Prasad V. Potluri Siddhartha Institute of Technology (Autonomous)

Kanuru, Vijayawada –520007

(Affiliated to JNTUK, Accredited by NBA, ISO9001:2015 Certified Institution)

7.1.6 Quality audits on Environment and Energy

Prasad V. Potluri Siddhartha Institute of Technology
(Autonomous)
Kanuru, Vijayawada – 520 007
(Affiliated to JNTUK, Accredited by NBA, ISO 9001:2015 Certified Institution)

Academic Year 2022 – 23

ENERGY AUDIT REPORT

Prasad V Potluri Siddartha Institute of Technology

Kanuru, Vijayawada-520007: Krishna Dist. AP

Dt: 26-4-2023

Audit Conducted by

Er .R.V.Ramana Rao BE.BL, FIE
Certified Energy Auditor /Bureau of Energy Efficiency /Min.of Power
Superintending Engineer (Retd) APEPDCL
Lead Auditor in 9001,14001,45001,50001
Visakhapatnam -530022
Mobile: 6305796162 /9490835145

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ABBREVIATIONS

C	Degree Centigrade
A	Ampere
AC	Alternating Current
APFC	Automatic Power Factor Controller
Avg.	Average
Cfm	Cubic Feet per Minute
Cm.	Centimeter
CO_2	Carbon Dioxide
CO	Carbon Monoxide
DG	Diesel Generating
Ft.	Feet
FTL	Fluorescent Tube Light
Gm.	Gram
Hr.	Hour
HSD	High Speed Diesel
Kcal	Kilo Calories
Kg.	Kilogram
KVA	Kilo Volt Ampere
KVAr	Kilo Volt Ampere Reactive
KW	Kilo Watts

KWh	Kilo Watt Hour
LDO	Light Diesel Oil
Ltd.	Limited
M	Meter
V	Voltage
MW	Mega Watts
PF	Power Factor
LED	Light Emitting diode
KVAh	Kilo Volt Ampere Hour
KWs	Kilo Watts

Preface

Potluri.V.Prasad Siddhartha Institute of Technology, PVPSIT is a private engineering college located at Chalasani Nagar. Kanuru in Vijayawada 520007, Andhra Pradesh, India that offers undergraduate education and postgraduate education in Engineering Branches. The institution is the first private institution to offer engineering education in united Andhra Pradesh and first private college to offer PG Programmes in engineering in the state. The college was approved to be an autonomous institution by Acharya Nagarjuna University in the year 1977

PVP Siddhartha Institute of Technology is located in the serene ambience of Kanuru, surrounded by lush green fields in the milieu of Vijayawada, the second largest city of Andhra Pradesh. The city which is built on the banks of the Krishna, is recognized as a "Global City of the Future" by McKinsey Quarterly and known as one of the commercial hubs of South India. At a distance of 8 kms from the heart of the city, the Institution is well connected by Rail, Road and Air. The Institution is established in an area of 19.98 acres land.

PVP Siddhartha Institute of Technology, established in 1998, is a pioneering private self-financed Institution out of the 18 Academic Institutions run under the aegis of the premier Organization, Siddhartha Academy of General & Technical Education, Vijayawada.

Established with the sole aim of promoting Quality Technical Education, the Institution has a vision to foster Academic and Professional excellence of the students. Renowned for Academic Excellence and Sustenance of Quality, the Institution is ISO 9001-2015 certified.

A Monolithic RCC structure in a built up area of 36,537 Sq. m. caters to the needs of the Institution. PVPSIT is ISO 9001:2008 certified Institution approved by AICTE and has permanent affiliation to JNTUK, Kakinada.

PVPSIT is an Autonomous College by UGC since 2012 and affiliated to JNTU Kakinada. The college offers B.Tech. programmes in CSE, CSE(AI/ML),CSE(DS), IT, ECE, EEE, ME and CE; M.Tech. in ECE, ME and MBA.

All the UG Programmes offered are accredited by NBA. 5 UG programmes in CSE, IT, ECE, EEE and Mechanical are accredited by NBA for the first time for three years in 2007, second time in 2013, third time in in 2016 for 6 all UG programmes of CSE, IT, ECE, EEE, ME and CE and reaccredited in 2022.

The Institution is accredited by NAAC in 2013 with 'B' grade and later conferred with 'A+' Grade in 2017 in recognition to the quality initiatives and standards. UGC conferred Autonomous Status to the Institution in 2012. The college is accorded 2(f) and 12(B) status by UGC. State Government awarded 'A' grade to the Institution. MHRD ranked the Institution as 141 in the Academic Institutions in NIRF ranking. Careers 360 ranked the Institution with AAA+. The college secured 124th position in India Today ranking. The Institution secured 36th position in Data Quest.

College Infrastructure

This college was a well-known college in the city of Vijayawada. This college was established in 1998 by the most prestigious organization Siddhartha academy of general and Technical education, Vijayawada. This college got autonomous status in 2012.It is approved by AICTE and permanently affiliated to JNTUK , Kakinada. Renowned for Academic Excellence and Sustenance of Quality. College is located in the serene ambience of Kanuru, surrounded by lush green fields in the milieu of Vijayawada.

Under the Dynamic leadership of

Principal

Dr. K. Sivaji Babu

P.V.P. Siddhartha Institute Of Technology

Kanuru, Vijayawada-520 007

And

HOD (EEE)

Dr. Ch. Padmanabha Raju

E.E.E Department: P.V.P.Siddhartha Institute Of Technology

Kanuru, Vijayawada-520 007.

hodeee@pvpsiddhartha.ac.in/ Mobile No 92464 00881

1.1 Scope of the work

The present assignment is for checking levels of Energy Efficiency for this Educational institute situated at Chalasani Nagar, Kanur, Vijayawada,Andhra Pradesh. The energy audit is aimed at recording and quantification of the energy consumption in this institution and possible reduction in Energy Bills which was noticed at alarming levels.

An effort is also to be made to compare the audit results indicated from the Energy audit done during March 2022. Subsequently it also tries to explore the possibilities of Conserving Energy through better utilization practices by the students and staff of this institution and employ education of newer technologies.

It is felt also expect that the institution stands as a first and best Efficient Energy Educational Institution.

The report has classified the suggestions in to short, medium and long-term investment opportunities in energy efficient implementation methods so that the management can take up the implementation according to investment and payback priorities in line with the available budget provisions of the College management.

Besides the Energy audit the safety points also verified for operation and maintenance of the electrical installation for the safety of the equipment, staff and students of the institution. The number of Electrical, Mechanical and other equipment like computers, air conditioners in the entire institution are on higher side involves safety during Electricity usage.

Strategic approach by College Management to achieve the intended results

Vision

To provide rich ambience for academic and Professional excellence, Research and Employability skills, Entrepreneurship and Social responsibility

Mission

To empower the students with Technical knowledge, Awareness of up-to- date technical trends, Inclination for research in the areas of human needs, Capacity building for Employment / Entrepreneurship, Application of Technology for societal needs.

Quality Policy

At PVPSIT, We commit ourselves to offer Quality professional education in engineering & Management by adhering to applicable statutory and regulatory requirements and through continuous improvement in the Quality of our services.

Acknowledgement

An energy audit is a joint exercise conducted by Energy Auditors and the client's authorized representatives to identify the equipment where the energy losses are on higher and to recommend ways and means to reduce the losses resulting the conservation of energy without sacrificing the purpose and comfort levels. The contribution of client's team is equally important in the venture. An organization is made up of individuals.

We sincerely acknowledge the contribution and commitment to wards Energy Conservation and Safety of the Equipment of the following dignitaries because of whom the study could progress smoothly –

I thank the following dignitaries for their cooperation in bringing out this audit results and report.

Dr. K. Sivaji Babu B.Tech, M.Tech, Ph.D
Principal

Dr Ch. Padmanabha Raju
Professor & Head, EEE Dept.

Dr. M. Ramesh. Associate Professor and In charge of Electrical Installations.

We are also thankful to the other staff members who were actively involved while collecting data and conducting the field studies in the Institution.

R.V.RAMANA RAO
Certified Energy Auditor /BEE

1.2 Executivesummarysheet

Key Result Areas for Energy Savings & Estimated Potential along with Cost Benefit analysis.

Sr. No.	***Energy Saving Area***	***Saving Potential in KHW & In Rs. p.a.***	***Investment In Rs. ST/MT/LT***	***Payback period In month***	***Action for Implementation***
1	Replacement of old Fans with star rated fans	20,250 Units Rs 1,54,913	Rs 14,55,000 Long Term	9 years-	Replacement fans in a phased manner
2	Replacement of Conventional Florescent Lamps	84,000 Units Rs 6,42,600	Rs2,40,000 Short term-	3years	Replacement in a phased manner
3	Switch off the computers instead off log off when not in use	27,648 units Rs 2,11,507	Attitude and change of habits	Immediate	Awareness programmes to be conducted for the students and staff in this regard .
4	Replacement of old Air conditioners with star rated ACs as per BEE Recommendations	70,452 Units Rs 5,39,000	Rs 11,78,000	2 Years 2 months	Action plan should be drawn and replace the old Ones

Other improvements recommended to achieve Energy Efficiency are

1. Improvement in earthing system
2. Balancing of loads in Electrical system and also on DG Systems
3. Tight connections in cable and general wiring improves 5-10% Efficiency.
4 Using star rated Air conditioners, fans, and lights will reduce Energy Consumption drastically.
5. Using solar Energy will give a great relief in the system, Expenditure Environmental benefits.

Chapter 1

EXISTING ENERGY SCENARIO

1.1 The importance of Energy Efficiency:

World Economic growth is driven by energy, whether in the form of finite resources such as coal, oil and gas or in renewable forms such as hydroelectric, wind, solar and biomass or its converted form. This energy generation and consumption strengthens the nation's industries, vehicles, homes and offices. It also has significant impact on the quality of the country's air, water, land and forest resources. For future growth to be both rapid and sustainable, it needs to be as resource efficient and environmentally benign as possible.

The growth in installed power generating capacity has not kept pace with the projected demand though the existing installed capacity in Indian Energy Sector is 1, 76,850 MWs. Out of this installed capacity 64% energy comes from thermal energy includes gas, oil, and coal .To meet this demand, it is necessary to set up more power plants and most of these power plants will be either fossil fuel based or hydroelectric units. However, the conventional power stations cause enormous damage to be environment due to pollution and other side effects.

In this circumstances the Energy Efficiency gathers much importance in the present day energy Scenario. In this direction the Govt .,of India ,under Ministry of Power has introduced Energy Conservation Act in 2001 to make mandatory Energy Audit for all Designated consumers where huge Electricity Consumption identified in this Act. Recently the Govt is also taking up awareness campaign through various sources to create adequate knowledge among the consumers to save the power and plug the losses. It is estimated that there is 30% of energy is being wasted by various consumers and if this is curbed there would be an additional demand available to a tune of 25,000 MWs supply which is equivalent to financial saving of Rs1,20,000 Cr of Rupees apart from the protecting the Environment from carbon emissions. The carbon emission levels

are to tune of 29.92 Billion tons as on April 2021, mostly from the thermal power stations. Apart from this the consumers has felt the pinch of increasing tariffs from time to time, and the production cost is being increased. It is also to know that the fuel prices also being increased enormous as the world oil prices are going up substantially from year to year.

Renewable energy sources energy source are wonderful options because they are limitless. These will not be exhausted though fossil fuel will be gradually exhausted in course of time. Also another great benefit from using renewable energy is that most of these sources do not pollute the environment; the way burning of fossil fuels dose.

Green House Gas Emissions

The greenhouse gas emissions (GHG) come primarily from the combustion of fossil fuels in energy use. Energy use is largely driven by economic growth with short-term fluctuations in its growth rate created by weather patterns affecting heating and cooling needs, as well as changes in the fuel used in electricity generation.

