Draft Report

ENERGY AUDIT

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Approved by AICTE, Permanently Affiliated to JNT University Kakinada,
ACCREDITED BY NAAC and Recognized under 2(f) &12 (b) by UGC, New Delhi)
Tamaram, Makavarapalem, Narsipatnam (RD), Visakhapatnam-531113
May 2022

Submitted By

Sri. A Pradhasaradhi, External Member

DEE, APEPDCL

&

Dr. T. Srinivasa Rao, Chairman, Energy Audit

Sri. P. Varahala Dora, Member, Energy Audit

Sri. S. Rishikesh, Member, Energy Audit

Principal
Avanthi Institute of Engg. & Technology
Tamaram, Makavarapalem Md.,
Visakhapatnam District., Pin: 531113

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ACCREDITED BY NAAC and Recognised under 2 (f) & 12(b) by UGC, New Delhi.)
Tamaram, Makavarapalem, Narsipatnam Revenue Division, Visakhapatnam Dist. - 531 113.
Administrative Office : 51-8-40/21/2, Beside Rythu Bazar, Nakkavanipalem,
Visakhapatnam - 530 013 (A.P). Ph : 0891-2748231, 9652012340
e-mail : principal_aiet@yahoo.com Website : www.avanthi.edu.in
Ph : 08932 - 222382
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Cell : 98666 64636

Dr. C.P.V.N.J.Mohan Rao, M.Tech., Ph.D.
Principal

Lr: AIETM/Committees/Energy Audit/2021-22/2 **Date: 02/03/2022**

To
Sri. A Pradhasaradhi
Deputy Executive Engineer
APEPDECL
Visakhapatnam
Mobile: 7382585651

Sub: Request to act as External Member for Energy Audit team to take up Internal Energy Audit in AIETM for 2021-'22 – reg.

Sir,

As part of conduct of Quality Audit in our institute, we are taking up Internal Energy Audit in our campus for the year 2021-'22. In this regard, **I request you to you act as External Member for Energy Audit team of our college**. The convener of the Internal Energy Audit team will be contacting you for your guidance and suggestions. Please spare your valuable time and guide our team for the successful completion of the audit and finalization of the audit report covering the recommendations for effective utilization of Energy in our campus.

AVANTHI INSTITUTE OF ENGG. & TECH. SEAL TAMARAM

Principal
Principal
Avanthi Institute of Engg. & Technology
Tamaram, Makavarapalem Md.,
Visakhapatnam District., Pin: 531113

Acceptance as external audit member in avanthi institute thanks reg

From: pardha saradhi (pardhasaradhiadabala@gmail.com)

To: principal_aiet@yahoo.com

Date: Wednesday, March 05, 2022 at 03:24 PM GMT+5:30

Sir

It's Pardhasaradhi Adabala thanking you for appointed as external energy Audit member in you institute.
And also treat it as my acceptance as external audit member.

Yours faithfully

A pardhasaradhi
Deputy Executive Engineer
Autonagar Vizag

Principal
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Tamaram, Makavarapalem, Narsipatnam(R D), Visakhapatnam Dist-531113

Lr: AIETM/Committees/Energy Audit/2021-22/1 **Date: 27/04/2022**

APPOINTMENT OF ENERGY AUDIT COMMITTEE -ORDERS

The Principal is pleased to appoint the following faculty as members of Energy Audit Committee for the year 2021-22. They are directed to take up the assignment and carry out Energy Audit and submit the recommendations for effective utilization of Energy in our campus.

ENERGY AUDIT COMMITTEE

S.NO	Name of the Committee Member	Designation	Position	Signature
1.	Dr. T. Srinivasa Rao	HOD, Dept. of EEE	Chairman	
2.	Sri. P Varahala Dora	Asstc. Professor, EEE	Member	
3.	Sri. S Rishikesh	Asstc. Professor, EEE	Member	

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Copy to:

1. All the Members
2. Coordinator, IQAC
3. Administrative Officer

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Principal
Avanthi Institute of Engg. & Technology
Tamaram, Makavarapalem Md.,
Visakhapatnam District., Pin: 531113

INTRODUCTION

1.1 ABOUT COLLEGE

Avanthi Educational Society under the Leadership of Sri M Srinivasa Rao Garu as chairman was started in the Year 1991. Within a short span of its establishment, the group has made a remarkable stride in the field of education offering various courses at Under Graduate, Post Graduate, Pharmacy & Engineering levels. This milestone is achieved as the institution carved itself to impart quality and career oriented education, countering the challenges of the modern world through planning, dedication, determination, prompt execution and with the innovative ideas of our advisory board.

Today, Avanthi Educational Society is proud to have a strength of over 28000 students with 15 institutions under its ambit. It is the path of glory towards the success during the last 31 years. The institution has been adjudged many times as the second best educational institutions in the twin cities and 16th best in all over India through the impartial survey made by the renowned magazine "India Today".

Avanthi Institute of Engineering and Engineering (AIET), Makavarapalem, Visakhapatnam was started in the year 1999 and offers various courses at Engineering and PG level. The college is provide with rooms, computer center, laboratories and seminar hall with audio-visual equipments. Industry Institute interaction is conducted regularly to emphasize on the latest trends in the present market.

It is very near to Narsipatnam. Frequent bus facilities are available both from and to Visakhapatnam and Narsipatnam. Very safe and secure hostel facility is available for Girl students. These are the additional facilities besides excellent academic atmosphere in the college campus.

Courses Offered

1. B.Tech ((Electronics & Communication Engg.)
2. B.Tech (Electrical and Communication Engineering)
3. B.Tech (Computer Science and Engineering)
4. B.Tech (Mechanical Engineering)
5. B.Tech (Computer Science and Engineering- AI&ML)
6. M.Tech (CSE)
7. M.TECH (VLSI Design)
8. M.TECH (Power Electronics)
9. M.TECH (Power Systems)
10. M.TECH (Digital Electronics And Communication Systems)
11. Master in Business Administration

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1.2 SCOPE OF THE STUDY

The energy audit was conducted with the following scope of work to cover the energy utilisation in various areas of the campus.

