ENERGY AUDIT REPORT

For

GITAM UNIVERSITY

Nagadinahalli, Bengaluru

By

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ACKNOWLEDGEMENT

Conserve Consultants Private Limited wishes to thank all the staff, Management & Technical Team of **GITAM UNIVERSITY, Bengaluru** for the kind co-operation and assistance extended to our Auditor during the course of the Energy audit.

Energy Consultants

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Table of Contents

1. EXECUTIVE SUMMARY

Energy Audit of GITAM University, Bengaluru was carried out by Conserve Consultants during February 2022.

The approach taken in this facility included different tools such as preparation of questionnaire, physical inspection of the campus, observation and review of the documentation, interviewing key persons and associated systems & equipment, including the electrical, lighting & AC systems, and operational & maintenance procedures. Sample measurements were taken using various instruments like ALM Power Analyzer, clamp meter, Infrared Thermometer, Lux meter, Humidity meter, CO_2 meter, etc. Operational Data were also collected from the past records.

The report accounts for the energy consumption patterns of the GITAM University based on actual assessment. The report compiles a list of possible actions to conserve and efficiently access the available scarce resources and their saving potential was also identified.

The overall annual energy consumption from the grid is 8, 27,676 kWh/annum. The annual greenhouse gas emissions equivalent for this electricity is **703.52 tons of CO_2** (0.85kg of CO_2 emits /kWh of unit generation).

Over all **248,000 kWh** unit savings have been identified with an average payback of **8 months** and reduced annual greenhouse gas emissions equivalent (GHG_e) to **126.5 tons of CO_2.**

At present nearly **498 kW of Solar PV** has been installed with energy generation of **594,384 kWh** in the past One Year. Its overall contribution is around **40% of the total energy**. Renewable and grid energy contribution is **40% and 60%** respectively. It is recommended to increase Solar PV on rooftop to reduce **CO_2 emission.**

For continuous improvement, every identified Performance Improvement Measure, a detailed M&V Plan shall be established for continuous monitoring & evaluation of the effect of the system over which PIM will be implemented.

2. List of Performance Improvement Measures at GITAM University, Bengaluru

S No.	ECM Description	Annual Energy savings kWh	Annual savings, Lakhs.	Cost of Measure, Lakhs.	Payback Months
1	Maintain the Solar PV in roof top to increase the power generation eff	17,832	1.5	0.0	0
2	Replace Split units with efficient VRF system	1,35,600	11.1	10.0	11
3	Replace exterior lamps with Solar PV	12,600	1.0	1.5	8
4	Measurement & Verification (M&V) as per IPMVP	82,768	6.8	20.0	35
Total		**248,800**	**20.4**	**31.5**	**8**

3. Project Background

GITAM Bengaluru campus was established in 2012, with modern infrastructure supported by dedicated faculty and administrative staff. The campus is located in an ideal environment in Nagadenahalli on the highway, close to Bengaluru International Airport and at a distance of 3.5 km from Doddaballapur Railway Station. The campus is provided with smart classrooms, laboratories, auditoria, seminar halls, play fields, student hostels and other student support services.

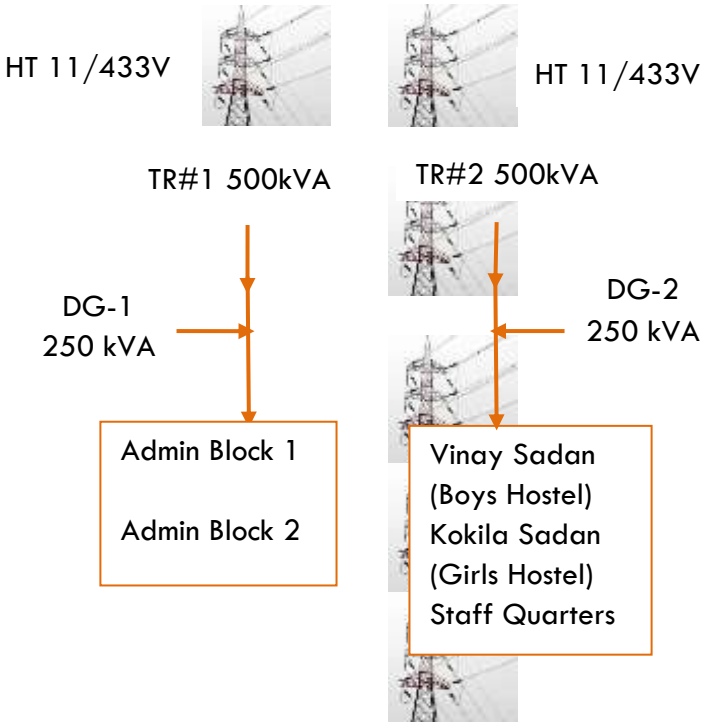
Bengaluru campus consists of three schools: GITAM School of Technology, GITAM School of Business - Bengaluru and GITAM School of Science to impart high quality training in the fields of Technology and Management in the silicon valley of India.

The campus is located near the IT hub of the city. The campus has two academic blocks, one spacious library building, an administrative block and two hostels. All the academic departments have adequate number of smart classrooms, staff rooms, seminar halls well- equipped laboratories, central library, and other facilities.

4. ELECTRICAL SYSTEM

The electrical power is availed from Bangalore Electricity Supply Company Limited of Karnataka Electricity Board. The power is distributed through LT panel located in the Facility Area. The power is distributed to the industry through transformer of loading position 11KV/433V distribution transformer. And connected load is 1678.6 KW/1865.1 KVA

There are total 3 Nos. of DG set each 250 kVA (2 Nos. of 250 kVA DG sets are inside the Campus) and (1 No. (New one) outside the Campus for New Hostel) for the backup to handle any grid power interruption.



5.1 ELECTRICAL BILL ANALYSIS

The Energy bill data were analyzed from January'20 to December'21, the total electricity bill for the year 2020 - 21 is Rs.144 Lakhs and unit consumption is 13.4 lakhs kWh.