The burning of fossil fuels produces around 29.62 billion tons of Carbon Dioxide per year, but it is estimated that natural processes can only absorb about half of that amount, so there is a net increase of 10.65 billion tones of atmospheric carbon dioxide per year. Carbon dioxide is one of the GHG that enhances radioactive forcing and contributes to global warming, causing the average surface temperature of the earth to rise. Environment scientists predict that this will cause major adverse effects, including reduced biodiversity.

The electricity sector is unique among industrial sectors in its very large contribution to emissions associated with nearly all air issues. Electricity generation produces a large share of nitrogen oxides and sulphur dioxide emissions, which contribute to smog and acid rain and the formation of fine particulate matter in addition to carbon dioxide. In addition, this sector has significant impacts on water and habitat and species. In particular, hydro dams and transmission lines have significant effects on water and Biodiversity

Central Electricity Authority under the Ministry Power. Govt of India has framed the Electricity safety Regulations and guide lines for safe operation of Electrical Equipment and made mandatory implementation for the safety of Product, Property and Personnel.

These regulations are framed by superseding the IE Rules 1956 and became legal requirement for strict implementation. CEA regulations are called CEA Act 2010 and amended these regulations from time to time due to technology improvement in Electricity design and usage in Institutions, Industries, Commercial Establishment, Hospitals, Restaurants and other Educational Institutions etc.,

1.2 Energy Auditor's qualifying & Competency Certificate issued by Bureau of Energy Efficiency. Ministry of Power. Govt., of India

Regn. No. EA-1600 No. 1301

National Productivity Council

(National Certifying Agency)

PROVISIONAL CERTIFICATE

This is to certify that Mr. / Ms. R.V. Ramana Rao

son / daughter of Mr./Ms. R.V. Suryanarayana Rao

has passed the National Certification Examination for Energy Auditors held in 2006, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India.

He / She is qualified as Certified Energy Manager as well as Certified Energy Auditor.

He / She shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfillment of qualifications for the Accredited Energy Auditor and issue of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.

This certificate is valid till the issuance of an official certificate by the Bureau of Energy Efficiency.

Place : Chennai, India

Date : 2nd November, 2006

Controller of Examination

1.3 Brief about Energy Auditor:

A Graduate in Electrical Engineering from Andhra University 1973. with more than 33 years engineering experience in APSEB/EPDCL and retired as Superintending Engineer from Govt.service

2. Certified Energy Auditor from Bureau of Energy Efficiency with registration number EA 1600, Conducted several Energy Audits and Safety audits in various organisations including Industries, Engineering colleges, Educational institutions, MSMEs, Commercial Buildings, Hospitals and Restaurants

3. ISO Lead Auditor in QMS, EMS,OHSMS and EnMS system standards.

4. Corporate member in Institution of Engineers, faculty member for PCRA, APPC,

5. Senior Faculty member REC Institute of Power Management& Training. Hyderabad

6. Conducted several Electrical Safety and Energy audits in various organisations.

7. Empanelled Lead Auditor in DNVGL and IRQS

8. Senior consultant in RTQMS for EnMS system implementations in HPCL,HAL, KCP Cements. IRQS etc.

9. Conducting several safety programme in Industries, Thermal station power Distribution systems in AP Power Sector, Educational Institutions and industries.

1.4 INTRODUCTION

The PVP Siddhartha Institute of Technology, Chalasai Nagar Kanuru has the college buildings and premises contains multi storied buildings with different Electrically connected loads like fans, lighting systems, computers systems supported by UPS, Lab equipment for all branches of Engineering and Information technology Boys and Girls Hostels etc.,

Scope of Energy Audit

The scope of an energy audit, the complexity of calculations, and the level of economic evaluation are all issues that may be handled differently by each individual auditor and should be defined prior to beginning any audit activities. An energy audit can be simply defined as a process to evaluate where an institution uses energy, and identify opportunities to reduce consumption.

Introduction to Energy Audit

General

The Management of PVP Siddhartha Institute of Technology entrusted the work of conducting a Walkthrough Energy Audit of campus at Kanuru ,Vijayawada with the main objectives as below:

a. To study the present pattern of energy consumption

b. To identify potential areas for energy optimization

c. To recommend energy conservation proposals with cost benefit analysis.

Scope of Work, Methodology and Approach

Scope of work and methodology were as per the proposal. While undertaking data collection, field trials and their analysis, due care was always taken to avoid abnormal situations so as to generate normal / representative pattern of energy consumption at the facility.

Approach to Energy Audit

We focused our attention on energy management and optimization of energy efficiency of the systems, sub systems and equipment. The key to such performance evaluation lies in the sound knowledge of performance of equipment and system as a whole.

Energy Audit

The objective of Energy Audit is to balance the total energy inputs with its use and to identify the energy conservation opportunities in the stream.

Energy Audit also gives focused attention to energy cost and cost involved in achieving higher performance with technical and financial analysis. The best alternative is selected on financial analysis basis.

Energy Audit Methodology

Energy Audit Study is divided into following three steps:

1.4 a. Historical Data Analysis

The historical data analysis involves establishment of energy consumption pattern to establish base line data on energy previous consumption and its variation with change in different months of year.

1.4 b. **Identification and evaluation** of Energy Conservation Opportunities

This step involves evaluation of energy conservation opportunities identified during the energy audit. It gives potential of energy saving and investment required to implement the proposed modifications with payback period. All recommendations for reducing losses in the system are backed with its cost benefit analysis

1.4 C. Compared the previous audit results and noted that the most of the previous observation have been addressed.

1.5 Energy sources and Utilization

The Electrical supply is fed through a 11KV feeder from Kanuru 33/11KV substation forms part rural through a HT Supply at 11KV level. The LT supply is drawn from a 250 KVA step down power transformer of 11KV/433 V.

1.5.1.0 Electricity Metering: The metering is done at HT side of the transformer as per the norms of the utility which indicates that transformer losses are included in the HT Billing and the consumer has to pay for the transformer losses.

1.5.2.0 Diesel Generator set : Two Diesel run generator is also available with 125

KVA and 250KVA capacity which has to supplement and extend the supply during power failures.

The total connected load of the this HT service as verified mainly supplying the lights and fans, Computers and UPS Systems further supplying the computers in the institution among laboratory motors and equipment.

Electricity, & HSD is the primary energy sources for the Institution. The utilization of diesel oil consumption is more due to frequent power interruptions on the rural HT feeder of Substation. Apart from this due recent reduction in power generation due to short supply of coal to the thermal power stations the power supply is staggered drastically.

1.6 HT Electrical Service Connection: VJA 754 Cat 2A2. 11KV CMD 213 KVA with a minimum billing KVA 176

Tariff for payment Electricity Consumption

As per the present Tariff the Rs 475/ KVA and Rs 7.65/ KVAh

1.7 Monthly consumption of the Institution:

The tables indicates the consumption details like KWh. KVAh, recorded Maximum Demand and Total bill amount.

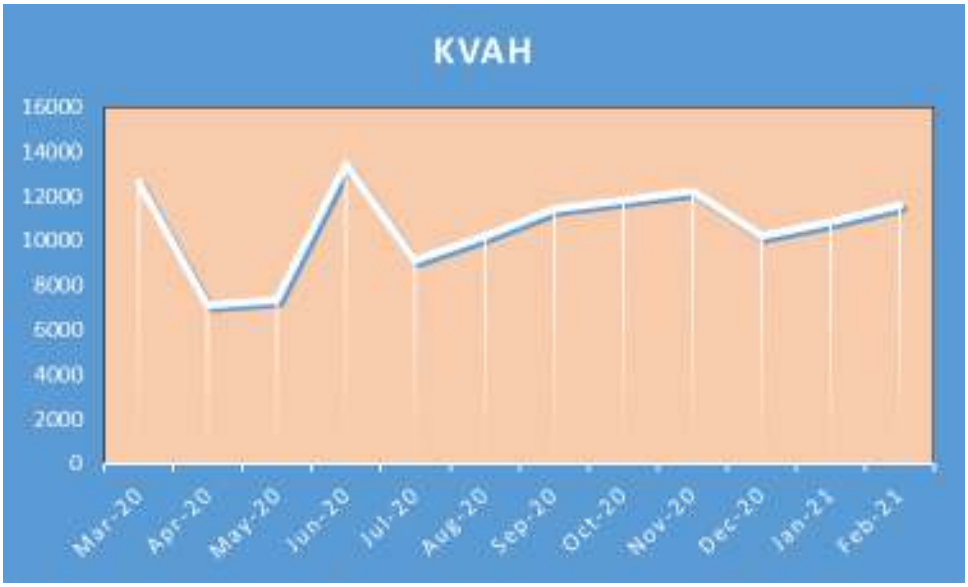
The following tables and graphs shows the consumption patterns for the year 2020-21, 2021-22, 2022-23

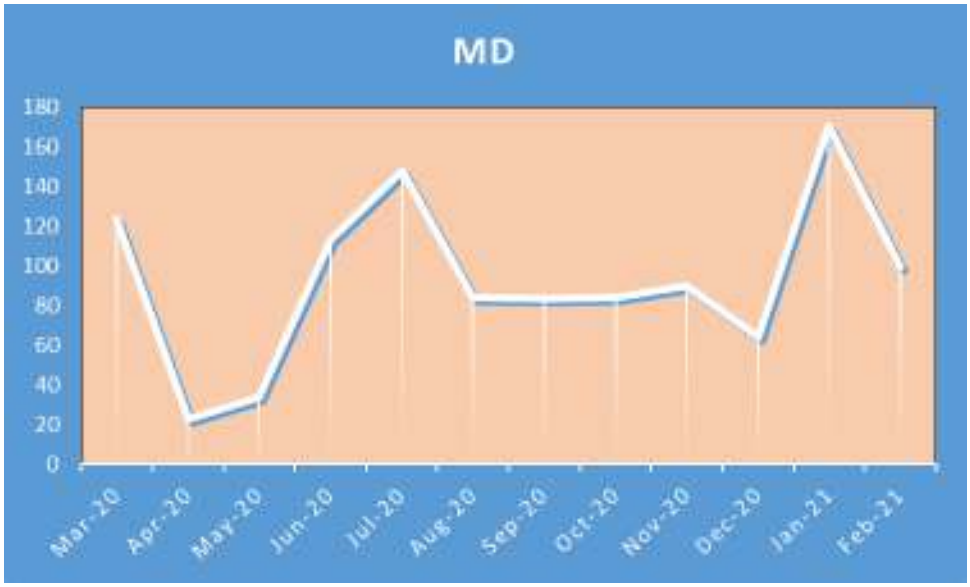
	consumption particulars 2020-21			
Month	KVAh	MD	PF	Solar Energy
Mar-20	12618	123.4	0.93	12042
Apr-20	7130	23	0.99	21002
May-20	7364	34	0.99	18224
Jun-20	13414	113.33	0.96	4998
Jul-20	9138	148.2	0.97	9320
Aug-20	10236	83.78	0.96	8066
Sep-20	11448	83.4	0.95	7048
Oct-20	11816	84	0.96	6838
Nov-20	12200	89.78	0.96	2962
Dec-20	10212	64.12	0.98	11514
Jan-21	10866	170.4		10910
Feb-21	11618	99.54	0.94	6778

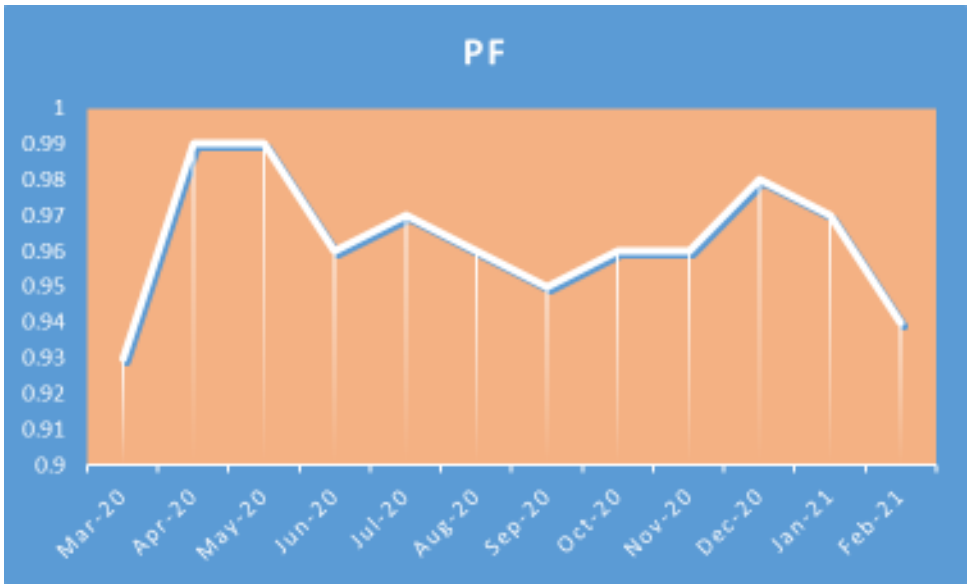
1.7.1 Graphical Representation of Consumption