- Conduct Awareness Programme on 'Energy Conservation'
- Assess the inputs, outputs and wastage for each usage area
- Develop benchmarks for energy consumption
- Evaluate the tariff and optimisation of tariff
- Assess potential for renewable energy sources
- Identify energy saving measures
- Discussion and brainstorming of the measures evolved
- Cost benefit analysis of the evolved measures.

1.3 AUDIT APPROACH

As per the Energy Conservation Act, 2001 "Energy audit" means the verification, monitoring and analysis of use of energy including submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption. The audit was carried out by undertaking a field visit to the site during May 2022. During the field visit, a number of on-site measurements were taken for various equipment in the campus along with collection of energy consumption, equipment and operational data from the administration. Discussions were held with concerned Technical / Managerial staff so as to fully understand the working requirements to arrive at practically realizable solutions. The audit team collected relevant data and made key measurements.

The following areas were covered as part of the study:

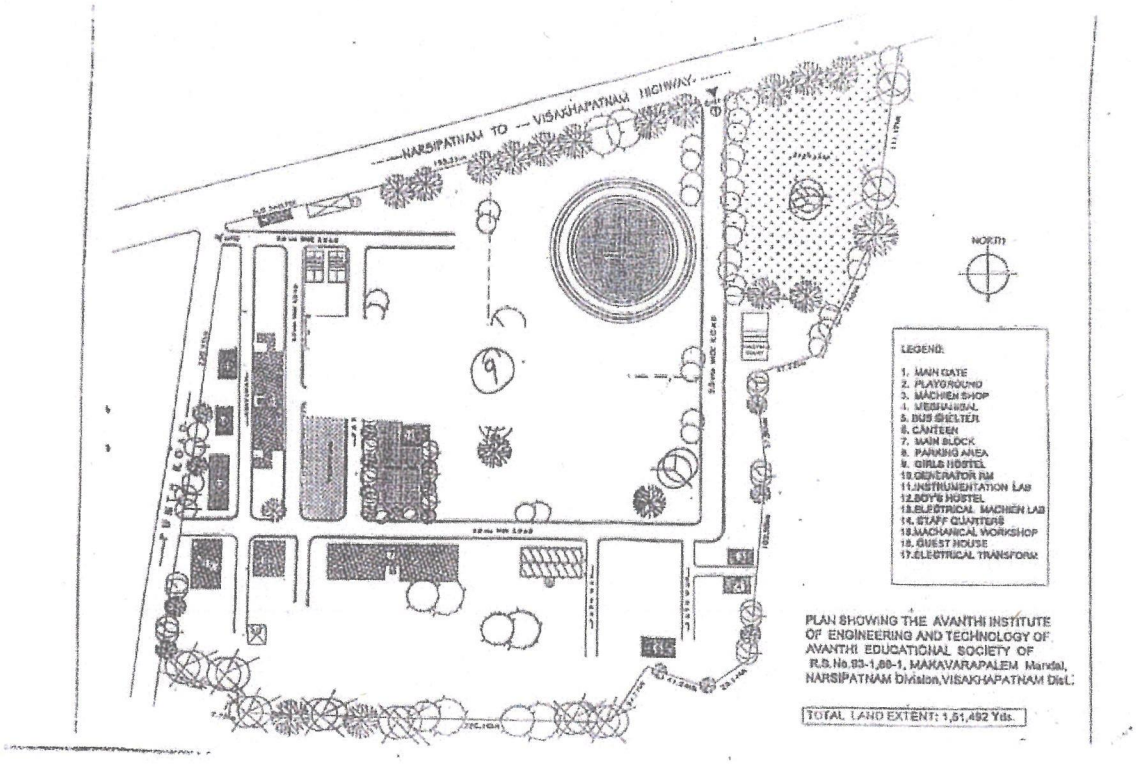
- Tariff
- Electrical Systems: Distribution and management
- Air conditioners
- Lighting
- Ceiling and pedestal fans
- UPS
- Servo stabilisers
- Computers
- Various machinery in Laboratories
- CCTV system
- DG sets

After carrying out the measurement & field study, the preliminary observations of the study were discussed with the management. The report presents the field

measurements, operational data, data analysis, key observations made, and recommendations for achieving energy use efficiency for each of the above-mentioned equipment/area. The recommendations are followed by cost-benefit analysis. Major emphasis is laid on short and medium term measures. The ultimate aim of this exercise is to enable the management to understand and prioritize energy efficiency measures identified through the study.

1.4 CAMPUS DESCRIPTION

Avanthi Institute of Engineering and Engineering (AIET), Makavarapalem, Visakhapatnam and is an affiliated college of JNTUK Kakinada. The Campus consists of Administrative Block, Academic Block, Laboratories, Hostel Blocks, Canteens and Teaching and Non-Teaching Quarters. There are 1507 students, 97 faculty and 70 staff members in the campus.



1.5 ENERGY SOURCES

The main source of energy used in the campus is electricity from Andhra Pradesh Eastern Power Distribution Company Limited (APEPDCL). In times of power shutdown the Diesel Generators are operated which use Diesel as a fuel and Diesel is also used for cars and busses of AIET Transportation Department.