Month	Energy Consumption kWh	Energy Bill Charges Rs	Maximum Demand kVA	Power Factor
Jan-20	156,000	1503776	600	0.90
Feb-20	176,910	1691635	600	0.90
Mar-20	101,430	985493	600	0.90
Apr-20	-	96222	600	0.90
May-20	2,277	110242	600	0.90
Jun-20	9,525	189192	600	0.90
July-20	6,789	167857	600	0.90
Aug-20	15,699	243312	600	0.90
Sept-20	11,094	203801	600	0.90
Oct-20	7,398	36555	600	0.90
Nov-20	11,622	212920	600	0.90
Dec-20	21,327	302202	600	0.90
Total	**520,071**	**5,743,207**	**7200**	**0.90**

Table: Energy Bill Analysis Jan'20 to Dec'20

Month	Energy Consumption kWh	Energy Bill Charges Rs.	Maximum Demand kVA	Power Factor
Jan-21	50703	563913	600	0.90
Feb-21	104046	1039146	600	0.90
Mar-21	125607	1221184	600	0.90
Apr-21	42447	489067	600	0.90
May-21	12426	114637	600	0.90
Jun-21	18252	276410	600	0.90
July-21	26334	344606	600	0.90
Aug-21	24939	332836	600	0.90
Sept-21	18819	299675	600	0.90
Oct-21	60987	674043	600	0.90
Nov-21	153471	1484916	600	0.90
Dec-21	189645	1817447	600	0.90
Total	**827676**	**8657880**	**7200**	**0.90**