The Electricity consumption for the year 2020-2021

KVAh Consumption for 2020 -21





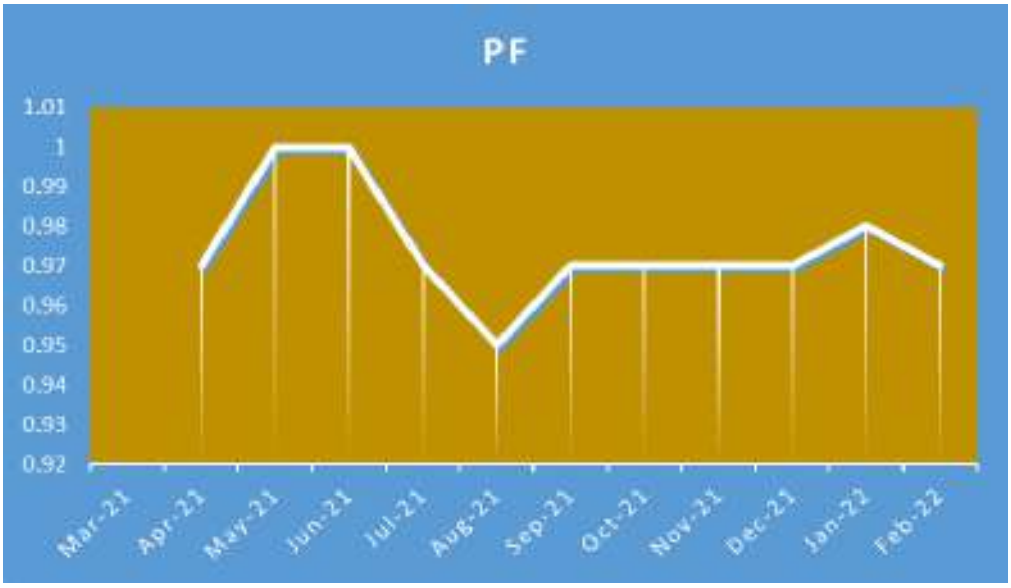


1.7.2 Consumption Pattern for the year 2021-2022

Month	KVAh	MD	PF	Solar
Mar-21	15340	164.3		6896
Apr-21	15098	165.4	0.97	8880
May-21	8880	43.86	1.00	15210
Jun-21	10256	77.00	1.00	8486
Jul-21	13270	104.2	0.97	5126
Aug-21	15422	105.86	0.95	4782
Sep-21	14774	98.84	0.97	4918
Oct-21	16434	144.66	0.97	7324
Nov-21	19804	187.74	0.97	3324
Dec-21	17664	164.14	0.97	5574
Jan-22	13512	99.5	0.98	6424
Feb-22	11144	125.2	0.97	8024

1.7.3 Graphical representation for the year 21-22

Month wise recorded Demand in KVA

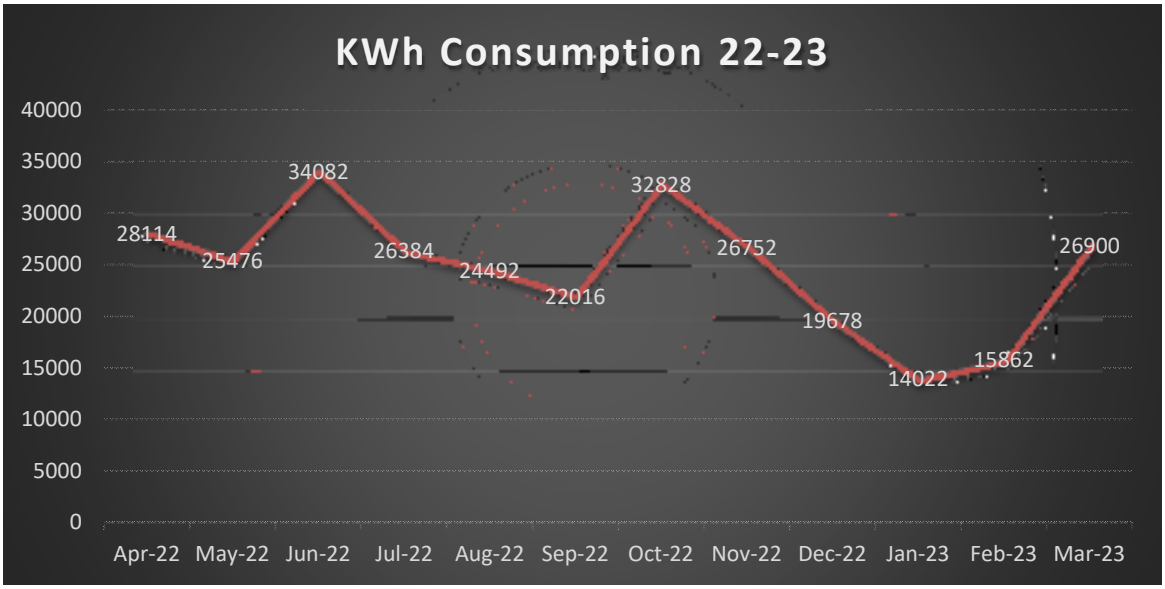


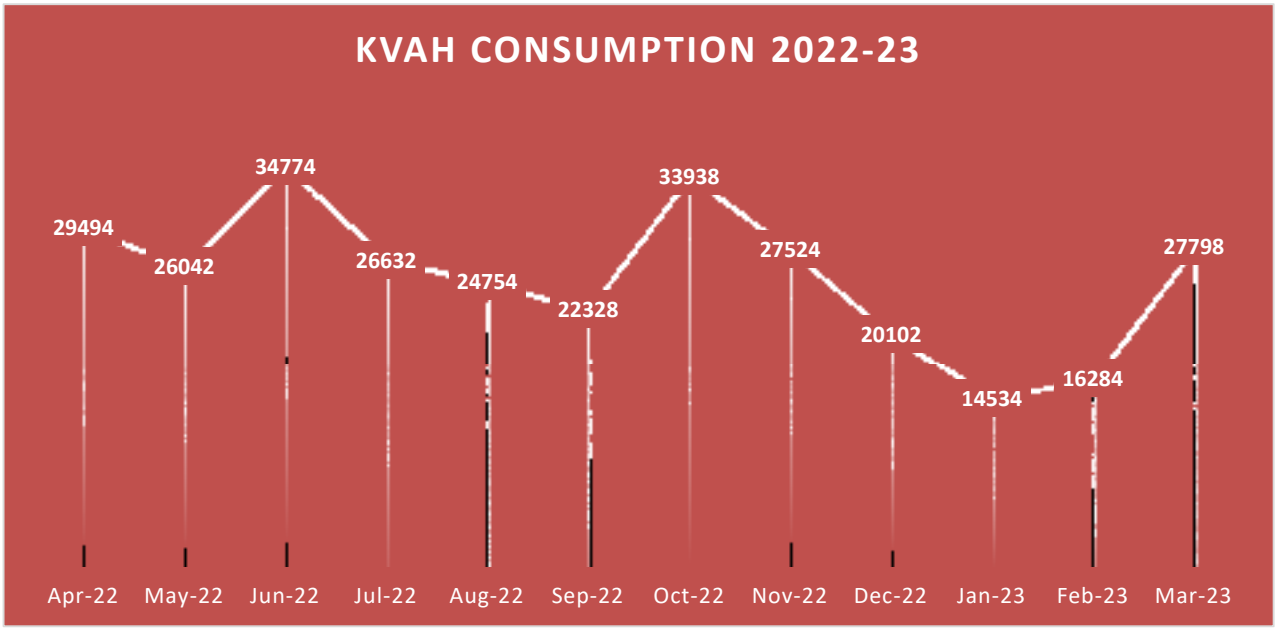
1.7.4 Consumption Pattern for the year 2022-2023

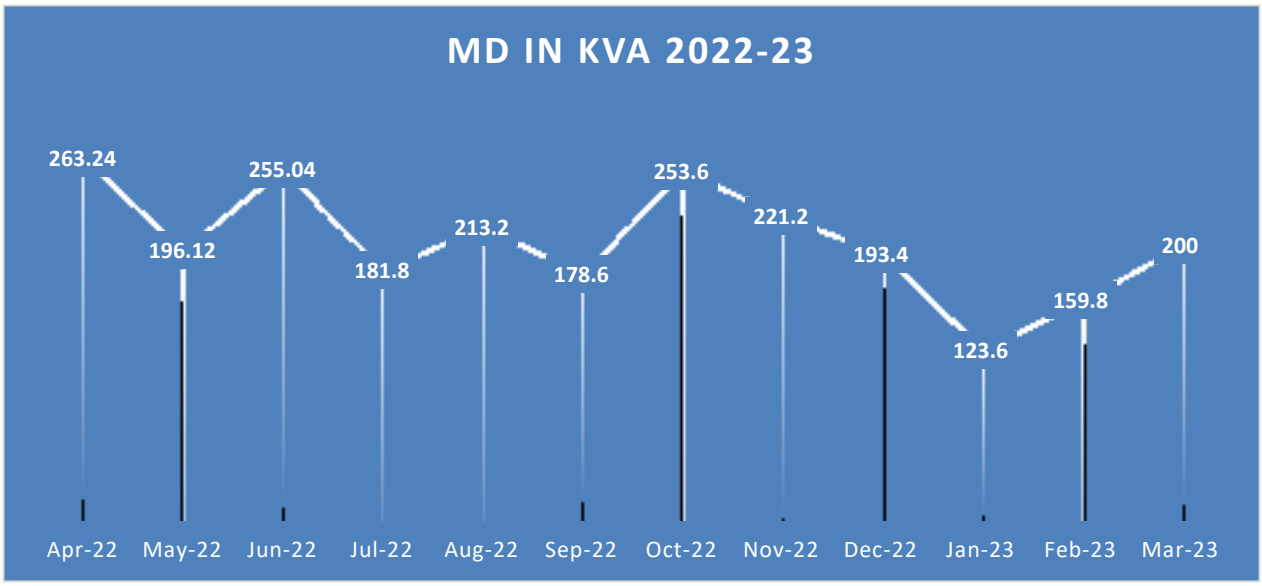
Month	KWh	KVAh	KVA	PF	Solar units
Apr-22	28114	29494	263.24	0.95	3606
May-22	25476	26042	196.12	0.98	4926
Jun-22	34082	34774	255.04	0.98	3834
Jul-22	26384	26632	181.8	0.99	2692
Aug-22	24492	24754	213.2	0.99	2370
Sep-22	22016	22328	178.6	0.99	4102
Oct-22	32828	33938	253.6	0.97	2402
Nov-22	26752	27524	221.2	0.97	3056
Dec-22	19678	20102	193.4	0.98	3320
Jan-23	14022	14534	123.6	0.96	7624
Feb-23	15862	16284	159.8	0.97	4714
Mar-23	26900	27798	200	0.97	3534
	296606	304204	2439.6	11.7	46180