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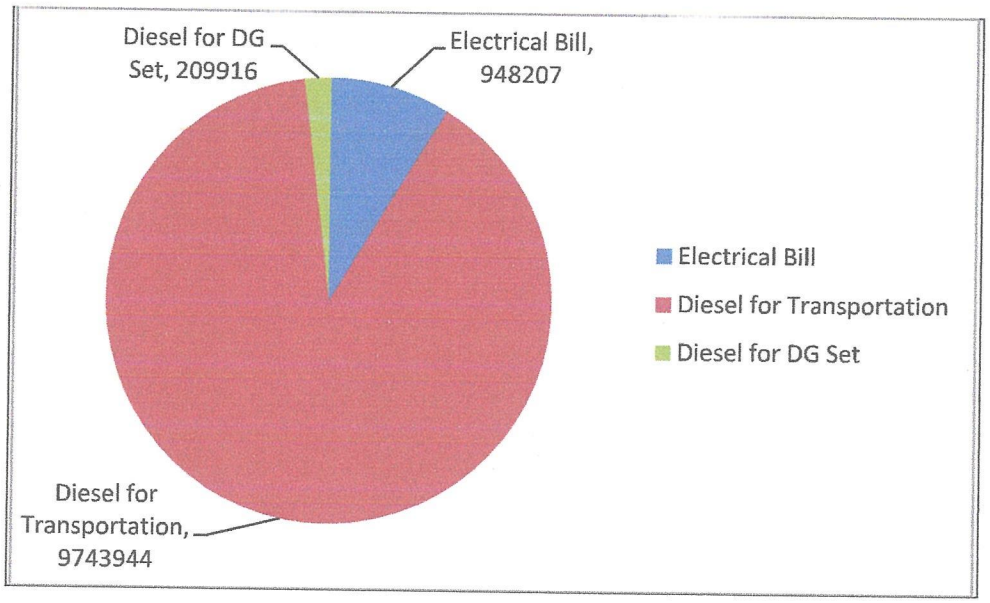
1.6 ENERGY CONSUMPTION& ENERGY COST

Annual energy consumption for the plant during the year 2021-22 is given below in the table

Energy source	Annual Quantity	Annual Cost
Electricity	97,716 kWh	Rs.9,48,207/-
Diesel for Transportation Department	99428 litres	Rs. 97,43,944/-
Diesel for DG sets	2142 litres	Rs. 2,09,916/-
Total annual energy cost		**Rs. 109,02,067/-**



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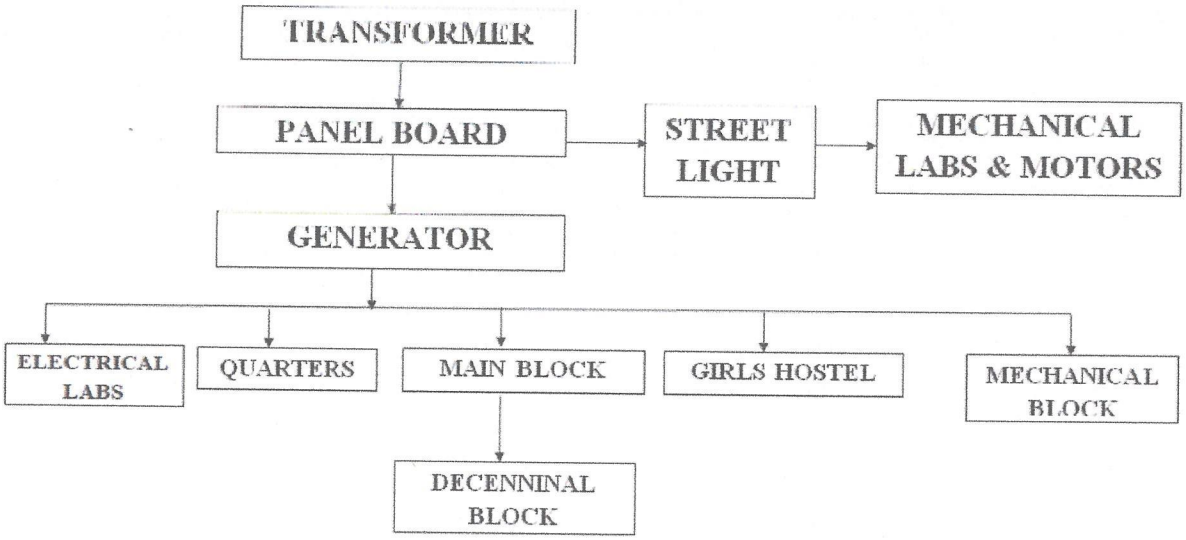
CAMPUS ENERGY SYSTEM

2.1 ELECTRICAL SYSTEM

AIET has an HT connection with a connected with Andhra Pradesh Eastern Power Distribution Company Limited (APEPDCL). The service details are given below.



2.1TOTAL LOAD IN AIET CAMPUS:

S. No	Name of the Equipment	Total No's	Approx. Load in Watts	Total Lad in Watts
1	Fans	912	75	68400
2	Tube Lights	905	56	50680
3	AC's	17	1000	17000
4	Systems	298	150	44700
5	Eg. Fans	4	100	400
6	Table Fans	2	50	100
7	Xerox Machines	4	1500	6000
8	Printers	4	40	160
9	Scanners	3	18	54
10	Fridges	12	400	4800
11	TV	7	100	700
12	Amplifiers	1	60	60
13	Speakers	10	60	600
14	Water Cooler	9	575	5148
15	Bells	3	100	300
16	1-Ph IM	4	1119	4476

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17	3-Ph IM	1	1492	1492
18	Grinders	1	500	500
19	Mixer	7	100	700
20	Washing Machine	1	512	512
21	Elec. Cooker	3	1000	3000
22	Heater	5	4000	20000
23	Air Cooler	1	75	75
24	Lab Equipments(All Labs)		25000	25000
Total Load				**254857**

2.2 ELECTRICAL APPLIANCE TYPICAL ENERGY CONSUMPTION TABLE:

Appliances	Consumption(watts)
Toaster	800-1500
Popcorn popper	250
Blender	300
Electric cooker with oven	1000-2500
Microwave	600-1500
Waffle iron	1200
Hot plate	1200
Frying pan	1200
Dishwasher	1200-1500
Sink waste disposal	450
Washing machine-Automatic	500
Washing machine-Manual	300
Vacuum cleaner-High power	1600-2000
Vacuum cleaner-Upright	200-700
Vacuum cleaner-Hand	100
Sewing machine	100
Iron	1000
Clothes dryer-Eiectric	4000
Clothes dryer-Gas heated	300-400
Heater-Electric water heater	4000
Heater-Engine block	150-1000
Heater-portable	1500
Heater-Waterbed	400
Heater-stock tank	100
Furnance blower	300-1000
Air conditioner-Room	1000
Air conditioner-central	2000-5000
Garage door opener	350
Ceiling fan	75