Table: Energy Bill Analysis Jan'21 to Dec'21

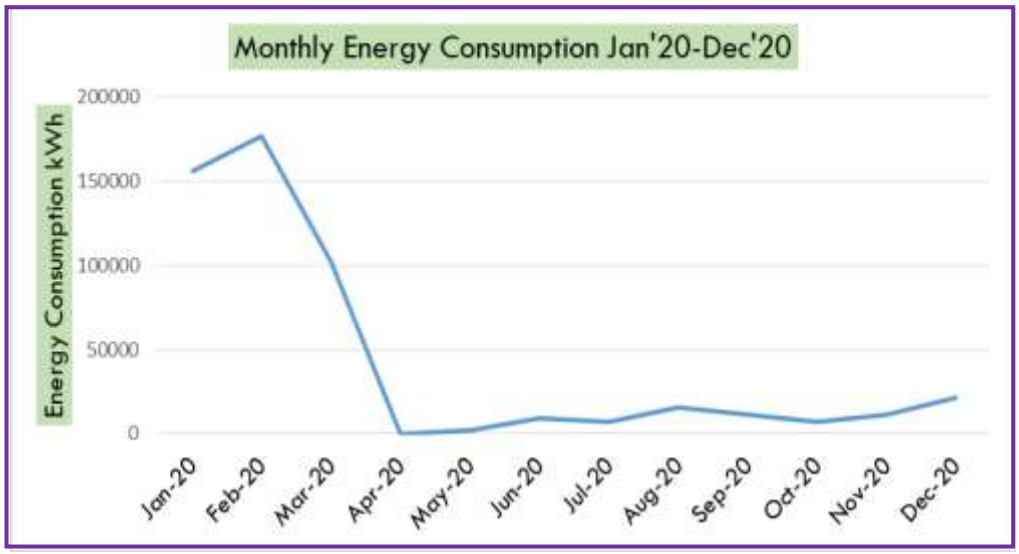


Chart: kWh Consumption analysis – During Feb 2020 energy consumption is high

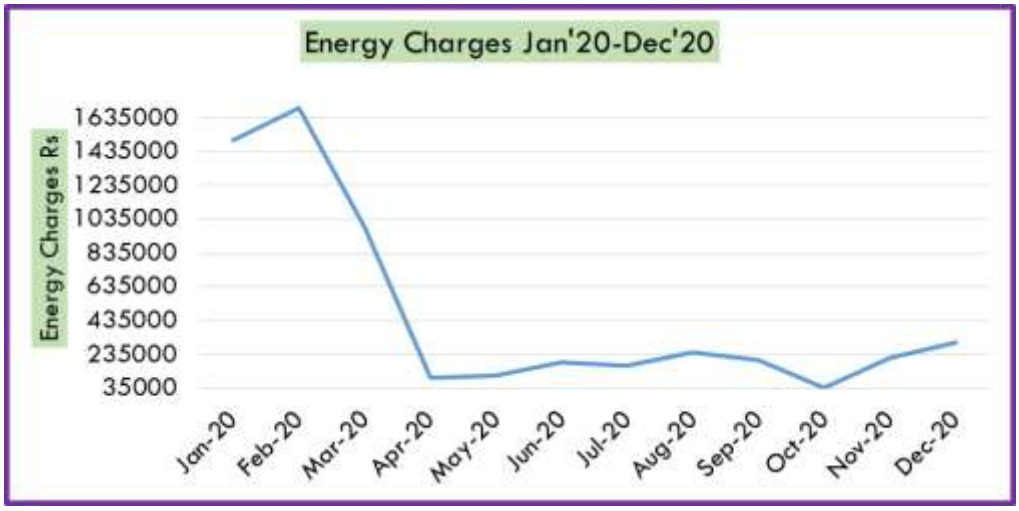


Chart: Monthly Unit Consumption Charges – During Feb 2020 energy bill is high

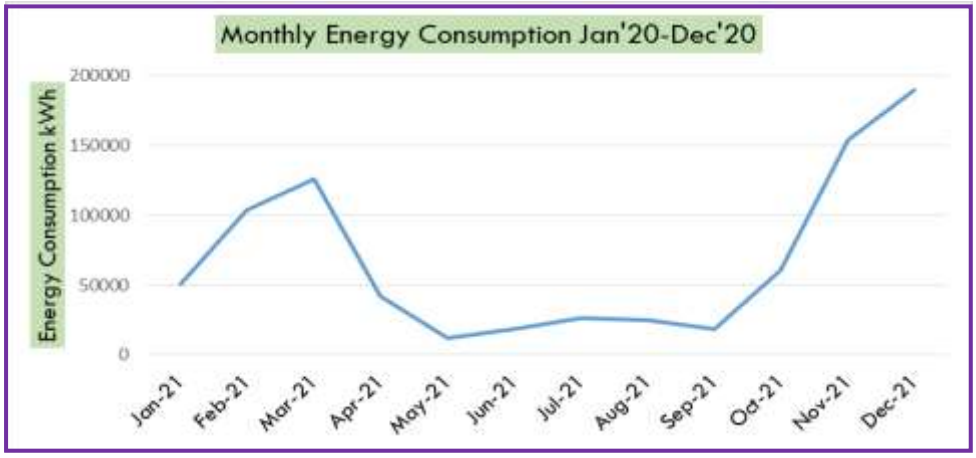


Chart: kWh Consumption analysis – During Dec 2021 energy consumption is high

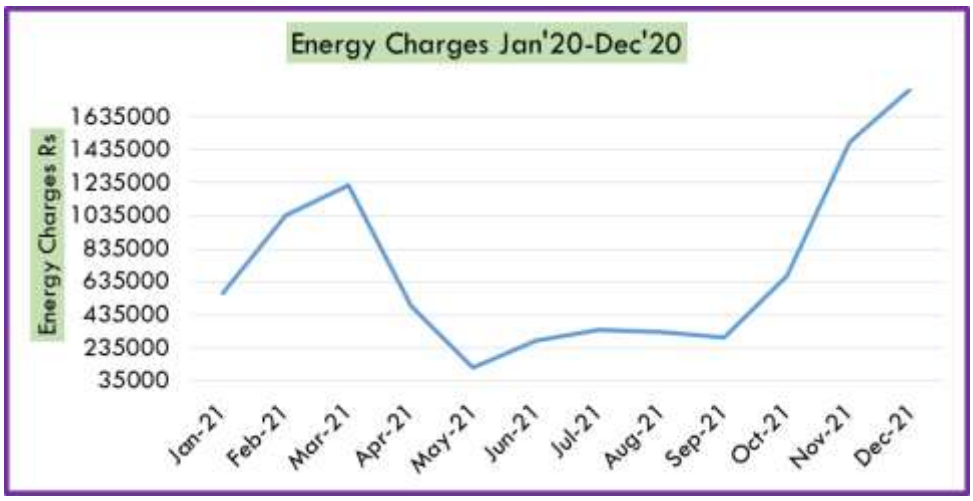


Chart: Monthly Unit Consumption Charges – During Dec 2020 energy bill is high

5.2 POWER LOGGING OF TRANSFORMER 1- MAIN LT PANELS

Time		Maximum	Minimum	Average
Voltage	RY	444.5	410.9	428.0
	YB	444.1	410.7	427.9
	BR	445.2	410.5	427.0
Current	R	108.7	2.8	55.8
	Y	1757.2	386.6	1071.9
	B	109.4	4.0	56.0
Hz		50.2	49.9	50.0
kW		310	70	172.5
kVAr		371.2	20.8	188.7
kVA		486.4	45.9	245.6
Power Factor PF		0.93	0.59	0.72
Voltage THD %	R	3.6	0.7	1.9
	Y	3.6	0.6	2.0
	B	4.2	0.5	2.1
Current THD %	R	24.7	6.3	19.0
	Y	3.4	0.6	1.2
	B	75.8	7.9	22.8

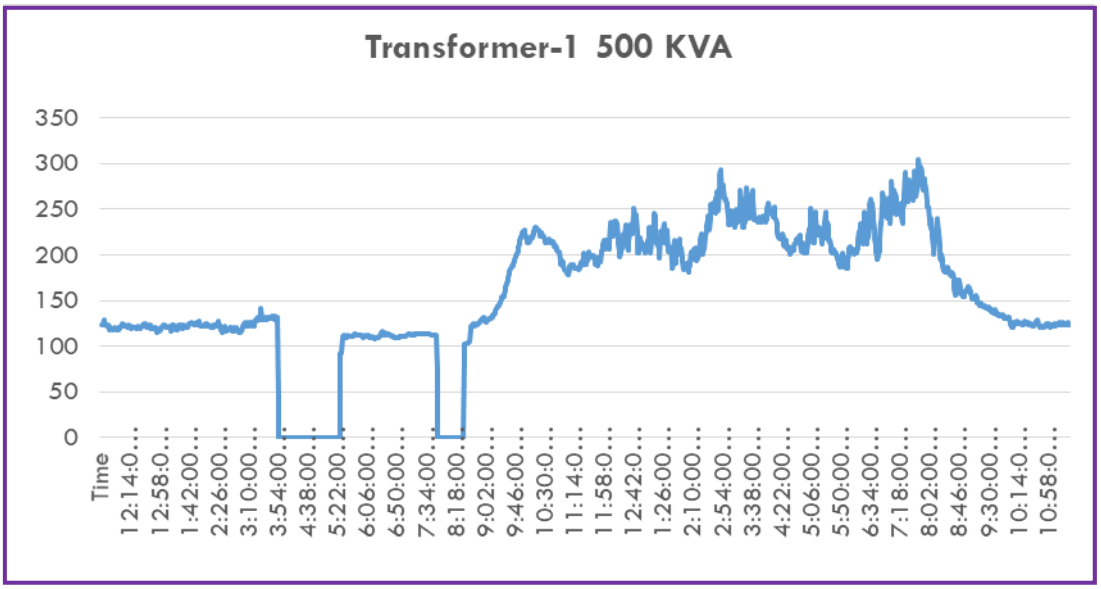


Chart: Transformer-1 Power Consumption – During 24 hrs cycle power consumption varies from 70 to 310 kW, during the Morning and evening time power consumption is high

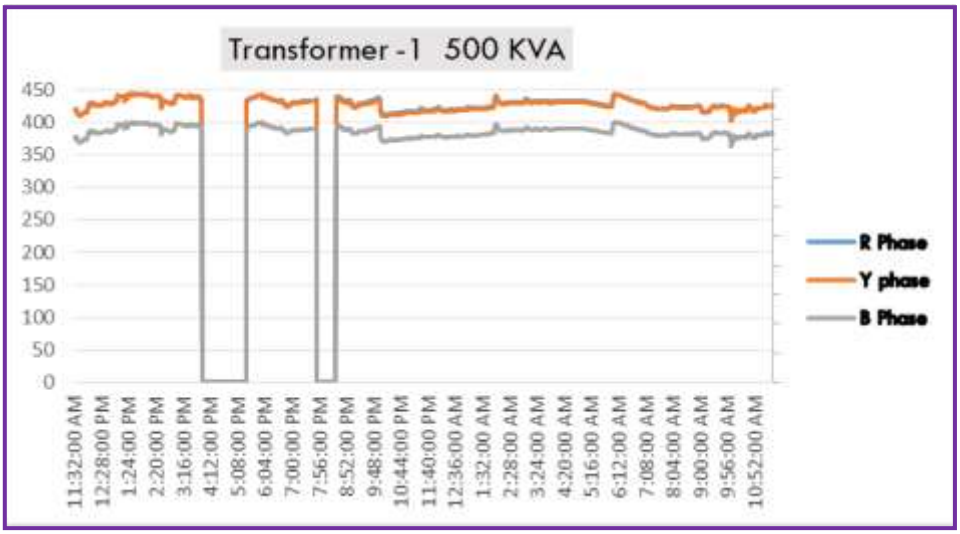


Chart: Transformer-1 Voltage – During 24 hrs cycle voltage varies from 360 to 445 V.