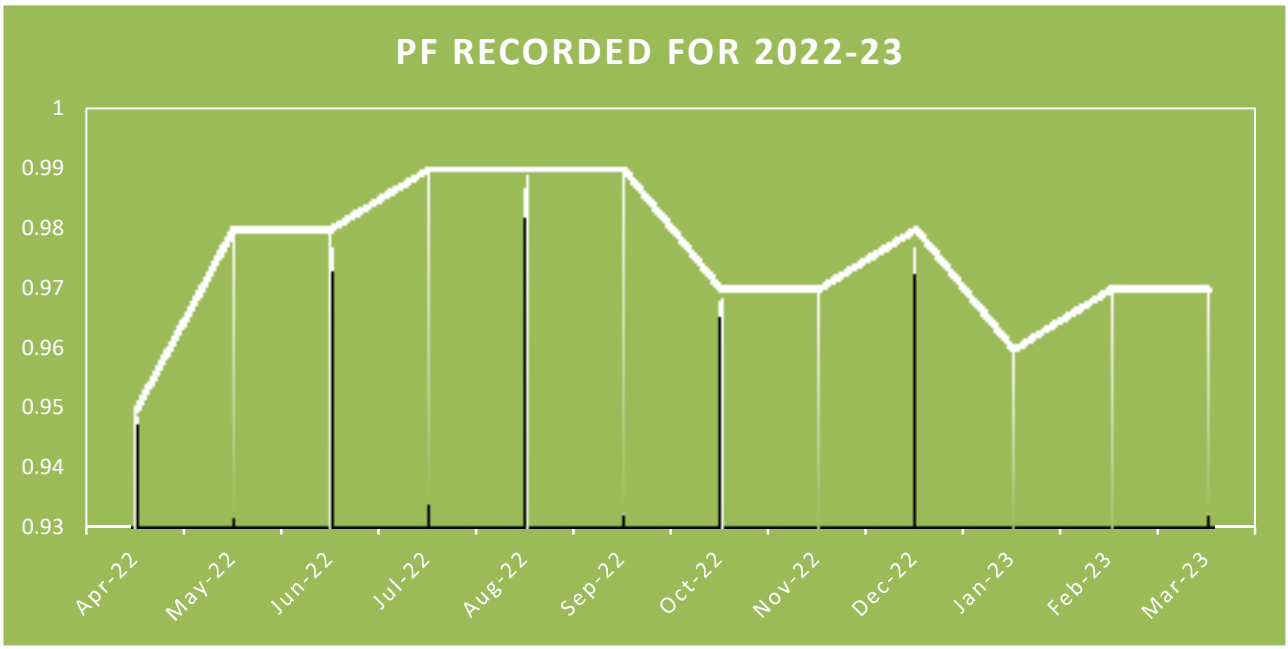
Monthly Average for the year 2022-23

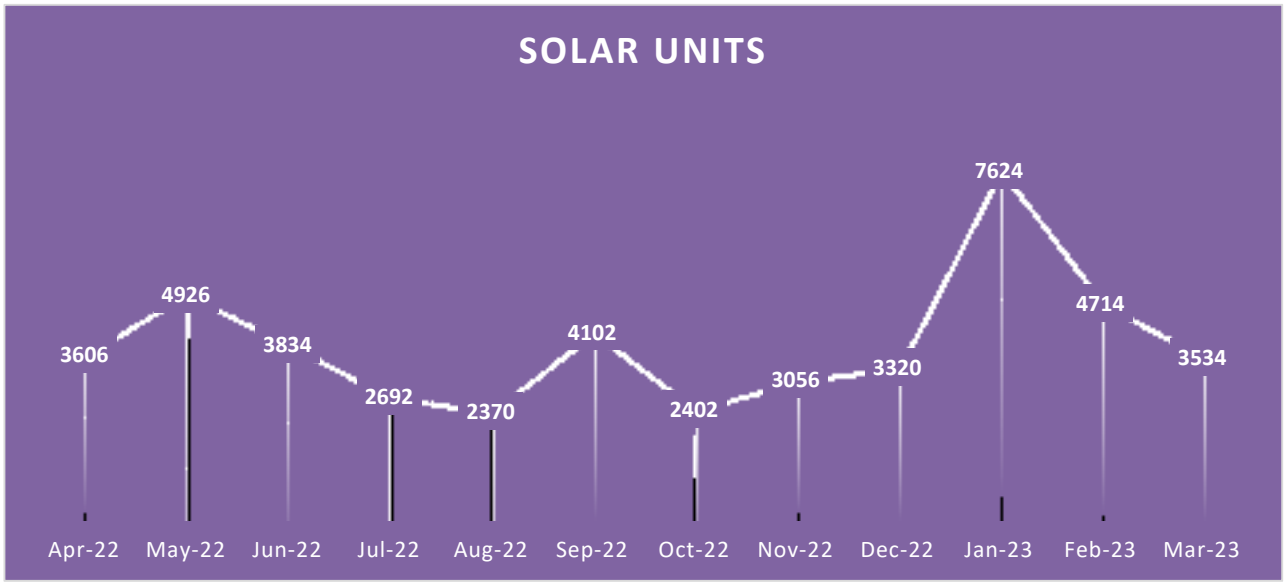
1. Monthly Average KWh Consumption 24717.16 units	
2. Monthly Average KVAH consumption	25350.33 KVAh Units
3. Monthly Average KVA demand	203.3 KVA
4. Average PF	0.975
5. Monthly Average solar units generated	3848.33 KVAh units




KVAH CONSUMPTION 2022-23
29494
26042
34774
26632
24754
22328
33938
27524
20102
14534
16284
27798
Apr-22
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23


MD IN KVA 2022-23
263.24
196.12
255.04
181.8
213.2
178.6
253.6
221.2
193.4
123.6
159.8
200
Apr-22
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23


PF RECORDED FOR 2022-23
1
0.99
0.98
0.97
0.96
0.95
0.94
0.93
Apr-22
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23


SOLAR UNITS
3606
4926
3834
2692
2370
4102
2402
3056
3320
7624
4714
3534
Apr-22
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23

1.8 Electrical Energy- Details of Installation.

Electricity supply from the electricity department is at 11 KV and is stepped down to 433 V by a 250 KVA capacity step down transformer. Metering is done on the HT side.

The above indicated t*ables shows the month wise electrical consumption data and analysis of electricity bills for the years 2020,2021,2022 and upto March 2023.*

The Institution is supplied by the CPDCL distribution lines and maintains 213 KVA Contracted Maximum Demand with the electricity department.

The institution has a 1x125 KVA and 1x 250KVA DG Sets run on HSD to supplement the energy during power outages.

The annual electricity consumption for the institution for 2022-23 is around 3.04 lakh units and The Institution maintains the P.F of 0.98 with existing capacitors

HSD

HSD is an energy source for generating electricity from stand by DG Sets. It is primarily stored in the tank farm. Tank farm transfers the fuel to the DG room day tank.

Details about Diesel Generator sets and performance analysis.

1. Diesel Generator: Make: Kirloskar Green Generators Pvt Ltd Model No KG 225L Rating 125 KVA 3 Ph V=415V,, 1500 RPM S.No 0507524
2. Diesel Generator: Make: 250 KVA Stamford PF 0.8 RPM 1500
3. Diesel Generator: Make: Powerica Cummins S. No M13040008 Rating 250 KVA 3 Ph V =415V,, 1500 RPM

1.8.1 Monthly Diesel consumptionon 250KVA for 2021-22

Month	Running hours	Diesel input in Ltrs
Feb 2022	3 Hrs	60
Jan 22	3	59
Dec 21	2	40
Nov 21	5	100
Oct 21	2	40
Sept 21	3	72
Aug 21	8	159
July 21	2.45	55
June 21	4.3	188
May 21	1.30	37
April 21	7.1	180
March 21	4.0	119
Total	45.15 hrs	1109 lts

HSD Consumption for 2022-2023 (250KVA)

Month	Running hours	Diesel input in Ltrs
April 2022	4 Hrs	80 Ltrs
May 2022	26 Hrs	520 Ltrs
June 2022	5.00 Hrs	100 Ltrs
July 2022	15.45 Hrs	315 Ltrs
Aug 2022	1.40 Hrs	33 Ltrs
Sept 2022	12.10 Hrs	242 Ltrs
Oct 2022	24.15 Hrs	597 Ltrs
Nov 2022	27.45 Hrs	666 Ltrs
Dec 2022	15.00 Hrs	285 Ltrs
Jan 2023	12.30 Hrs	300 Ltrs
Feb 2023	9.00 Hrs	216 Ltrs
March 2023	9.00 Hrs	170 Ltrs
Total Annual quantities	160.85 hrs	3524 Ltrs

As there is no much use of 125 KVA only 4 hrs used .Hence not taken into consideration.

Specific fuel oil consumption on DG Set

Specific fuel oil consumption is the measure of the mass of fuel consumed per unit time to produce per KW. The Energy Meter is available with the

DG Set but noted it is not functioning, accurate performance can be arrived with energy out put with amount oil input. Records for the quantity of oil used on hourly based are maintained by the operator and noted.

The Energy meter on DG set is to be made functional and Energy produced to be monitored and records maintained. Recommendation. The diesel consumption against the Energy generation from DG Sets should be monitored. The Energy meter readings are to be taken and records to be maintained. The total consumption of HSD in ltrs per month and number of Hours running to be recorded and monitored. The energy generated per Litre of HSD to be compared with standards given by Bureau of Energy Efficiency.

Note: Specific fuel consumption as BEE is 160-180 grams/KWh.(Density of HSD IS 0.84 Kilo grams / Ltr of HSD

Inference: 1. Unbalanced voltages and currents in each phase are found resulting overheating of cables and further insulation failures .Loads in each phase should be balanced

2. More than 5% unbalanced voltages of will increase fuel consumption on DG Set.

Voltages at DG Set terminals are found to be very high from the generator when Compared to name plate designed Voltage.

3. It is reported that radiator is clogged due combustible particulates, resulting clogging of exhausts from diesel engine and hence efficiency will be reduced.

4. An energy meter along CTs is to be installed for measurement of Output Energy for specific quantity of Diesel oil input.

5. It is important to calculate energy generated for input quantity of diesel oil to find out accurate performance of DG Set.

6. Specific oil consumption does not match with standard values, maintenance on the DG Set may be taken up

1.9 Total Connected load of the premises

Total load in the Campus details:

S.No	Item	Description	Quantity (Q)	Wattage (W)	(Q*W)	Total Wattage
1	Fans	Old	810	75	60,750 W	83,500
		New	350	55	19250 W	
		BLDC FANS CHANGED	100	35	3500 W	
2	Lights	Fluorescent Type (Tube lights)	800	40	32000	47200
		LED Type	700	22	15200	
3	Air Conditioners	Old	38	2480	94240	
		New	136	1450	197200	
		Auditorium	8	8500	68000	
		Main office Cassette 2 Ton ACs(2.235 W/Each)	6	2235	13400	372840
4	Computers	All departments	1280	60	76800	76800
5	Laboratories Motors	EEE	.	104	104000	219000
		Mechanical	.	100	100000	
		Civil	.	15	15000	
6	Motors	(Submersible motors, Fountain pumps, Fire safety motors, water plant motors)			35200	35200
7	Canteen				13000	13000
Total load in Watt						**847540**

Total Connected load 847.54 KWs.

Note : The Connected load may be got reconciled with actual contracted load as per the HT Agreement of CPDCL. The extra load beyond the contracted load may be regularized.

2.0 Full Loading Currents at Each panel (Measured Values) on 26-4-2023

There are 6 numbers of LT Panels distributing power to various floors.

Panel No	V R-Y Volts	V Y-B Volts	V B-R Volts	I r Amps	I y Amps	I b Amps	In Amps	V E-N Volts
No 1	428	428	427	18.4	22.5	30.7	5.6	3.1
No 2	427	427	428	26	37.2	27.0	4.6	2.1
No 3	428	427	428	128.1	126.2	126.0	20.4	1.2
No 4	427	427	428	15.9	29.4	40.5	22.0	1.5
No 5	427	427	427	12.8	19.8	28.3	14.5	1.6
No 6	428	428	429	34.5	36.7	33.7	2.3	2.2

Note : Hence the loads to be balanced to avoid abnormal heating in the cable and load losses where ever find it is abnormal unbalanced currents are noted..