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Table fan	20
Electric blanket	200
Blow dryer	1000
Shaver	15
Waterpik	100
Well pump(1/3-1 HP)	480-1200
Laptop	20-60
PC	80-150
Charger:mobil phone charger	1
Television 25"color	150
Television-19"color	70
Television 12"black&white	20
VCR	40
CD player	35
Stereo	20
Clock radio	1
AM/FM auto cassette player	8
satellite dish	30
CB radio	5
Electric clock	3
Radiotelephone-Receving mode	5
Radiotelephone-Transmitting mode	40-150
Lights:100 watt incandescent	100
Lights:25 watt compact fluorescent	28
Lights:50 watt DC incandescent	50
Lights:40 watt DC halogen	40
Lights:20 watt DC compact fluorescent	22
Lights: Compact fluorescent 40 watt incandescent equivalent	11
Lights: Compact fluorescent 60 watt incandescent equivalent	16
Lights: Compact fluorescent 75 watt incandescent equivalent	20
Lights: Compact fluorescent 100 watt incandescent equivalent	30
Electric mower	1500
Hedge trimmer	450
Weed eater	500
1/4" drill	250
1/2" drill	750
1" drill	1000
9" dise sander	1200
3" belt sander	1000
12" chain saw	1100
14" band saw	1100

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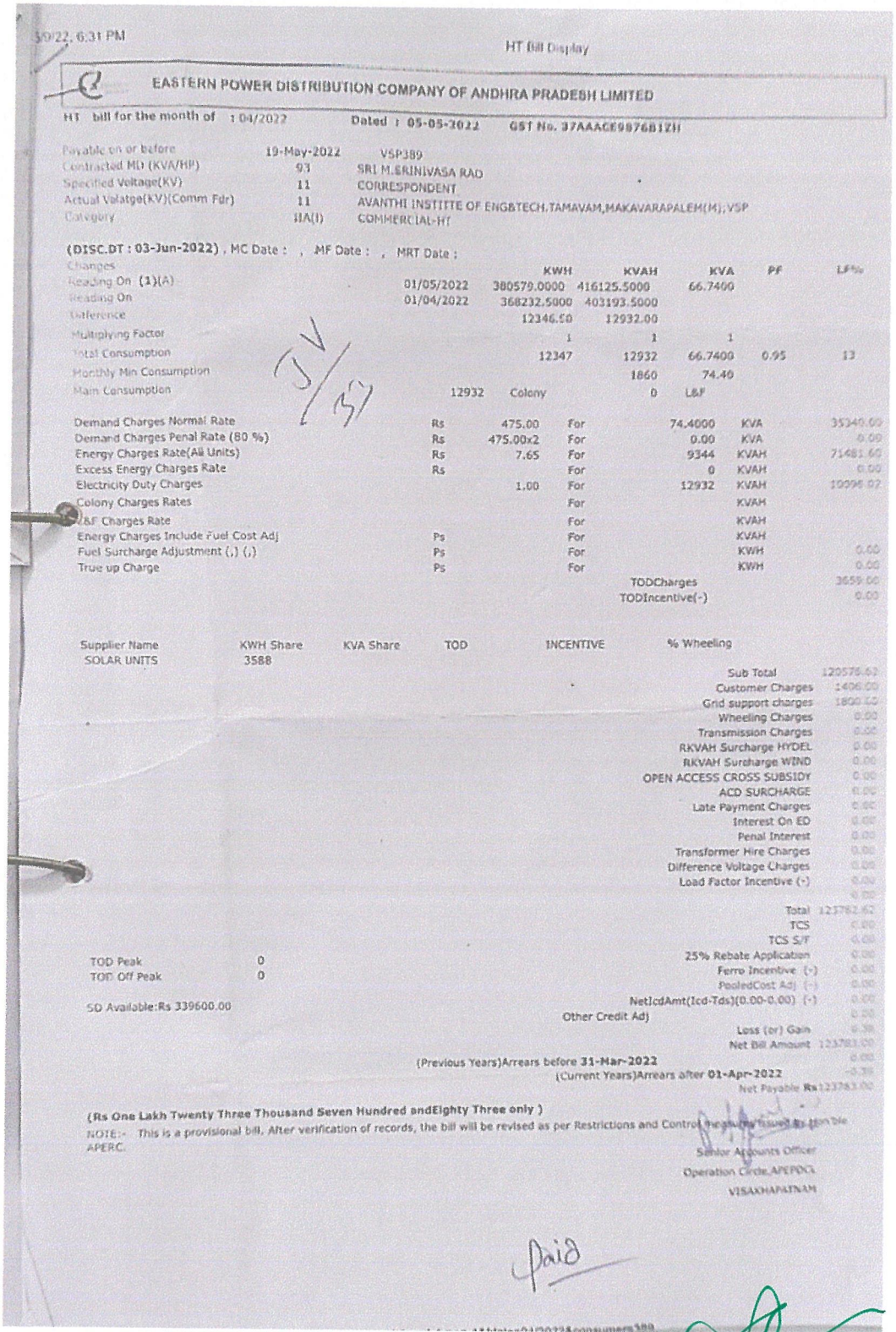
7-1/4"circular saw	900
8-1/4" circular saw	1400
Refrigerator/Freezer-16 cu.ft.(AC)	1412 watt-hours/day
Freezer 15 cu.ft.(Upright)	1239 watt-hours/day