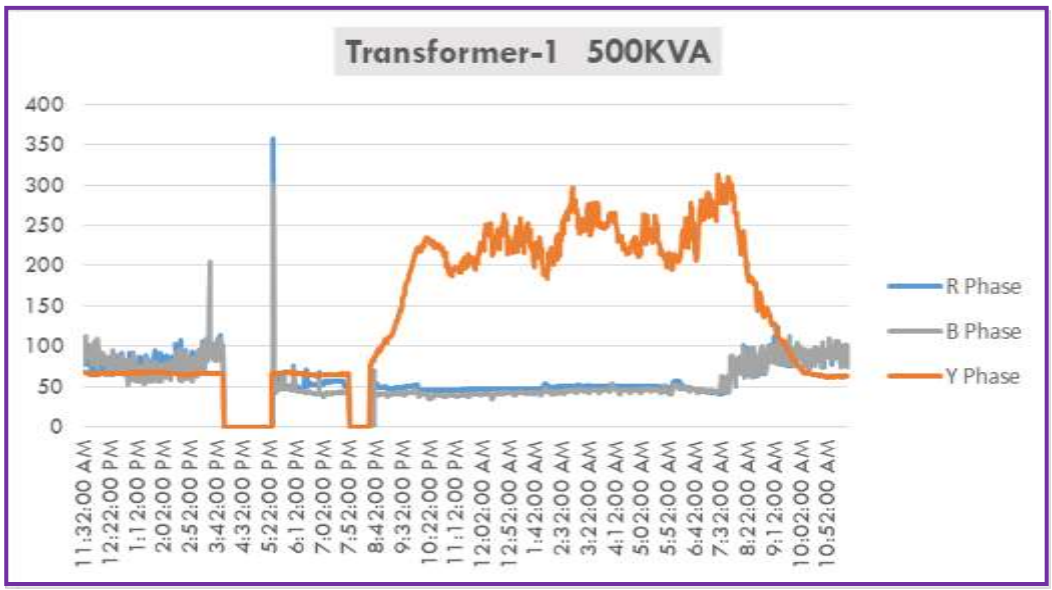


Chart: Transformer-1 Current – During 24 hrs cycle current varies from 3 to 1700 A.

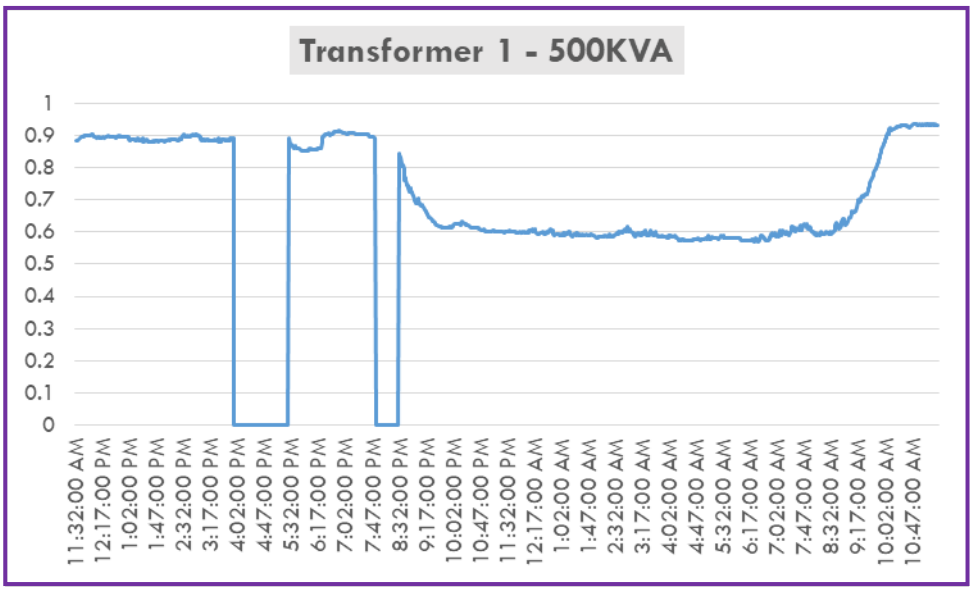


Chart: Transformer-1 Power Factor– During 24 hrs cycle Power Factor varies from 0.59 to 0.93, during the Morning and evening time power factor nearing unity.

5.3 HARMONIC ANALYSIS

Harmonics are caused by and are the byproduct of modern electronic equipment such as Adjustable speed drives and variable frequency drives, Rectifiers, battery chargers, UPS, personal or notebook computers, laser printers, fax machines, telephone systems, stereos, radios, TVs & any other equipment powered by switched- mode power supply (SMPS) equipment's. All the above loads are non-linear loads which are widely used in modern office buildings and also widespread in factories and industrial plants.

As per IEEE-519 1992, THD of voltage shall be limited to a maximum of 5%, with no individual harmonics to exceed 3% and THD of current is limited to a maximum of 4% with no individual harmonics to exceed 1%. It is evident that there are no any serious magnitudes of harmonics.

Harmonic limits are calculated based on IEEE 519-1992 standards. Same is attached herewith for reference

Harmonic Limits						
Current Distortion Limits for General Distribution Systems (120 through 69000 V)						
Maximum harmonic Current Distortion in Percent of I_L						
Individual harmonic Order (Odd harmonics)						
I_{sc}/I_L	**<11**	**11≤*h* <17**	**17≤ *h* <23**	**23 ≤*h* <35**	**35≤ *h***	**TDD**
<20	4	2.0	1.5	0.6	0.3	5
20<50	7	3.5	2.5	1.0	0.5	8
50<100	10	4.5	4.0	1.5	0.7	12
100<1000	12	5.5	5.0	2.0	1.0	15
>1000	15	7.0	6.0	2.5	1.4	20
Even harmonics are limited to 25% of the odd harmonic limits above.						
Current Distortion that result in a DC offset, e.g. half-wave converters, are not allowed						
*All power generation equipment is limited to these values of current distortion, regardless of actual I_{sc} / I_L.						
Where:						
I_{sc} = maximum short-circuit current at PCC						
I_L = maximum demand load current (fundamental frequency component) at PCC						
TDD = Total demand distortion (RSS), harmonic current distortion in % of maximum demand load current (15 or 30 min demand)						
PCC = Point of common coupling						

Voltage distortion limits		
Bus Voltage at PCC	Individual Voltage Distortion (%)	Total Voltage Distortion THD (%)
69 kV and below	3	5
69.001 kV through 161 kV	1.5	2.5
161.001 kV and above	1	1.5
NOTE: High-voltage systems can have up to 2.0% THD where the cause is an HVDC terminal that will attenuate by the time it is tapped for a user		

Description		Transformer -1 500 kVA		
		Maximum	Minimum	Average
Voltage THD %	R	3.6	0.7	1.9
	Y	3.6	0.6	2.0
	B	4.2	0.5	2.1
Current THD %	R	24.7	6.3	19.0
	Y	3.4	0.6	1.2
	B	75.8	7.9	22.8