2.1 Major Cables used in the installation sizes and lengths

Location	cable size	Length of cable	No.Cables
Control room to Panel I	3.5 C 70 Sqmm	70 mtrs	1
Control room to Panel II	3.5 C 50 Sqmm	250 mtrs	1
Control room to Panel III	3.5 C 120 Sqmm	320 mtrs	1
Control room to Panel IV	3.5 C 50 Sqmm	170 mtrs	1
Control room to Panel V	3.5 C 95 Sqmm	250 mtrs	1
Control room to Panel VI	3.5 C 95 Sqmm	100 mtrs	1
Control room to IBM Lb	3.5 C 50 Sqmm	55 mtrs	1
Control room to Sun labs	3.5 C 50 Sqmm	50 mtrs	1
Control room to IT Lab	3.5 C 70 Sqmm	90 mtrs	1
Control room to E cad lab	3.5 C 70 Sqmm	320 mtrs	1
Control room to CC labs	3.5 C 70 Sqmm	85 mtrs	1
Control room to Computer lab 1st year	3.5 C 150 Sqmm	105 mtrs	1
Control room to CSE Incubation center	3.5 C 150 Sqmm	160 mtrs	1
Control room to FM labs	3.5 C 35 Sqmm	35 mtrs	1
Control room to MT labs	3.5 C 35 Sqmm	55 mtrs	1
Control room to Simulation labs	3.5 C 70 Sqmm	300 mtrs	1
Control room to work shop	3.5 C 70 Sqmm	45 mtrs	1

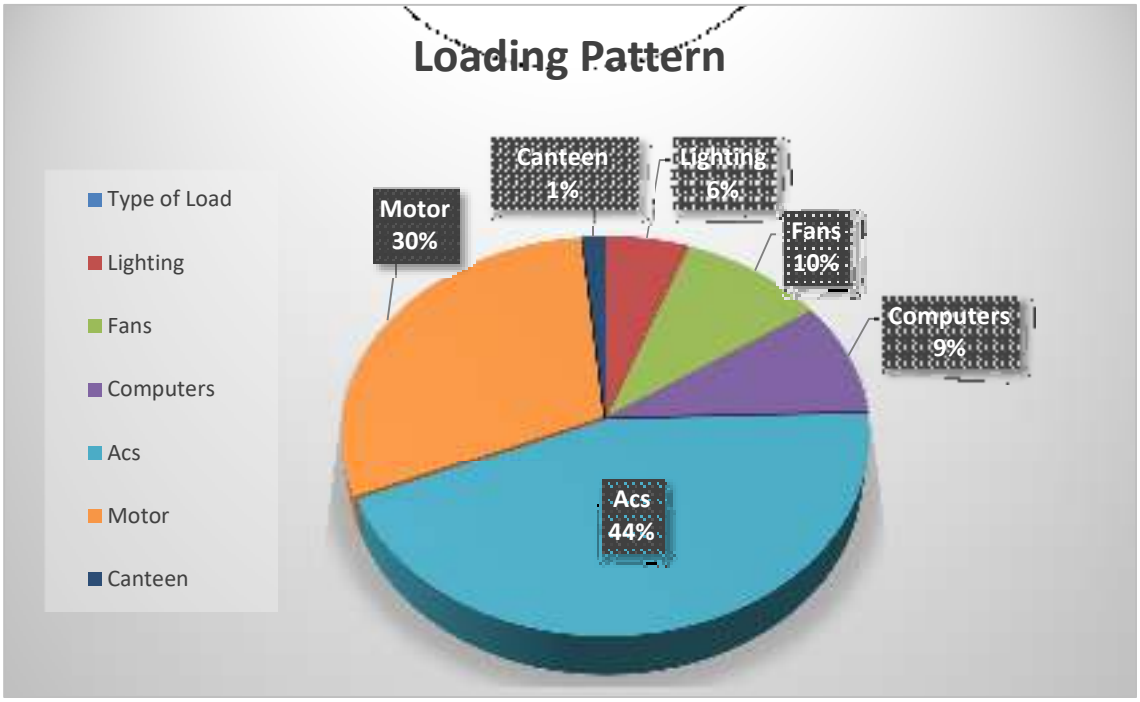
Note: 1. Since there is no considerable amount currents flowing in the neutral, the losses in the neutral conductor not considered and calculated, as it is felt that losses are very negligible amounts

2. The insulation resistance of cables (IR Values) are to be taken periodically on all cables and records maintained. This helps to find out the identification of potential damages or leakages

2.2 Loading Pattern of the Electrical Installations

Fans, Lighting and Air conditioning and computers loads have direct impact on the Energy consumption and demand

S.No	Type of load	Connected load
A	The lighting load	47.20 KWs
B	Ceiling Fan load	83.5 Kws
C	Computers Load	76.8 Kws
D	Air conditioners load	372.84 KWs
E	Motors and Misc. Load	254.2 KWs
F	Canteen load	13 KWs
	Total Load as on 26-4-2023	847.54 KWs



Chapter -3 Energy Saving Opportunities

3.1. Replacement old Fans with new 5 Star rated Ceiling fans

a. There are about 810 number fans are available in the installations with 75-80W

b. Replace these fans with 5 star rated fans as per BEE recommendation.

c. Power saving due to replacement of these fans 810 (75-50 w) = 20250 KWh

d. Consideration 8 hrs/day,0.8 diversity factor,0.6 load factor

e. Cost of energy saving 20250 KWhs x Rs 7.65 = Rs1, 54,913

f. Cost of investment Rs 1800/fan = 810 x Rs 1800 = Rs 14, 58,,000

g. The return on investment = 9.5 Years approx.

h. The life of the fan is minimum of 15 years without compromising the performance. j) Periodical greasing in the fan bearings will increase the life of the fan

k) The college management may draw an action plan to replace the old fans in a phased manner or whenever contemplating to change the old fans whichever is earlier.

l) It is appreciated that the management has already changed about 100 BLDC Fans and planning to Change the rest of the fans in due course

3.2. Replacement of Conventional tube lights

a. There are about 900 number of conventional tube lights fans are available in the installations with 40 W tube with 13W conventional chokes =53 W

b. Replace these fans with 18 W LEDs as BEE recommendation.

c. Power saving due to replacement of LED lamps 800 (53-18 w) = 28.KW

d. Annual Energy savings @10 hrs of usage/day for 300 Days =

= 84,000 KWhs/ year

e. Cost of energy saving = Rs 6,42,600

f) Cost of investment Rs300/ LED = 800x Rs 300 = Rs 2,40,000

g) The return on investment on LED lamps = 3 Years.

h) The LED is giving effective illumination more than the Convention Florescent lamps as the Lumen out put varies from 90-95 lumens /watt of LED against 55 Lumens of Florescent lamps.

j) The positive point is the college management has already taken an initiation and action plan is in place to replace the florescent lamps in a phased manner or whenever contemplating to change the old FL whichever is earlier.

3.3) Energy Saving in Operational controls in Computers.

a. The computer LED screen and CPU will draw a power up to 25- 50 W during log off condition which consumes power during not using condition and hence to be switched off when not in use.

b. There are about 1280 Computers are connected to the supply in different labs in the college and 50% of the computers are found in log off condition instead of switch off when not in use. It has seen during the audit each computer is drawing a power of 25-50 W during log off.

d. Energy Wastage in KWh estimated for = 27,648 KWhs /Anum (Considering 50%)

e. Cost of Energy wastage per anum = Rs 7.65x 27,648 KWh = Rs 2, 11,507 f.

Cost of investment is nill except the change of the attitude and habit of the users.

g. It is recommended to paste the posters with slogans at all computer labs to create an awareness among the computers users at all laboratories.

h. To impart awareness training for students and staff regarding above mentioned issue and energy loss there off.

3.4 Replacement of old Air conditioners with star rated ACs as per BEE Recommendations

a. There are about 38 Numbers of old Air conditioners consumer more power than the star rated ACs.

b. Energy saving 38(2.48-1.45 Kw) at 6 hrs usage 70,452 KWhs

c. Cost of Energy Rs 5,39,000

d. Investment Rs 11,78,000

e. Simple pay back period 2years 2 months

Chapter -4 Safety aspects in the College Electrical

4.0 Safety aspects in the College installation

1. Standard operating procedure for maintenance activities are to be prepared including solar panel systems to get more efficiency form solar system.
2. To reconcile the additional load if any as per the HT agreement with CPDCL
3. Personal Protective Equipment to be issued for all technicians for safe operation of system. At present no PPE is used by them
4. All Electricians should have competency certificate from CEIG of AP Govt.
5. Illumination levels are to be taken in the street lights and records maintained and lux meter is to be calibrated.
6. Transformer yard fencing to be earthed as per CEA regulations Cl 49(ii).
7. Energy meters are fixed to measure the energy of each panel inside the building. The Energy to be compared with the main energy meter and records maintained. This is useful for monitoring the total energy
8. Insulation Resistance values for all cables are to be taken periodically as per CEA Regulations and records maintained.
9. All high raised buildings should earthed against lightning under cl 74 of CEA regl as per IS 2309
10. Cable route is to be identified and painted to avoid the confusion in future.
11. Adequate number of fire extinguishers to be provided in the central library.
12. Fire extinguishers to be provide at LPG shed at Canteen.
13. AB Switch at the transformer yard is to be earthed.
14. It is observed that in the transformer yard earth pits not covered and not maintained properly as per IS 3043.
15. The existing transformer capacity may be increased to 500 KVA if any additional load is contemplated .
16. First aid box to be made available with medicines recommended by authorized. Medical officer

19. Emergency Phone numbers are to be made available inside the lifts emergency use.

20. Energy and Safety audits are to be conducted periodically In the premises as per regulations.

21. Loose wiring in the panel rooms to be avoided

5.0 Conclusions

Metering & Monitoring System

It is said that good energy metering and monitoring can save 6-8 % energy wastage. Therefore good data collection and data management system for energy is the prerequisite for successful energy management.

Electrical Energy Metering: The total energy received at 11KV HT point is measured through a HT meter which is sealed and inspected by the APEPDCL authorities periodically. The energy read in the HT meter is inclusive of Transformer losses and for better under standing of energy use the consumption of each building to be compared with the main consumption.

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Certified Energy Auditor /Regd No 1600
Bureau of Energy Efficiency. New Delhi
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Prasad V. Potluri Siddhartha Institute of Technology
(Autonomous)
Kanuru, Vijayawada – 520 007
(Affiliated to JNTUK, Accredited by NBA, ISO 9001:2015 Certified Institution)

Academic Year 2021 – 22

ENERGY AUDIT REPORT

Prasad V Potluri Siddartha Institute of Technology

Kanuru, Vijayawada-520007: Krishna Dist. AP

Audit carried during
27th to 29th March 2022

Audit Conducted and R Prepared By

Er. R.V.Ramana Rao BE., BL, FIE
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IV	Performance Diesel Generators
V	Study on Safety issues on Transformer yard, Control rooms
VI	Study on Erthing and Earthing systems of installations

ABBREVIATIONS

°C	Degree Centigrade
A	Ampere
AC	Alternating Current
APFC	Automatic Power Factor Controller
Avg.	Average
Cfm	Cubic Feet per Minute
Cm.	Centimeter
CO_2	Carbon Dioxide
CO	Carbon Monoxide
DG	Diesel Generating
Ft.	Feet
FTL	Fluorescent Tube Light
Gm.	Gram
Hr.	Hour
HSD	High Speed Diesel
Kcal	Kilo Calories
Kg.	Kilogram
KVA	Kilo Volt Ampere
KVAr	Kilo Volt Ampere Reactive
KW	Kilo Watts

KWh	Kilo Watt Hour
LDO	Light Diesel Oil
Ltd.	Limited
M	Meter
V	Voltage
MW	Mega Watts
PF	Power Factor
LED	Light Emitting diode
KVAh	Kilo Volt Ampere Hour
KWs	Kilo Watts

Preface

About the institution: Potluri.V.Prasad Siddhartha Institute of Technology, PVPSIT is a private engineering college located at Chalasani Nagar. Kanuru in Vijayawada 520007, Andhra Pradesh, India that offers undergraduate education and postgraduate education in Engineering Branches. The institution is the first private institution to offer engineering education in united Andhra Pradesh and first private college to offer PG Programmes in engineering in the state. The college was approved to be an autonomous institution by Acharya Nagarjuna University in the year 1977

PVP Siddhartha Institute of Technology is located in the serene ambience of Kanuru, surrounded by lush green fields in the milieu of Vijayawada, the second largest city of Andhra Pradesh. The city which is built on the banks of the Krishna, is recognized as a "Global City of the Future" by McKinsey Quarterly and known as one of the commercial hubs of South India.