5/9/22, 6:31 PM HT Bill Display

EASTERN POWER DISTRIBUTION COMPANY OF ANDHRA PRADESH LIMITED

HT bill for the month of : 04/2022 Dated : 05-05-2022 GST No. 37AAACE9876B1ZH

Payable on or before 19-May-2022 VSP389
Contracted MD (KVA/HP) 93 SRI M.SRINIVASA RAO
Specified Voltage(KV) 11 CORRESPONDENT
Actual Valatge(KV)(Comm Fdr) 11 AVANTHI INSTITTE OF ENG&TECH,TAMAVAM,MAKAVARAPALEM(M),VSP
Category IIA(I) COMMERCIAL-HT

(DISC.DT : 03-Jun-2022) , MC Date : , MF Date : , MRT Date :

Changes		KWH	KVAH	KVA	PF	LF%
Reading On (1)(A)	01/05/2022	380579.0000	416125.5000	66.7400		
Reading On	01/04/2022	368232.5000	403193.5000			
Difference		12346.50	12932.00			
Multiplying Factor		1	1	1		
Total Consumption		12347	12932	66.7400	0.95	13
Monthly Min Consumption			1860	74.40		
Main Consumption	12932	Colony	0	L&F		

Demand Charges Normal Rate	Rs	475.00	For	74.4000	KVA	35340.00
Demand Charges Penal Rate (80 %)	Rs	475.00x2	For	0.00	KVA	0.00
Energy Charges Rate(All Units)	Rs	7.65	For	9344	KVAH	71481.60
Excess Energy Charges Rate	Rs		For	0	KVAH	0.00
Electricity Duty Charges		1.00	For	12932	KVAH	10096.02
Colony Charges Rates			For		KVAH	
L&F Charges Rate			For		KVAH	
Energy Charges Include Fuel Cost Adj	Ps		For		KVAH	
Fuel Surcharge Adjustment (,) (,)	Ps		For		KWH	0.00
True up Charge	Ps		For		KWH	0.00
				TODCharges		3659.00
				TODIncentive(-)		0.00

Supplier Name	KWH Share	KVA Share	TOD	INCENTIVE	% Wheeling
SOLAR UNITS	3588				

Sub Total	120578.62
Customer Charges	1400.00
Grid support charges	1800.00
Wheeling Charges	0.00
Transmission Charges	0.00
RKVAH Surcharge HYDEL	0.00
RKVAH Surcharge WIND	0.00
OPEN ACCESS CROSS SUBSIDY	0.00
ACD SURCHARGE	0.00
Late Payment Charges	0.00
Interest On ED	0.00
Penal Interest	0.00
Transformer Hire Charges	0.00
Difference Voltage Charges	0.00
Load Factor Incentive (-)	0.00
Total	123782.62
TCS	0.00
TCS S/F	0.00
25% Rebate Application	0.00
Ferro Incentive (-)	0.00
PooledCost Adj (-)	0.00
NetIcdAmt(Icd-Tds)(0.00-0.00) (-)	0.00
Other Credit Adj	0.00
Loss (or) Gain	-0.38
Net Bill Amount	123783.00
(Previous Years)Arrears before 31-Mar-2022	0.00
(Current Years)Arrears after 01-Apr-2022	-0.38
Net Payable Rs	123783.00

TOD Peak 0
TOD Off Peak 0

SD Available:Rs 339600.00

(Rs One Lakh Twenty Three Thousand Seven Hundred andEighty Three only)

NOTE:- This is a provisional bill. After verification of records, the bill will be revised as per Restrictions and Control regulations issued by Hon'ble APERC.

Senior Accounts Officer
Operation Circle,APEPDCL
VISAKHAPATNAM

Paid

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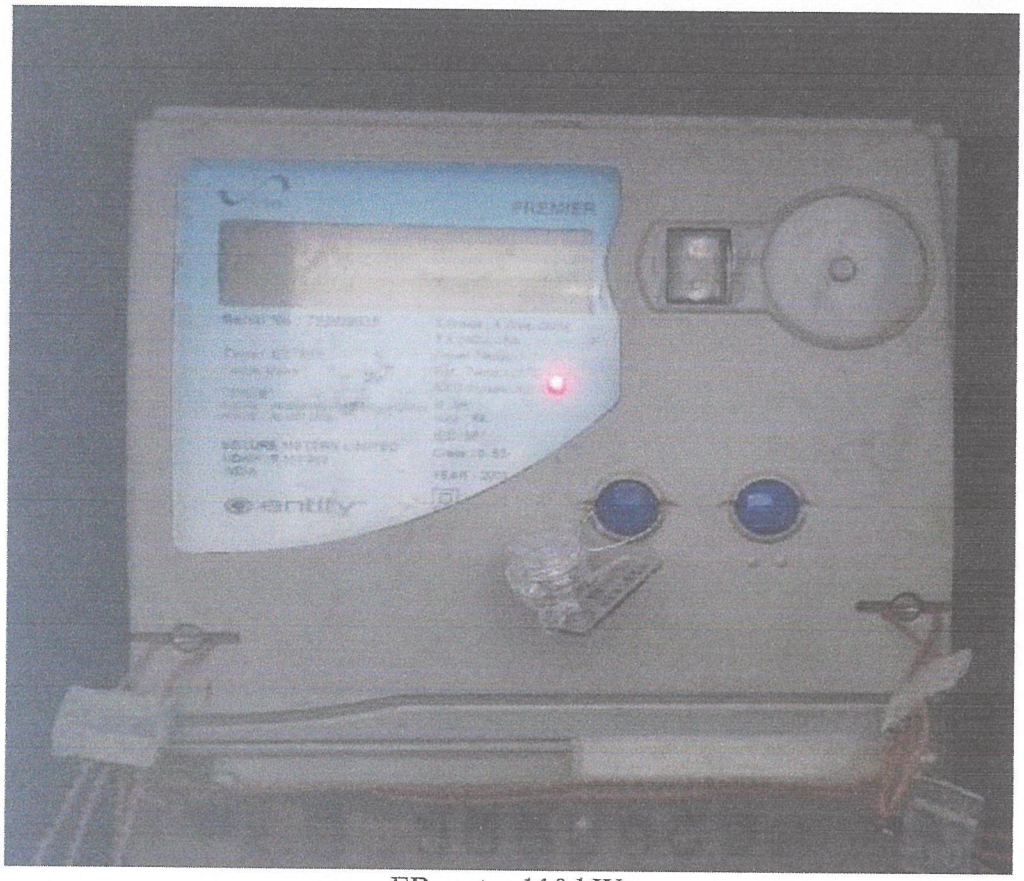
Visakhapatnam District., Pin: 531113

Though the supply is 3 phase most of the loads in use are of single phase. The premise has one DG set of 250 kVA which acts a standby and is operated during power failure period from grid. The single line diagram of the electricity system is given below.