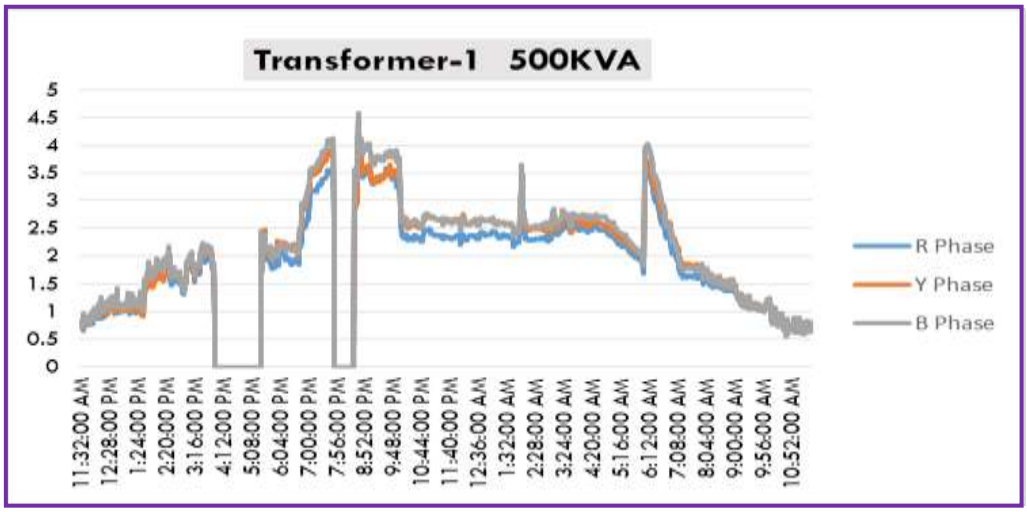


Chart: Transformer-1 Voltage THD – During 24 hrs cycle voltage harmonics varies from 0.5% to 4.2%.

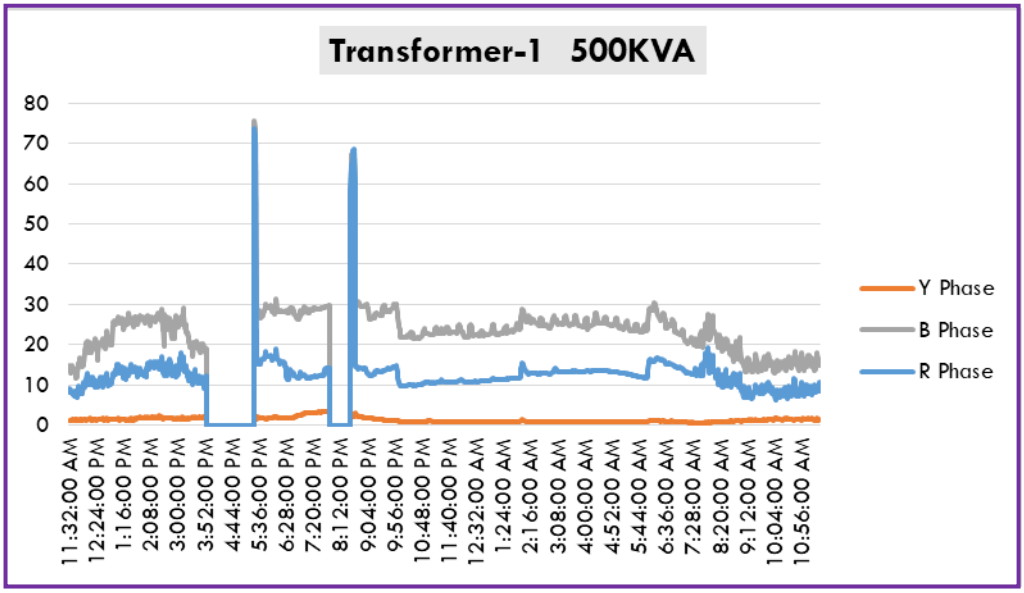


Chart: Transformer-1 Current THD – During 24 hrs cycle current harmonics varies from 1% to 75%.

Comments:

From the above table it can be seen that individual voltage are within the prescribed limits set by IEEE and current harmonics are higher than the limit. We recommend closely monitoring harmonics level periodically for the particular locations listed above and take necessary action if required.

6. Heating Ventilating & Air Conditioning (HVAC)

In College campus for human comfort, sum of 21 TR capacities of split units installed, in Administration Block 1 and Administration Block 2 are installed in the campus to meet the cooling requirement. Along with this, for ventilation in the facility, ceiling and exhaust fans are installed.

6.1 Performance Analysis of Split Units

Administration Block 1- (Directorate of Admission) - (Unit-1)		
Description	**Name Plate Details**	
Make	Lloyd	
Model	LS24AA3	
Motor Power, kW	3.1	
Rated Current, A	13.5	
Refrigerant & Charge	R-410A, 1.1 kg	
Energy Star	3	
Capacity, TR	2	
Performance Analysis		
Description	**Actual**	**Units**
Motor running current	9.5	A
Voltage	243.8	V
PF	0.89	
Motor power	2	kW
Supply air quantity	588	CFM
Return air temperature	24.2	°C
Relative humidity	59.1	%
Supply air temperature	21.3	°C
CO_2 Level	702	PPM

Comments:

Power consumption is within the design limit and CO_2 level is within limits. Every 3 months once Filter cleaning is recommended.

Administration Block 1- (Directorate of Admission) - (Unit-2)		
Description	**Name Plate Details**	
Make	Lloyd	
Model	LS24AA3	
Motor Power, kW	3.1	
Rated Current, A	13.5	
Refrigerant & Charge	R-410A, 1.1 kg	
Energy Star	3	
Capacity, TR	2	
Performance Analysis		
Description	**Actual**	**Units**
Motor running current	9.5	A
Voltage	242.8	V
PF	0.89	
Motor power	2	kW
Supply air quantity	601	CFM
Return air temperature	24.2	°C
Relative humidity	59.3	%
Supply air temperature	21.7	°C
CO_2 Level	702	PPM

Comments:

Power consumption is within the design limit and CO_2 level is high. Every 3 months once Filter cleaning is recommended.

Administration Block 1- (Directorate of Admission) - (Unit-3)		
Description	**Name Plate Details**	
Make	Lloyd	
Model	LS24AA3	
Motor Power, kW	3.1	
Rated Current, A	13.5	
Refrigerant & Charge	R-410A, 1.1 kg	
Energy Star	3	
Capacity, TR	2	
Performance Analysis		
Description	**Actual**	**Units**
Motor running current	9.8	A
Voltage	238	V
PF	0.87	
Motor power	2	kW
Supply air quantity	554	CFM
Return air temperature	24.2	°C
Relative humidity	59.5	%
Supply air temperature	22.3	°C
CO_2 Level	702	PPM

Comments:

Power consumption is within the design limit and CO_2 level is high. Every 3 months once Filter cleaning is recommended.