College Infrastructure

This college was a well-known college in the city of Vijayawada. This college was established in 1998 by the most prestigious organization Siddhartha academy of general and Technical education, Vijayawada. This college got autonomous status in 2012.It is approved by AICTE and permanently affiliated to JNTUK , Kakinada. Renowned for Academic Excellence and Sustenance of Quality. College is located in the serene ambience of Kanuru, surrounded by lush green fields in the milieu of Vijayawada.

Under the Dynamic leadership of

Principal

Dr. K. Sivaji Babu

P.V.P.Siddhartha Institute Of Technology

Kanuru, Vijayawada-520 007

And

HOD (EEE)

Dr. M. Venu Gopala Rao

E.E.E Department: P.V.P.Siddhartha Institute Of Technology

Kanuru, Vijayawada-520 007.

hodeee@pvpsiddhartha.ac.in/ Mobile No: 9440931217

Scope of the Work:

The present assignment is for checking levels of Energy Efficiency for this Educational institute situated at Chalasani Nagar, Kanur, Vijayawada .Krishna district of Andhra Pradesh. The energy audit is aimed at recording and quantification of the energy consumption in this institution and possible reduction in Energy Bills which was noticed at alarming levels. Subsequently it also tries to explore the possibilities of Conserving Energy through better utilization practices by the students and staff of this institution and employ education of newer technologies.

It is felt also expect that the institution stands as a first and best Efficient Energy Educational intuition.

The report has classified the suggestions in to short, medium and long-term investment opportunities in energy efficient implementation methods so that the management can take up the implementation according to investment and payback priorities in line with the available budget provisions of the College management.

Vision

To provide rich ambience for Academic and Professional Excellence, Research, Employability skills, Entrepreneurship and Social responsibility.

Mission

To empower the students with Technical knowledge, Awareness of up-to-date technical trends, Inclination for research in the areas of human needs, Capacity building for Employment / Entrepreneurship, Application of technology for societal needs.

Quality Policy

At PVPSIT, We commit ourselves to offer Quality professional education in engineering & Management by adhering to applicable statutory and regulatory requirements and through continuous improvement in the Quality of our services.

Acknowledgement

An energy audit is a joint exercise conducted by Energy consultant and the client authorized representatives to identify and conserve energy usage without sacrificing the purpose and comfort levels. The contribution of client's team is equally important in the venture. An organization is made up of individuals.

We sincerely acknowledge the contribution of the following dignitaries because of whom the study could progress smoothly –

- Principal : Dr. K. Sivaji Babu
- HOD Dr. M. Venu Gopala Rao
  E.E.E Department

Dr. M. Ramesh. Associate Professor and In charge of Electrical Installations .

We are also thankful to the other staff members who were actively involved while collecting data and conducting the field studies in the Institution.

R.V.RAMANA RAO
Certified Energy Auditor /BEE

Executive summary sheet

Key Result Areas for Energy Savings & Estimated Potential along with Cost Benefit analysis.

Sr. No.	***Energy Saving Area***	***Saving Potential in KHW & In Rs. p.a.***	***Investment In Rs. ST/MT/LT***	***Payback period In month***	***Action for Implementation***
1	Replacement of old Fans with star rated fans	26,208 Units Rs 2,00,491	Rs 16,38,000 Long Term	8 years-	Replacement fans in a phased manner
2	Replacement of Conventional Florescent Lamps	94,500 Units Rs 7,22,925	Rs2,70,000 Short term-	3years	Replacement in a phased manner
3	Reduction in Demand from 213 KVA to 173 KVA	Rs 2,28,000	No investment	Imme diate	Address a letter to SAO / Exp /CPDCL /VJA
4	Switch off mode for computers instead off log off when not in use	27,648 units Rs 2,11,507	Attitude and change of habits	Immediate	Awareness programmes to be conducted
5	Replacement of old Air conditioners with star rated ACs as per BEE Recommendations	70,452 Units Rs 5,39,000	Rs 11,78,000	2 Years 2 months	Can be changed in phased manner

Other improvements recommended to achieve Energy Efficiency are

1. Improvment in earthing system
2. Balancing of loads in Electrical system and also on DG Systems
3. Tight connections in cable and general wiring improves 5-10% Efficiency.
4 Using star rated Air conditioners, fans, and lights will reduce Energy Consumption drastically.
5. Using solar Energy will give a great relief in the system, Expenditure Environmental benefits.

Chapter 1

EXISTING ENERGY SCENARIO

1.1 The importance of Energy Efficiency:

World Economic growth is driven by energy, whether in the form of finite resources such as coal, oil and gas or in renewable forms such as hydroelectric, wind, solar and biomass or its converted form. This energy generation and consumption strengthens the nation's industries, vehicles, homes and offices. It also has significant impact on the quality of the country's air, water, land and forest resources. For future growth to be both rapid and sustainable, it needs to be as resource efficient and environmentally benign as possible.

The growth in installed power generating capacity has not kept pace with the projected demand though the existing installed capacity in Indian Energy Sector is 1, 76,850 MWs. Out of this installed capacity 64% energy comes from thermal energy includes gas, oil, and coal .To meet this demand, it is necessary to set up more power plants and most of these power plants will be either fossil fuel based or hydroelectric units. However, the conventional power stations cause enormous damage to be environment due to pollution and other side effects.

In this circumstances the Energy Efficiency gathers much importance in the present day energy Scenario. In this direction the Govt .,of India ,under Ministry of Power has introduced Energy Conservation Act in 2001 to make mandatory Energy Audit for all Designated consumers where huge Electricity Consumption identified in this Act. Recently the Govt is also taking up awareness campaign through various sources to create adequate knowledge among the consumers to save the power and plug the losses. It is estimated that there is 30% of energy is being wasted by various consumers and if this is curbed there would be an additional demand available to a tune of 25,000 MWs supply which is equivalent to financial saving of Rs1,20,000 Cr of Rupees apart from the protecting the Environment from carbon emissions. The carbon emission levels

are to tune of 29.92 Billion tons as on April 2021, mostly from the thermal power stations. Apart from this the consumers has felt the pinch of increasing tariffs from time to time, and the production cost is being increased. It is also to know that the fuel prices also being increased enormous as the world oil prices are going up substantially from year to year.

Renewable energy sources energy source are wonderful options because they are limitless. These will not be exhausted though fossil fuel will be gradually exhausted in course of time. Also another great benefit from using renewable energy is that most of these sources do not pollute the environment; the way burning of fossil fuels dose.

Green House Gas Emissions

The greenhouse gas emissions (GHG) come primarily from the combustion of fossil fuels in energy use. Energy use is largely driven by economic growth with short-term fluctuations in its growth rate created by weather patterns affecting heating and cooling needs, as well as changes in the fuel used in electricity generation.

The burning of fossil fuels produces around 29.62 billion tons of Carbon Dioxide per year, but it is estimated that natural processes can only absorb about half of that amount, so there is a net increase of 10.65 billion tones of atmospheric carbon dioxide per year. Carbon dioxide is one of the GHG that enhances radioactive forcing and contributes to global warming, causing the average surface temperature of the earth to rise. Environment scientists predict that this will cause major adverse effects, including reduced biodiversity.

The electricity sector is unique among industrial sectors in its very large contribution to emissions associated with nearly all air issues. Electricity generation produces a large share of nitrogen oxides and sulphur dioxide emissions, which contribute to smog and acid rain and the formation of fine particulate matter in addition to carbon dioxide. In addition, this sector has significant impacts on water and habitat and species. In particular, hydro dams and transmission lines have significant effects on water and biodiversity.

1.2 Energy Auditor's qualifying & Competency Certificate issued by Bureau of Energy Efficiency. Ministry of Power. Govt., of India

Regn. No. EA-1600 No. 1301

National Productivity Council

(National Certifying Agency)

PROVISIONAL CERTIFICATE

This is to certify that Mr. / ~~Ms.~~ R.V. Ramana Rao

son / daughter of Mr./~~Ms.~~ R.V. Suryanarayana Rao

has passed the National Certification Examination for Energy Auditors held in 2006, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India.

He / ~~She~~ is qualified as Certified Energy Manager as well as Certified Energy Auditor.

He / ~~She~~ shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfillment of qualifications for the Accredited Energy Auditor and issue of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.

This certificate is valid till the issuance of an official certificate by the Bureau of Energy Efficiency.

Place : Chennai, India

Date : 2nd November, 2006

Controller of Examination

1.3 Brief about Energy Auditor:

A Graduate in Electrical Engineering from Andhra University 1973. with more than 33 years engineering experience in APSEB/EPDCL and retired as Superintending Engineer from Govt.service

2. Certified Energy Auditor from Bureau of Energy Efficiency with registration number EA 1600 , MOP: Conducted several Energy Audits in various organisations including Industries, Engineering colleges, Educational institutions, MSMEs, Commercial Buildings

3 ISO Lead Auditor in QMS, EMS,OHSMS and EnMS system standards.

4. Corporate member in Institution of Engineers, faculty member for PCRA, APPC,

5 . Senior Faculty member REC Institute of Power Management& Training. Hyderabad

6. Conducted several Electrical Safety and Energy audits in various organisations.

7. Empanelled Lead Auditor in DNVGL and IRQS

8. Senior consultant in RTQMS for EnMS system implementations in HPCL,HAL, KCP Cements. IRQS etc.

9. Conducting several safety programme in Industries, Thermal station power Engineers, distribution systems

1.4 INTRODUCTION

The PVP Siddhartha Institute of Technology, Chalasai Nagar Kanuru has the college buildings and premises contains multi storied buildings with different Electrically connected loads like fans, lighting systems, computers systems supported by UPS, Lab equipment for all branches of Engineering and Information technology Boys and Girls Hostels etc.,

Scope of Energy Audit

The scope of an energy audit, the complexity of calculations, and the level of economic evaluation are all issues that may be handled differently by each individual auditor and should be defined prior to beginning any audit activities. An energy audit can be simply defined as a process to evaluate where an institution uses energy, and identify opportunities to reduce consumption.

Introduction to Energy Audit

General

The Management of PVP Siddhartha Institute of Technology entrusted the work of conducting a Walkthrough Energy Audit of campus at Kanuru ,Vijayawada with the main objectives as below:

a. To study the present pattern of energy consumption

b. To identify potential areas for energy optimization

c. To recommend energy conservation proposals with cost benefit analysis.

- **Scope of Work, Methodology and Approach**

Scope of work and methodology were as per the proposal. While undertaking data collection, field trials and their analysis, due care was always taken to avoid abnormal situations so as to generate normal / representative pattern of energy consumption at the facility.

- **Approach to Energy Audit**

We focused our attention on energy management and optimization of energy efficiency of the systems, sub systems and equipment. The key to such performance evaluation lies in the sound knowledge of performance of equipments and system as a whole.

- **Energy Audit**

The objective of Energy Audit is to balance the total energy inputs with its use and to identify the energy conservation opportunities in the stream.

Energy Audit also gives focused attention to energy cost and cost involved in achieving higher performance with technical and financial analysis. The best alternative is selected on financial analysis basis.

- **Energy Audit Methodology**

Energy Audit Study is divided into following three steps:

1.4 a . Historical Data Analysis

The historical data analysis involves establishment of energy consumption pattern to establish base line data on energy previous consumption and its variation with change in different months of year.