From the main panel board the incoming 3 phase 440 V supply three separate feeders supply power to Main Block, Laboratories, Hostel Blocks, Canteens and Teaching and Non Teaching Quarters. The 250 kVA DG set is connected to the panel board through a bus coupler.

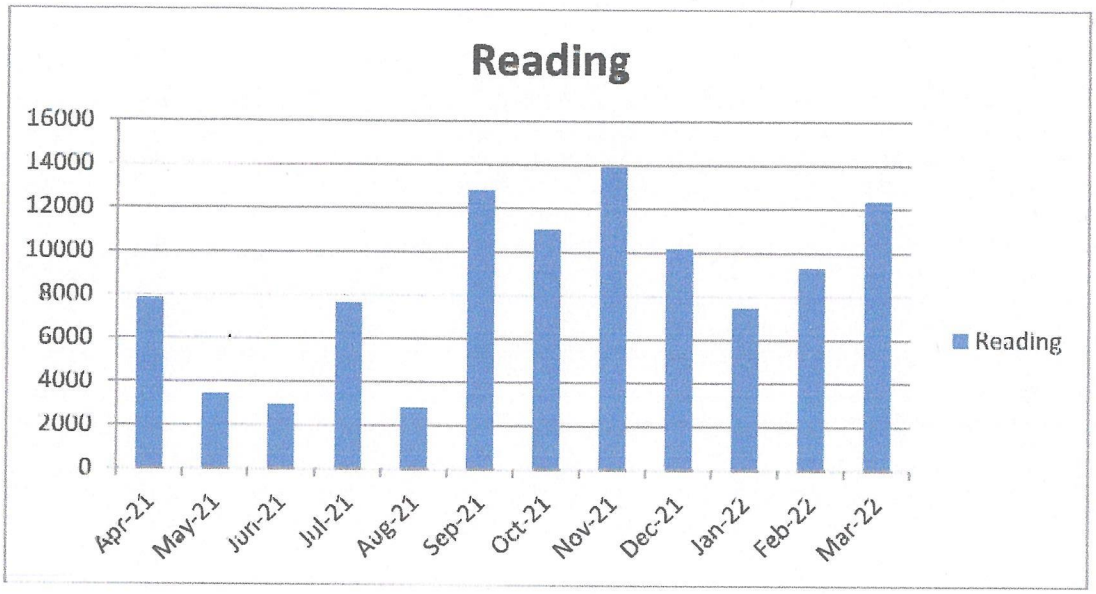


EB meter 110 kW

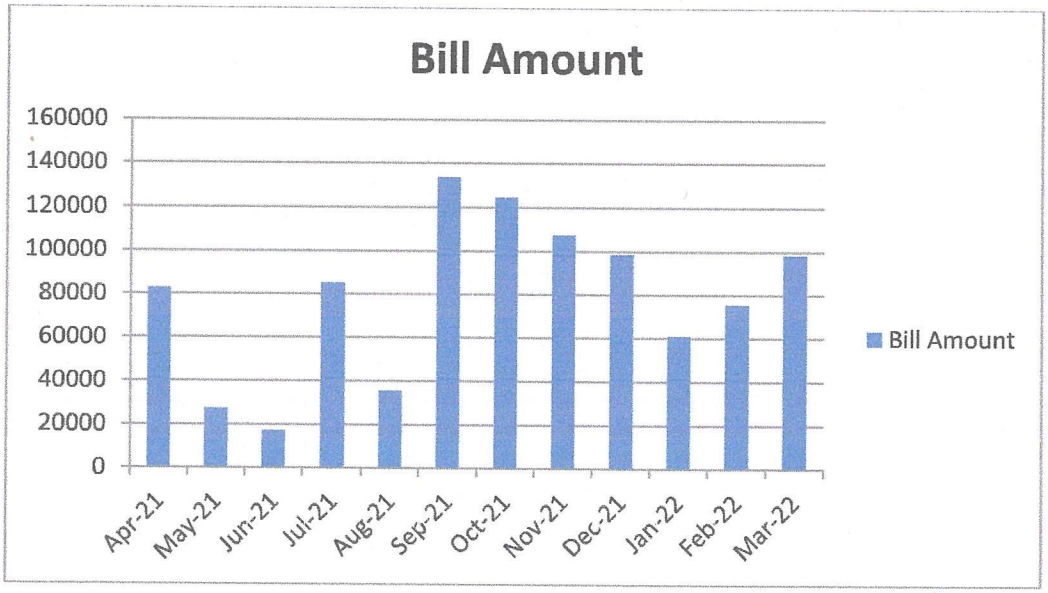
2.2 ELECTRICAL ENERGY USE PATTERN

Energy consumption is found to be lower during the month of June and August, which could be due to lower energy requirements for air conditioners. The peak energy consumption is during the month of November 2021 in which 13931 kWh was consumed.

The electrical energy consumption for various months is given in the following graph.



The energy cost varies directly in proportion to energy consumed. The energy bill consists of two components. The variable component which depends on the energy consumed determines the energy cost. This to be paid every month as fixed charges.