Administration Block 1- (Directorate Admission Room) - (Unit-4)		
Description	**Name Plate Details**	
Make	Lloyd	
Model	LS24AA3	
Motor Power, kW	3.1	
Rated Current, A	13.5	
Refrigerant & Charge	R-410A, 1.1 kg	
Energy Star	3	
Capacity, TR	2	
Performance Analysis		
Description	**Actual**	**Units**
Motor running current	8.3	A
Voltage	250.5	V
PF	0.85	
Motor power	1.8	kW
Supply air quantity	701	CFM
Return air temperature	22.1	°C
Relative humidity	62.5	%
Supply air temperature	18.6	°C
CO_2 Level	816	PPM

Comments:

Power consumption is within the design limit and CO_2 level is within limits. Every 3 months once Filter cleaning is recommended.

Administration Block 1- (Board Room) - (Unit-5)		
Description	**Name Plate Details**	
Make	Blue Star	
Model	3HW24SVBI	
Motor Power, kW	2.08	
Rated Current, A	9.3	
Refrigerant	R-22	
Energy Star	3	
Capacity, TR	2	
Performance Analysis		
Description	**Actual**	**Units**
Motor running current	7.1	A
Voltage	251.6	V
PF	0.87	
Motor power	1.6	kW
Supply air quantity	641	CFM
Return air temperature	22.6	°C
Relative humidity	66.5	%
Supply air temperature	20.4	°C
CO_2 Level	554	PPM

Comments:

Power consumption is within the design limit and CO_2 level is within limits. Every 3 months once Filter cleaning is recommended.

Administration Block 1- (Board Room) - (Unit-6)		
Description	**Name Plate Details**	
Make	Blue Star	
Model	3HW24SVBI	
Motor Power, kW	2.08	
Rated Current, A	9.3	
Refrigerant	R-22	
Energy Star	3	
Capacity, TR	2	
Performance Analysis		
Description	**Actual**	**Units**
Motor running current	8.4	A
Voltage	243.5	V
PF	0.87	
Motor power	1.8	kW
Supply air quantity	709	CFM
Return air temperature	22.7	°C
Relative humidity	66.5	%
Supply air temperature	22.4	°C
CO_2 Level	554	PPM

Comments:

Power consumption is within the design limit and CO_2 level is within limits. Every 3 months once Filter cleaning is recommended.

Administration Block 1- (Board Room) - (Unit-7)		
Description	**Name Plate Details**	
Make	Blue Star	
Model	3HW24SVBI	
Motor Power, kW	2.08	
Rated Current, A	9.3	
Refrigerant	R-22	
Energy Star	3	
Capacity, TR	2	
Performance Analysis		
Description	**Actual**	**Units**
Motor running current	9.2	A
Voltage	251.7	V
PF	0.88	
Motor power	2	kW
Supply air quantity	709	CFM
Return air temperature	22.7	°C
Relative humidity	66.5	%
Supply air temperature	16.1	°C
CO_2 Level	557	PPM

Comments:

Power consumption is within the design limit and CO_2 level is within limits. Every 3 months once Filter cleaning is recommended.

Administration Block 1- (3F – Seminar Hall) - (Unit-8)		
Description	**Name Plate Details**	
Make	Blue Star	
Model	3HW24SVBI	
Motor Power, kW	2.08	
Rated Current, A	9.3	
Refrigerant	R-22	
Energy Star	3	
Capacity, TR	2	
Performance Analysis		
Description	**Actual**	**Units**
Motor running current	8.6	A
Voltage	237.2	V
PF	0.88	
Motor power	2	kW
Supply air quantity	745	CFM
Return air temperature	21.7	°C
Relative humidity	63.3	%
Supply air temperature	17.2	°C
CO_2 Level	531	PPM

Comments:

Power consumption is within the design limit and CO_2 level is within limits. Every 3 months once Filter cleaning is recommended.

6.2 PERFORMANCE ANALYSIS OF DOMESTIC WATER PUMPS

Bore Well Water Pump Motor -1 (Backside of Administration -1 Building)

Description		Bore Well Water Pump -1
Make		Crompton
Installed motor power, kW		5.5
No. of Phase		3
Description Readings		
Voltage, V	RY	434.4
	YB	436.5
	BR	435.8
Current, A	R	13
	Y	13.2
	B	13.4
Power Factor, PF		0.88
Power consumption, kW		8.7

Comments:

Power consumption is above the design limit, so replace old Pump motor with new efficient IE4/5 motor. Water meter is installed in outlet of the bore well pipe to measure the water consumption from the bore well. Bore Water Consumption Record shall be maintained on daily, monthly basis to arrive at the water balance chart.

Bore Well Water Pump Motor -2 (Opposite to Staff Quarters Building)

Description		Bore Well Water Pump -1
Make		KSB
Installed motor power, kW		7.5
No. of Phase		3
Description Readings		
Voltage, V	RY	413.6
	YB	416.3
	BR	415.9
Current, A	R	11.2
	Y	11.3
	B	11
Power Factor, PF		0.88
Power consumption, kW		7

Comments:

Power consumption is below the design limit. Water meter is installed in outlet of the bore well pipe to measure the water consumption from the bore well. Bore Water Consumption Record shall be maintained on daily, monthly basis to arrive at the water balance chart.

Bore Well Water Pump Motor -3 (Near Main Gate)

Description		Bore Well Water Pump -1
Make		Suguna
Installed motor power, kW		5.5
No. of Phase		3
Description Readings		
Voltage, V	RY	406.1
	YB	390.2
	BR	404.9
Current, A	R	15.8
	Y	15.7
	B	15.8
Power Factor, PF		0.89
Power consumption, kW		9.6

Comments:

Power consumption is above the design limit, so replace the old Pump motor with new efficient IE3 motor. Water meter is not installed, so install the Water meter in outlet of the bore well pipe to measure the water consumption from the bore well. Bore Water Consumption Record shall be maintained on daily, monthly basis to arrive at the water balancing.

Sump Water Pump Motor (For Staff Quarters) -1

Description		Sump Water Pump -1
Make		Lubi
Installed motor power, kW		7.5
No. of Phase		3
Description Readings		
Voltage, V	RY	410.2
	YB	408
	BR	407.9
Current, A	R	15.5
	Y	16
	B	14.9
Power Factor, PF		0.87
Power consumption, kW		9.4

Comments:

Power consumption is above the design limit, so replace the old Pump motor with new efficient IE3 motor. Water meter shall be installed at the overhead tank outlet to measure the water consumption from the bore well. Water Consumption Record shall be maintained on daily, monthly basis to arrive at the Water balance chart.