1.4 b . **Identification and evaluation** of Energy Conservation Opportunities

This step involves evaluation of energy conservation opportunities identified during the energy audit. It gives potential of energy saving and investment required to implement the proposed modifications with payback period. All recommendations for reducing losses in the system are backed with its cost benefit analysis.

1.5 Energy sources and Utilisation

The Electrical supply is fed through a 11KV feeder from Kanuru 33/11KV substation forms part rural through a HT Supply at 11KV level. The LT supply is drawn from a 250 KVA step down power transformer of 11KV/433 V.

1.0 Electricity Metering : The metering is done at HT side of the transformer as per the norms of the utility which indicates that transformer losses are included in the HT Billing and the consumer has to pay for the transformer losses.

2.0 Diesel Generator set : Two Diesel run generator is also available with 125 KVA and 250KVA capacity which has to supplement and extend the supply during power failures. Unfortunately there are frequent power failures and other restrictions have been imposed due to short supply of power since there is no adequate power generation in the state.

The total connected load of the this HT service as verified mainly supplying the lights and fans, Computers and UPS Systems further supplying the computers in the institution among lab motors and equipment.

Electricity, & HSD is the primary energy sources for the Institution. The utilization of diesel oil consumption is more due to frequent power interruptions on the rural HT feeder of Substation. Apart from this due recent reduction in power generation due to short supply of coal to the thermal power stations the power supply is staggered drastically.

1.6 HT Electrical Service Connection: VJA 754 Cat 2A2. 11KV CMD 213 KVA with a minimum billing KVA 176

Tariff for payment Electricity Consumption

As per the present Tariff the Rs 475/ KVA and Rs 7.65/ KVAh

1.7 <u>Monthly consumption of the Institution</u> : Details of monthly energy consumption figures are given in *Annexure I* . The tables indicates the consumption details like KWh. KVAh, recorded Maximum Demand and Total bill amount.

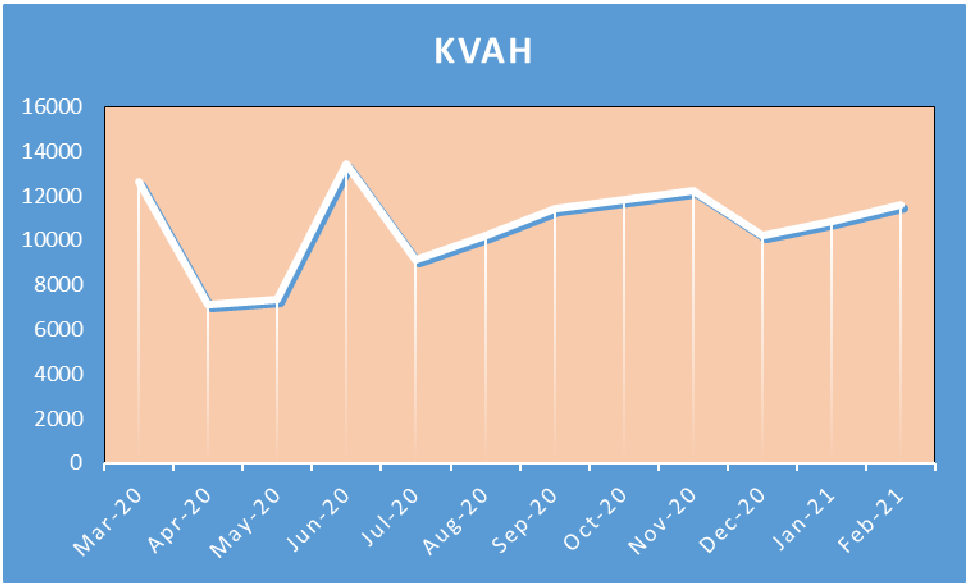
The following graphs shows the pattern of consumption every month
For the years 2020-2021, 2021-22.

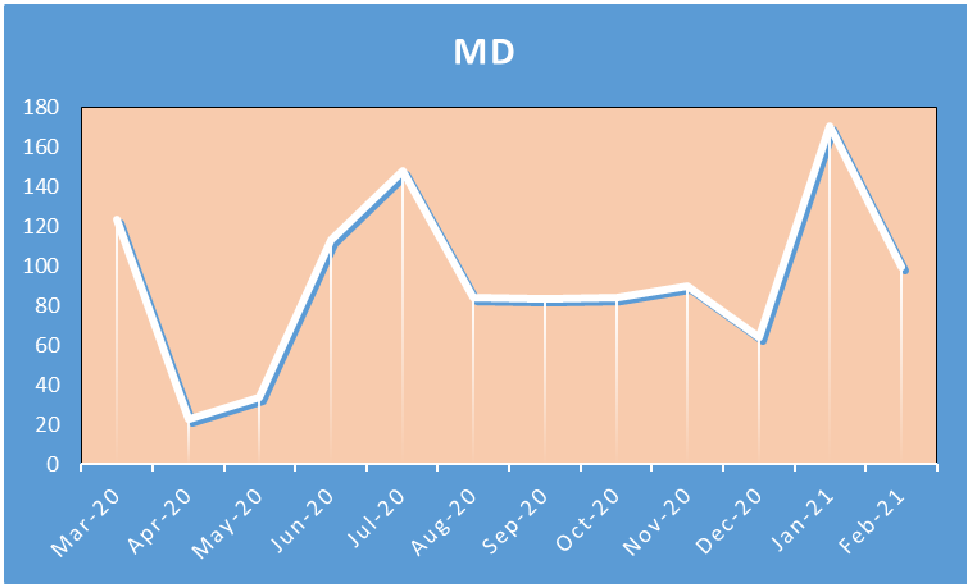
	consumption particulars 2020-21			
Month	KVAh	MD	PF	Solar Energy
Mar-20	12618	123.4	0.93	12042
Apr-20	7130	23	0.99	21002
May-20	7364	34	0.99	18224
Jun-20	13414	113.33	0.96	4998
Jul-20	9138	148.2	0.97	9320
Aug-20	10236	83.78	0.96	8066
Sep-20	11448	83.4	0.95	7048
Oct-20	11816	84	0.96	6838
Nov-20	12200	89.78	0.96	2962
Dec-20	10212	64.12	0.98	11514
Jan-21	10866	170.4		10910
Feb-21	11618	99.54	0.94	6778

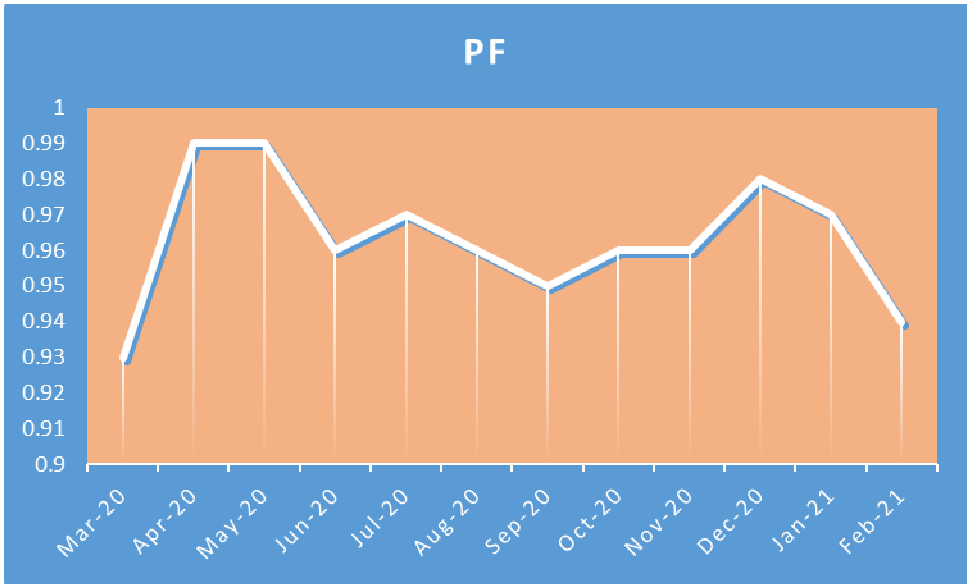
1.8 Graphical Representation of Consumption