2.3 DIESEL GENERATING (DG) SETS

The plant is equipped with one DG set of 82.5 kVA. t is used in times of power cuts and power shortage. There is no metering and monitoring of electrical energy generated from DG set. However the diesel consumption is monitored and the annual consumption is around 2142 litres amounting to Rs. 2.1 lakhs. The month wise diesel consumption is given in the figure below.

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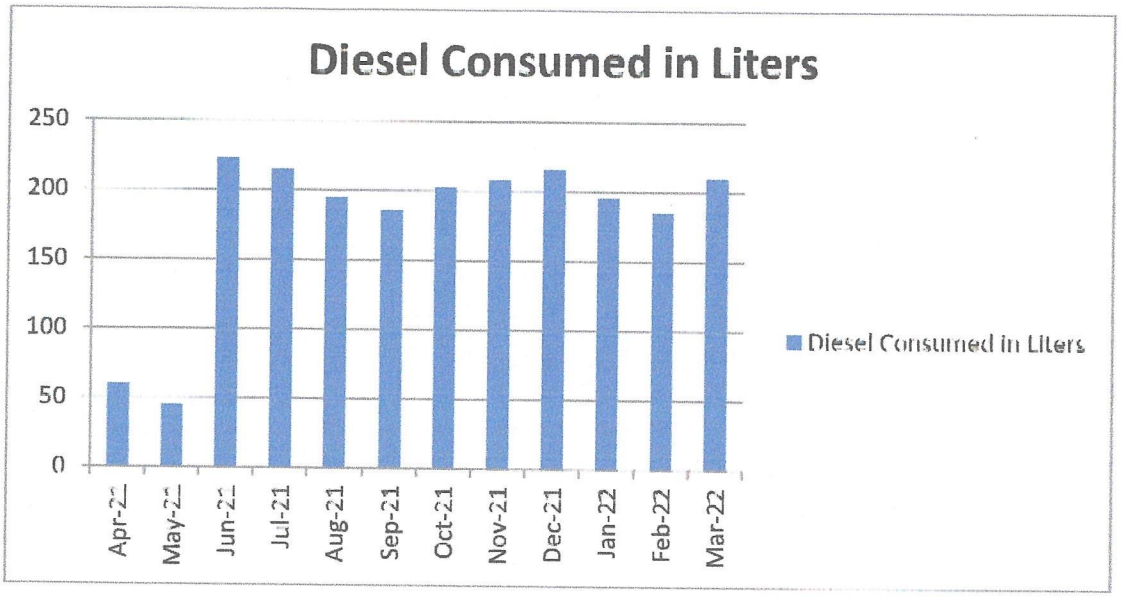

2.4 ANALYSIS OF POWER CONSUMPATION

Energy balance entails analysis of the site's energy use, identifying the sources of energy, determining the amount of the energy supplied and detailing what the energy is used for. The power measurements have been taken for various loads and based on this an energy balance has been made. The energy balance details are shown in the following figure.

With the use of the rating, we have analyzed the power consumption by equipment, application as well as location. Here is the summary of the analysis presented in form of charts for better understanding.

Overall Campus:

There are 2 Hostels, 3 Academic blocks, 1 quarter and supporting infrastructures like laboratories in AIET Campus. The analysis implies that Blocks in general Main block, First Year block and laboratories power are relatively more power consuming units of the campus. Main Block is the Single largest power consuming unit.

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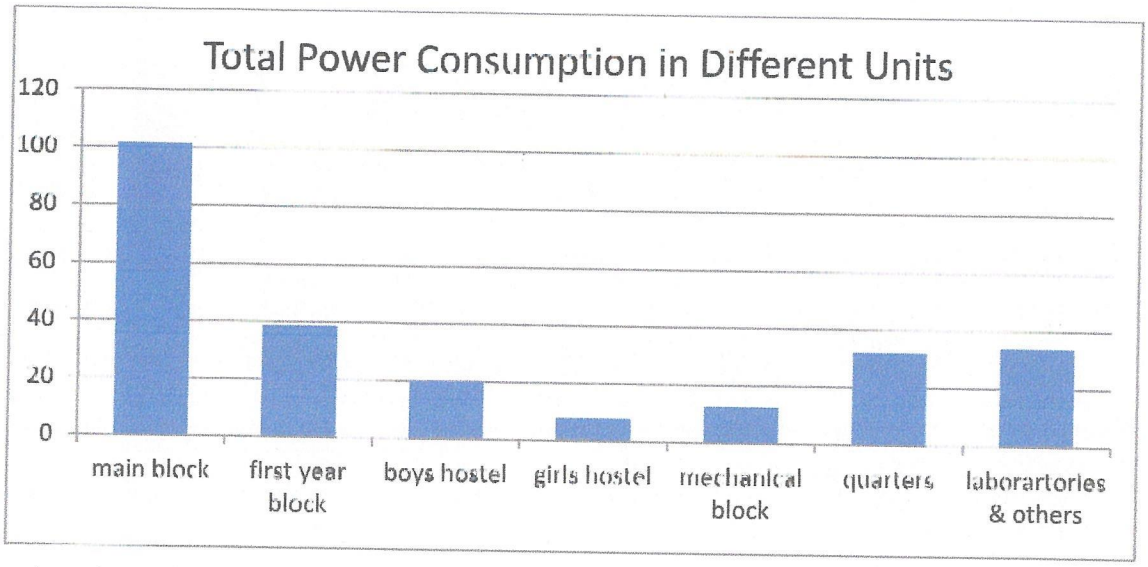

A point to note in the above chart is the higher consumption of Main Block as compared to other departments which in itself explains how ACs and Computers affect the consumption distribution. Small consumption of Girls hostel is due to its small size and less number of more power consuming apparatus. The next high power consuming block is First year block due to more number of class rooms, computer laboratories and seminar hall.

Equipment wise Analysis of Campus:

Equipment wise analysis has been performed in order to identify the equipment's, within same application area, which consume more power as compared to others. During equipment wise analysis of the overall campus, the equipment's with power consumption less than 1% of total power consumption of the campus were ignored so as to make the analysis results simple and easy to observe. Following chart summarizes the results of equipment wise analysis of power consumption of AIET Campus.