Sump Water Pump Motor (For Boys Hostel Vinay Sadan) -2

Description		Sump Water Pump -2
Make		Lubi
Installed motor power, kW		7.5
No. of Phase		3
Description Readings		
Voltage, V	RY	410.1
	YB	407.7
	BR	406
Current, A	R	15
	Y	14.2
	B	14.6
Power Factor, PF		0.87
Power consumption, kW		8.9

Comments:

Power consumption is above the design limit, so replace the old Pump motor with new efficient IE3 motor. Water meter shall be installed at the overhead tank outlet to measure the water consumption from the bore well. Water Consumption Record shall be maintained on daily, monthly basis to arrive at the Water balance chart.

Sump Water Pump Motor (For Girls Hostel Kokila Sadan) -3

Description		Sump Water Pump -3
Make		Lubi
Installed motor power, kW		7.5
No. of Phase		3
Description Readings		
Voltage, V	RY	407.1
	YB	410
	BR	410
Current, A	R	9.7
	Y	9.6
	B	10
Power Factor, PF		0.88
Power consumption, kW		6

Comments:

Power consumption is below the design limit. Water meter shall be installed at the overhead tank outlet to measure the water consumption from the bore well. Water Consumption Record shall be maintained on daily, monthly basis to arrive at the Water balance chart.

Sump Water Pump Motor (For Vinay Sadan) -4

Description		Sump Water Pump -4
Make		Kirloskar
Installed motor power, kW		7.5
Head, m		55
Motor RPM		2940
Volt, V		380
Amps, A		19.50
No. of Phase		3
Description Readings		
Voltage, V	RY	394.7
	YB	395.1
	BR	391.3
Current, A	R	15.4
	Y	15.7
	B	16.2
Power Factor, PF		0.89
Power consumption, kW		9.5

Comments:

Power consumption is above the design limit. Water meter shall be installed at the overhead tank outlet to measure the water consumption from the bore well. Water Consumption Record shall be maintained on daily, monthly basis to arrive at the Water balance chart.

6.3 PERFORMANCE ANALYSIS OF RO PUMPS

Administration Block-2 RO Water Plant (500 LPH)

Description	High Pressure Pump
Make	Leo
Capacity, m^3/hr	2
Motor current, A	10
Motor RPM	2900
Installed motor power, kW	1.8
Description	**Readings**
Voltage, V	238.5
Current, A	10.5
Power consumption, kW	2.2

Comments:

Power consumption is above the design limit.

Boys Hostel Vinay Sadan RO Water Plant 1 (500 LPH)

Description	High Pressure Pump
Make	Leo
Capacity, m^3/hr	2
Motor current, A	10
Motor RPM	2900
Installed motor power, kW	1.8
Description	**Readings**
Voltage, V	239.4
Current, A	9.4
Power consumption, kW	1.9

Comments:

Power consumption is above the design limit.

Administration Block-2 RO Water Plant 2 (1000 LPH)

Description	High Pressure Pump
Make	Leo
Capacity, m^3/hr	2
Motor current, A	10
Motor RPM	2900
Installed motor power, kW	1.8
Description	**Readings**
Voltage, V	230.6
Current, A	10.1
Power consumption, kW	2

Comments:

Power consumption is above the design limit.

Staff Quarters RO Water Plant (1000 LPH)

Description	High Pressure Pump
Make	Leo
Voltage, V	220
Motor current, A	9.11
Motor RPM	2800
Installed motor power, kW	1.5
Description	**Readings**
Voltage, V	243.5
Current, A	15.6
Power consumption, kW	3.4

Comments:

Power consumption is above the design limit.

Girls Hostel Kokila Sadan RO Water Plant (1000 LPH)

Description	High Pressure Pump
Make	Leo
Voltage, V	220
Motor current, A	9.11
Motor RPM	2800
Installed motor power, kW	1.5
Description	**Readings**
Voltage, V	234.9
Current, A	13.8
Power consumption, kW	2.8

Comments:

Power consumption is above the design limit.

GITAM University Performance Analysis of STP Water Pump

Description		Raw Water Feed Pump
Make		Jenny
Installed motor power, kW		5
No. of Phase		3
Description		**Readings**
Voltage, V	RY	434.8
	YB	434
	BR	433.8
Current, A	R	8
	Y	7.1
	B	7.6
Power Factor, PF		0.89
Power consumption, kW		5

Comments:

Power consumption is within the design limit.

Description		Filter Feeding Pump
Make		Kirloskar
Installed motor power, kW		1.5
No. of Phase		3
Description Readings		
Voltage, V	RY	410
	YB	428
	BR	432
Current, A	R	1.9
	Y	2.1
	B	2
Power Factor, PF		0.89
Power consumption, kW		1.3

Comments:

Power consumption is within the design limit.

Description		Filter Processed Feed Pump
Make		Suguna
Installed motor power, kW		7.5
No. of Phase		3
Description Readings		
Voltage, V	RY	436.6
	YB	436.4
	BR	435.2
Current, A	R	7.7
	Y	7.6
	B	7.5
Power Factor, PF		0.89
Power consumption, kW		5.1

Comments:

Power consumption is within the design limit.

7 SITE OBSERVATION REPORT

Site Observation Report (SOR)			
Report No.	C&A/SOR/03	**Date**	10.02.2022
Location	Class Rooms		
Observation Images			

Description
Daylight in the class rooms.
Potential Sustainability Measures
There is enough daylight available in the class rooms, views and natural ventilation are also good.

Site Observation Report (SOR)			
Report No.	C&A/SOR/04	**Date**	10.02.2022
Location	Dust Bins		

Observation Images
 
Description
Different type waste collection bins are kept for the collection of waste.
Potential Sustainability Measures
This helps in reducing the segregation of waste at source.

Site Observation Report (SOR)			
Report No.	C&A/SOR/06	**Date**	10.02.2022
Location	External Lights on the Pathways inside the Campus		

Observation Images

Description

External lights power are not with solar PV type.

Potential Sustainability Measures

It is recommended to install Solar PV type external lights in the whole campus. It helps to reduce the energy consumption and associated carbon footprints. When the campus aims towards net zero energy/carbon, these measures could be major stepping stones.

Site Observation Report (SOR)			
Report No.	C&A/SOR/07	**Date**	10.02.2022
Location	Admin 1 & 2 Blocks, Staff Quarters Roof Top (498 kW Solar PV Panels)		

Observation Images

Description

Dusts on Solar PV panels were observed.

Potential Sustainability Measures

It is highly recommended to clean the Solar PV Panel at manufacturer recommended intervals better power generation efficiency.

Site Observation Report (SOR)			
Report No.	C&A/SOR/11	**Date**	10.02.2022
Location	Admin Blocks, Staff Quarters, Boys & Girls Hostels		

Observation Images

Description

It is observed that all the rooms are fitted conventional type ceiling fans. And most of the rooms are fitted with 36 Watts CFL Tube Lights.

