARANYA NAIR

IMRAN SEIKH

BIKRAM SWAIN

MAHENDRA PEDNEKAR

RAJESH CHEJARA

SARVESH PAI

D M KULKARNI

Edition #7

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BITS PILANI K K BIRLA GOA CAMPUS

NEWSLETTER

ENERGY ENVIRONMENT GREEN

Let's contribute to the betterment of the climate

TOP NEWS OF THE MONTH

ENERGY

>>> READ MORE

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eeg@goa.bits-pilani.ac.in