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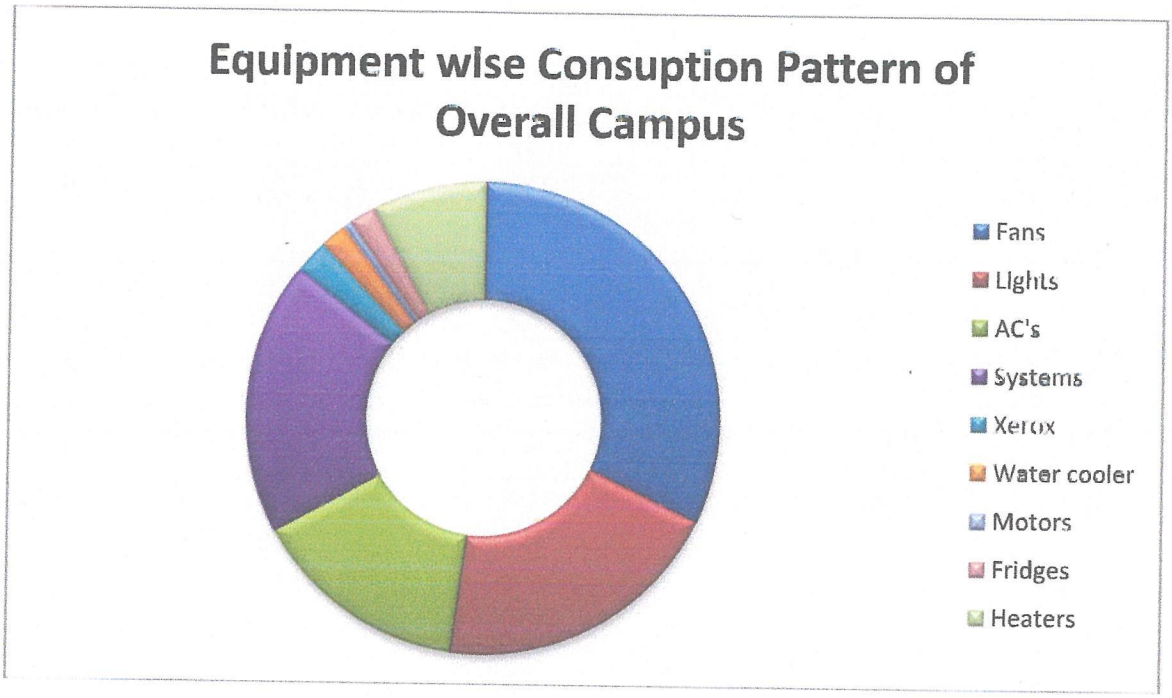

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ENERGY CONSERVATION OPPORTUNITIES

Based on the analysis of the power consumption data, certain steps have been recommended for improving energy efficiency of the campus. Complete cost analysis of implementation of recommended measures has been performed wherever necessary. Also, a number of general measures for energy efficiency have been listed. Described below are some important recommendations for better energy efficiency.

3.1 INCREASE TEMPERATURE SETTING OF AIR CONDITIONERS TO 25^{0}C

Maximum energy is consumed by the air conditioners in the campus. The energy consumption of the AC's is very sensitive to the set temperature. Increasing the air-conditioner temperature setting by just 10C can save about 6 per cent of electricity consumption, according to the Bureau of Energy Efficiency. A temperature of 250C is sufficient to satisfy human comfort as per International stands. An increase from 210C to 250C will result in 24% saving in energy consumption. Hence it is suggested to maintain a set temperature of 250C in all the air conditioners throughout the campus. High energy guzzling window air conditioners. Split air conditioners without any star rating.

3.2 REPLACING CONVENTIONAL BALLAST (CHOKE) FTLS WITH ELECTRONIC BALLAST (CHOKE) FTLS

Dominant light source at most places in the campus is traditional 40W FTLs with conventional Ballast (Choke) which consumes 14 – 16W in addition to the 40W. As per our data collection, the campus has in total 650 conventional Ballasts (Choke) FTLs and 255 electronic Ballast (choke) FTLs. If these conventional Ballasts (Choke)s are replaced by electronic Ballast(Choke), 10 – 12W power can be saved per FTL.

3.3 CONNECTING ELECTRONIC REGULATORS TO THE FANS:

Most of the buildings in AIET Campus are very old and so are the fans. Most of the fans doesn't have any regulator system. According to the data collected, there are a total of 912 fans without regulators. A saving of 8 – 10W per fan can be obtained by placing electronic regulators.

3.4 REPLACING THE CRT MONITORS WITH LCD MONITORS:

Computers with CRT and LCD monitors are nearly equal in number. In total, there are 43 computers with CRT monitors and 255computers with LCD monitors. On an average, CRT monitors consume 520W while LCD monitors consumes 200W. This saving of 320W per monitor is very large. But, the LCD monitors is also costlier by Rs. 4000 to 8000.

3.5 USE OF MOTION SENSORS IN CORRIDORS AND TOILETS:

Corridors and toilets have large potential of saving energy by use of automation tools. Motion sensors can be used where to automatically switch on the light when there is any movement and switch off the light when there is no movement. This can reduce the total load in corridors and toilets.

3.6 MINIMIZING REPAIR WORKS IN FANS:

During data collection, the repaired fans have been found to be consuming very high power as compared to the rated power. Fans repaired once and twice were consuming 16W and 43W more than the average consumption of new fans respectively. Thus, effort should be made to minimize the repairing of fans and also repair work should be supervised properly.

3.7 USE OF MASTER SWITCH OUTSIDE EACH ROOM

Installation of a master switch outside a room can make it easy for a person to switch off all the appliances of a room in case someone forgets to switch off while leaving the room. This can help improving energy efficiency.

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