Potential Sustainability Measures

It is advised to install BLDC type ceiling fans and replace CFL Tube Lights with LED Tube Lights which reduces the power consumptions.

Site Observation Report (SOR)			
Report No.	C&A/SOR/13	**Date**	10.02.2022
Location	Admin Block -2 Backside		

Observation Images

Description

It is observed that body earth is conventional type. University's Earthing system must be in better condition as it is prone to malfunction and gives rise to harmonic and multiply the same into the electrical network.

Potential Sustainability Measures

It is recommended to plan for maintenance free Earthing instead of the conventional Earthing.

And also location should be mentioned along with B.E -01 no.

Site Observation Report (SOR)			
Report No.	C&A/SOR/15	**Date**	10.02.2022
Location	Outside the Campus near Labour shed & New Hostel		

Observation Images

Description

Bore well pump motor is not working and it is malfunctioning. Panel maintenance can be improved.

Potential Sustainability Measures

Replace the old pump motor with new efficient IE4/5 motor. And maintenance of the panels shall be done regularly as per the preventive maintenance schedule.

Site Observation Report (SOR)			
Report No.	C&A/SOR/16	**Date**	10.02.2022
Location	Admin Block-1 & 2		

Observation Images

Description

Three Star rated Dx type Split AC units are installed in the Office Area.

Potential Sustainability Measures

It is recommended to replace them with the Five Star rated ones in the future. This reduces the power consumption to the maximum and it is highly efficient. Among all the loads, air-conditioning is the maximum load in any commercial building and hence even a small step on these systems could make an huge impact on the overall energy consumption and carbon footprint.

8 PERFORMANCE IMPROVEMENT MEASURES (PIM'S)

PIM 1: Solar PV panel Cleaning

Annual Energy Savings	17,832 kWh/annum
Recurring Annual Savings Potential	Rs 1.5 Lakhs
One-time Cost of Implementation	Rs. 0
Payback period	Immediately

Present System:

Presently 498 kW Solar PV panel is installed on the roof top of the building and panels are not maintained properly.

Proposed System:

To increase the power generation capacity and life of the panel, weekly maintenance is required.

Description	Value	Units	Formula
Installed solar PV Capacity	498	kW	A
Annual Energy Generation	594384	kWh/ year	B
Increased Efficiency after cleaning	3	%	C
Increased Energy Generation	17831.5	kWh/ year	D = B X C
Per unit energy cost	8.35	Rs.	E
Annual Cost Savings	1.49	Rs Lakhs	F
One time implementation	0.0	Rs lakhs	G
Payback	Immediately	Months	H

PIM 2: Convert Split Units to VRF unit to improves efficiency & power consumption reduction

Annual Energy Savings	1,35,600 kWh/annum
Recurring Annual Savings Potential	Rs. 11.1 Lakhs
One-time Cost of Implementation	Rs. 10.0 Lakhs
Payback period	**11** months

Present System

During our Audit in University premises, split units are installed in office areas, Board Rooms, Principal Room and Director Room. In this area split units were of non 5 star rated units. This AC unit consumes more energy compared to 5 Star rated.

Proposed System

It is recommended to replace these inefficient split units with VRF system to reduce the power consumption and increase the equipment life. This will reduce the power consumption 20 to 40% compared to individual split units.

Description	Value	Units	Formula
Power Consumption of Split units	113	kW	A
Decrease in power consumption after installing VRF system	40	%	B
Average power consumption after installing VRF	67.80	kW	C=A-(AxB%)
Annual saving hours considered	3,000	hrs/yr	D
Estimated annual energy savings	1,35,600	kWh	E=(A-C)xD
Unit power cost	8.20	Rs/kWh	F
Recurring annual savings	**11.1**	**Lakhs**	**G=E x F**
One-time cost of implementation	**10**	**Lakhs**	**H**
Payback	11	months	I=H/G x12

PIM 3: Exterior LED lamps should be installed with Solar PV based fixtures to reduce BESCOM power consumption

Annual Energy Savings	12,600 kWh/annum
Recurring Annual Savings Potential	Rs. 1.0 Lakhs
One-time Cost of Implementation	Rs. 1.5 Lakhs
Payback period	8 months

Present System

During the Audit, it is observed that Foot path and Gardening exterior lights are 75W, 35W and 200W LED lamps are installed and power is sourced from BESCOM.

Proposed System

It is recommended to replace External LED lamps with Solar PV based fixtures of rechargeable battery type

Description	Value	Units	Formula
Total power consumption in Exterior Lighting	3	kW	A
Present Annual Operating Hours	4,200	hrs	B
Present Annual Energy Consumption	12,600	kWh	C=AxB
Proposed Power consumption after installing Solar based LED lamps (considering 100% reduction)	-	kW	D = (A-(A*40%))
Proposed Energy Consumption	-	kWh	**E=DxB**
Proposed Energy savings in Units	12,600	kWh	**F=C-D**
Power cost	8.20	Rs/kWh	H
Annual Power cost savings	**1.0**	Rs. Lakhs	**I**
One-time cost of implementation	**1.5**	Rs. Lakhs	**J**
Payback period	8	Months	K=J/I x12

PIM 4: Measurement & Verification (M&V) as per IPMVP

Annual Energy Savings	82,768 kWh/annum
Recurring Annual Savings Potential	6.8 Lakhs
One-time Cost of Implementation	20 Lakhs
Payback period	35 Months

Present System:

Presently there is no M&V in place; it is difficult to monitor the energy consumption & energy wastage in the facility.

Proposed System:

It is recommended to have a proper M&V as detailed explained in the section Measurement & Verification. There are 22 energy meters to be installed and monitored online through open platform. This online M&V will reduce the overall energy consumption.

Description	Value	Units	Formula
Annual Energy Consumption	8,27,676	kWh/yr	A
Proposed M&V energy saving	10	%	B
Annual Energy Savings	82,768	kWh/yr	C =BX10%
Unit power cost	8.2	Rs/kWh	D
Annual Cost Savings	6.8	Rs Lakhs	E
One time implementation cost	20	Rs lakhs	F
Payback	35	Months	G=(F/E)X12

9 GOOD PRACTICES AT GITAM UNIVERSITY CAMPUS

During Conserve Consultant's Audit, it is observed that M/s GITAM University, Bengaluru Campus has already adopted the following Performance Improvement Measures in its facility;

1.1 Solar PV System

Solar PV is installed in the roof top of 498 kW which is of Zero Carbon Footprint Energy. It reduces the EB energy consumption from the grid and dependency on outside resources.

1.2 LED lamps in Building facility

In Class rooms, Labs and Office spaces are installed with LED lamps and the lux level is maintained within recommended limits. This Energy Conservation Measure gives savings in lighting energy consumption