The Electricity consumption for the year 2020-2021

KVAh Consumption for 2020 -21

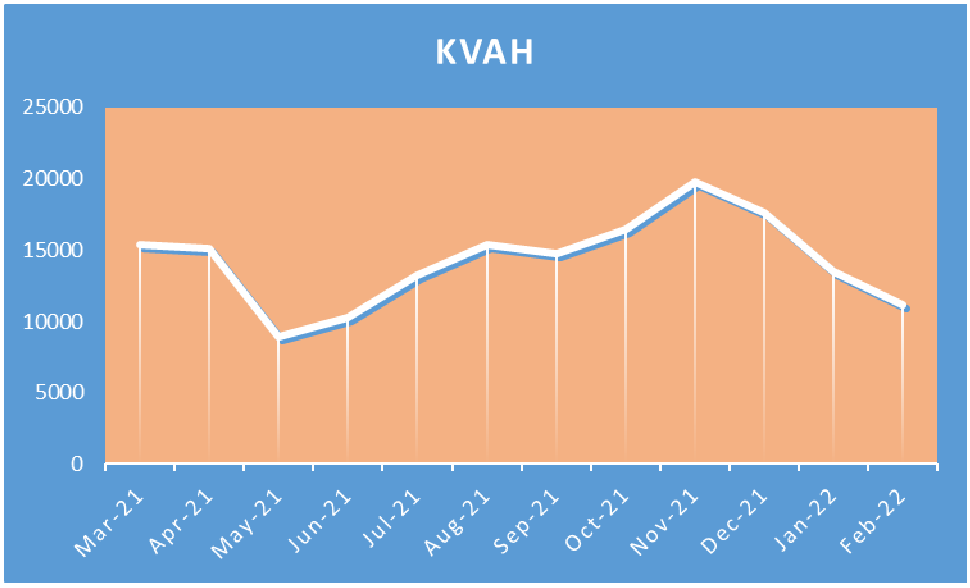




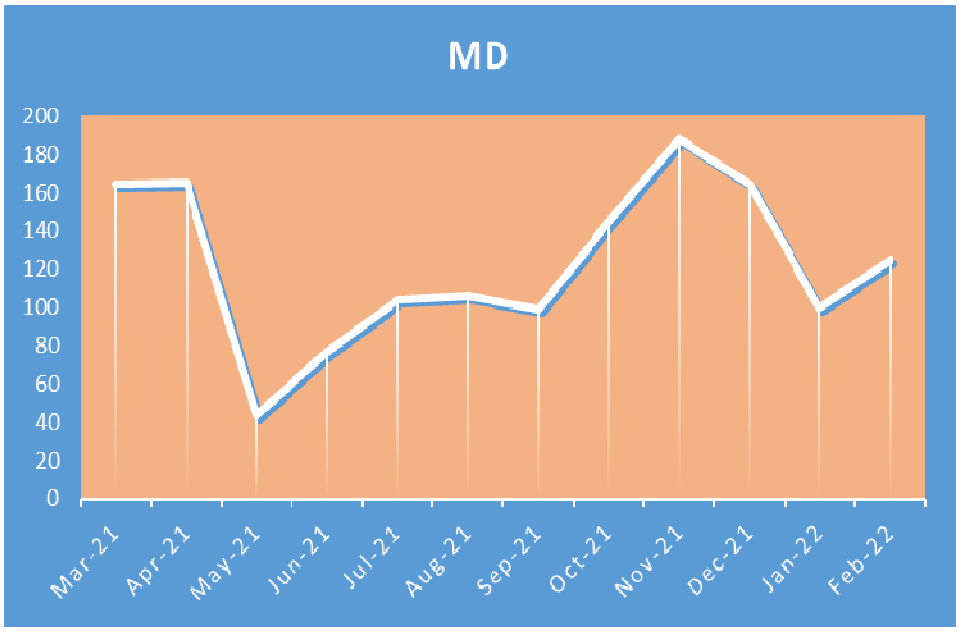


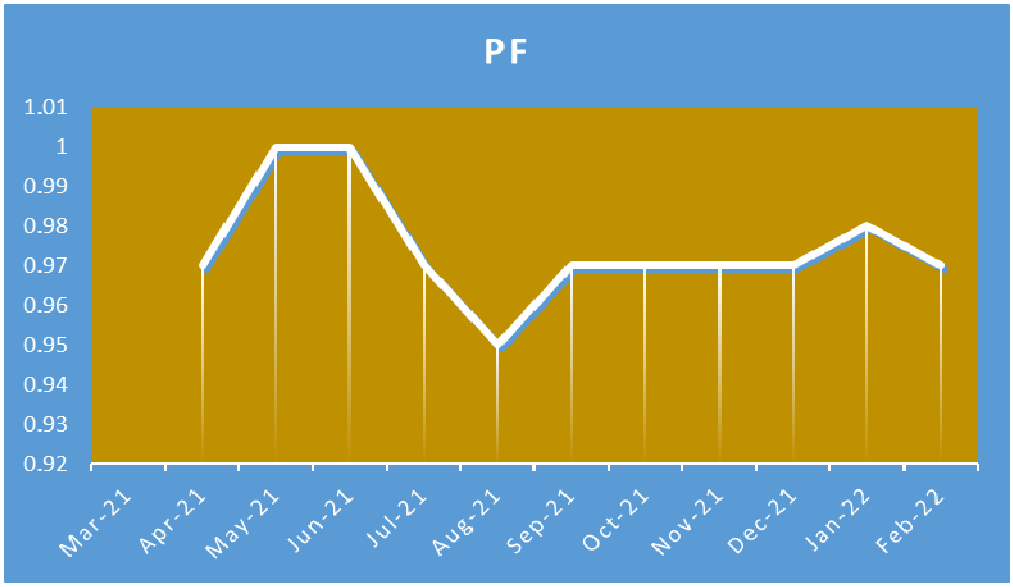
1.9 Consumption Pattern for the year 2021-2022

Month	KVAh	MD	PF	Solar
Mar-21	15340	164.3		6896
Apr-21	15098	165.4	0.97	8880
May-21	8880	43.86	1.00	15210
Jun-21	10256	77.00	1.00	8486
Jul-21	13270	104.2	0.97	5126
Aug-21	15422	105.86	0.95	4782
Sep-21	14774	98.84	0.97	4918
Oct-21	16434	144.66	0.97	7324
Nov-21	19804	187.74	0.97	3324
Dec-21	17664	164.14	0.97	5574
Jan-22	13512	99.5	0.98	6424
Feb-22	11144	125.2	0.97	8024



Month wise recorded Demand in KVA





1.10 Electrical Energy

Electricity supply from the electricity department is at 11 KV and is stepped down to 433 V by a 250 KVA capacity step down transformer. Metering is done on the HT side.

The above indicated t*ables shows the month wise electrical consumption data and analysis of electricity bills.*

The Institution is supplied by the CPDCL distribution lines and maintains 400 KVA Contracted Maximum Demand with the electricity department. The institution has a 1x125 KVA and 1x 250KVA DG Sets run on HSD.

Recommendation. The diesel consumption against the Energy generation from DG Sets should be monitored. The Energy meter readings are to be taken and records to be maintained The total consumption of HSD in ltrs per month and number of Hours running to be recorded and monitored.

As the Electricity gathers prime importance for the on going final year students who are appearing for practical examinations to run the laboratory for the experiments and exercises and to the study hours of hostlers.

The annual electricity consumption for the institution is around 2.25 lakh units for 2010 -2011. The plant maintains the P.F of 0.94 with additional capacitors but the lower power factor attracts the penal charges as PF recorded in certain months are lower than specified by EPDCL.

HSD

HSD is an energy source for generating electricity from stand by DG Sets. It is primarily stored in the tank farm. Tank farm transfers the fuel to the DG room day tank. HSD is available presently at Rs 49 / lit to the Institution.

7.0 Details about Diesel Generator sets and performance analysis.

1. Diesel Generator: Make: Kirloskar Green Generators Pvt Ltd Model No KG 225L Rating 125 KVA 3 Ph V=415V,, 1500 RPM S.No 0507524
2. Diesel Generator: Make: 250 KVA Stamford PF 0.8 RPM 1500
3. Diesel Generator :Make: Powerica Cummins S. No M13040008 Rating 250 KVA 3 Ph V=415V,, 1500 RPM

1.11 Monthly Diesel consumption on 250 KVA for 2021-22

Month	Running hours	Diesel input in Ltrs
Feb 2022	3 Hrs	60
Jan 22	3	59
Dec 21	2	40
Nov 21	5	100
Oct 21	2	40
Sept 21	3	72
Aug 21	8	159
July 21	2.45	55
June 21	4.3	188

May 21	1.30	37
April 21	7.1	180
March 21	4.0	119
Total	45.15 hrs	1109 lts

As there is no much use of 125 KVA ,no records maintained.

Specific oil Consumption in DG Set :

Specific fuel oil consumption is the measure of the mass of fuel consumed per unit time to produce per KW. Since no Energy Meter is available with the DG Set, accurate performance can be arrived with energy out put with amount oil input. Records for the quantity of oil used on hourly based are maintained by the operator.

1.12 DG Set particulars and Performance

1. Capacity of Generator 125 KVA (100KW) : Make Kirloskar Green .F L Amps 173.9 415 V,1500 RPM ,50Hz M/C no 22S3L205C5762

2. Capacity of Generator250 KVA (200KW) : Make Kirloskar Green .Full Load Amps 350 415 V,1500 RPM ,50Hz M/C no Not clearly visible.

Inference: 1. Unbalanced voltages and currents in each phase are found resulting overheating of cables and burning away .Loads in each phase should be balanced

2. More than 5% unbalanced voltages of will increase fuel consumption on DG Set.

3. Out terminal Voltages at DG Set are found to be very high from the generator when compared to name plate Voltage.

3. It is reported that radiator is clogged due combustible particulates, resulting clogging of exhausts from diesel engine and hence efficiency will be reduced.

4. An energy meter along CTs is to be installed for measurement of Output Energy for specific quantity of Diesel oil input.

5. It is important to calculate energy generated for input quantity of diesel oil to find out accurate performance of DG Set.

1.13 Connected Load in the Building as on 29-3-2022

Total load in the Campus details:

S.No	Item	Description	Quantity (Q)	Wattage (W)	(Q*W)	Total Wattage
1	Fans	Old	910	75	68250	87500
		New	350	55	19250	
2	Lights	Fluorescent Type (Tube lights)	900	40	36000	49200
		LED Type	600	22	13200	
3	Air Conditioners	Old	38	2480	94240	359440
		New	136	1450	197200	
		Auditorium	8	8500	68000	
4	Computers	All departments	1280	60	76800	76800
5	Laboratories Motors	EEE	.	104	104000	219000
		Mechanical	.	100	100000	
		Civil	.	15	15000	
6	Motors	(Submersible motors, Fountain pumps, Fire safety motors, water plant motors)			35200	35200
7	Canteen				13000	13000
Total load in Watt						**840140**

Total Connected load 840.14 KWs.

1.14 Full Loading Currents at Each panel (Measured Values).

There are 6 numbers of LT Panels distributing power to various floors.

Panel No	V R-Y Volts	V Y-B Volts	V B-R Volts	I r Amps	I y Amps	I b Amps	In Amps	V E-N Volts
No 1	417	415	419	19.4	8.5	14.5	8.4	1.1
No 2	427	427	424	33.1	21	30.6	7.6	2.1
No 3	428	427	428	62	62	60	0.4	1.5
No 4	414	413	409	17.4	23.4	39.5	7.1	1.5
No 5	427	427	427	15.8	33	30	9.7	1.0
No 6	418	418	419	13	18.8	41.7	25.3	2.2

Abnormal Unbalanced currents recorded in the case panel No 6 . Hence the loads to be balanced to avoid abnormal heating in the cable and load losses.

1.15 Major Cables used in the installation

Location	cable size	Length of cable	No.Cables
Control room to Panel I	3.5 C 70 Sqmm	70 mtrs	1
Control room to Panel II	3.5 C 50 Sqmm	250 mtrs	1
Control room to Panel III	3.5 C 120 Sqmm	320 mtrs	1
Control room to Panel IV	3.5 C 50 Sqmm	170 mtrs	1
Control room to Panel V	3.5 C 95 Sqmm	250 mtrs	1
Control room to Panel VI	3.5 C 95 Sqmm	100 mtrs	1
Control room to IBM Lb	3.5 C 50 Sqmm	55 mtrs	1
Control room to Sun labs	3.5 C 50 Sqmm	50 mtrs	1
Control room to IT Lab	3.5 C 70 Sqmm	90 mtrs	1
Control room to E cad lab	3.5 C 70 Sqmm	320 mtrs	1
Control room to CC labs	3.5 C 70 Sqmm	85 mtrs	1
Control room to Computer lab 1st year	3.5 C 150 Sqmm	105 mtrs	1
Control room to CSE Incubation center	3.5 C 150 Sqmm	160 mtrs	1
Control room to FM labs	3.5 C 35 Sqmm	35 mtrs	1
Control room to MT labs	3.5 C 35 Sqmm	55 mtrs	1
Control room to Simulation labs	3.5 C 70 Sqmm	300 mtrs	1
Control room to work shop	3.5 C 70 Sqmm	45 mtrs	1

Note: 1. Since there is no considerable amount currents flowing in the neutral, the losses in the neutral conductor not considered and calculated, as it is felt that losses are very negligible amounts

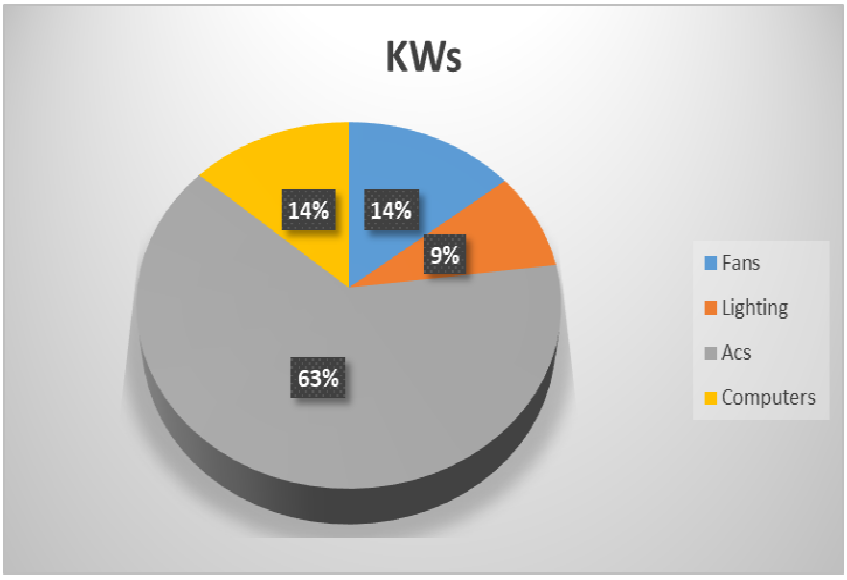
2. The insulation resistance of cables(IR Values) are to be taken periodically on all cables and records maintained; This helps to find out the identification of potential damages or leakages

Chapter -2 Energy Saving Opportunities

2.0 Fans , Lighting and Air conditioning and computers loads have direct impact on the Energy consumption and demand

A	The lighting load	49.20 KWs
B	Ceiling Fan load	81.0 Kws
C	Load of the computers	76.8 Kws
d	Load due to Air conditioners	360 KWs

Loading Pattern of the Electrical Installations



2.1 Monthly Energy Bill reduction by reducing the CMD

Reduction in Contract Maximum Demand:

a. Present CMD as per agreement is 213 KVA

b. It is noted from the HT Electricity bills for 20-21 and 21-22 that the recorded demand never crossed the average demand 170 KVA mark

c. Hence it is recommended to reduced the CMD may be derated to 173 KVA

d. The savings in the bill 40 KVAX Rs 475 = Rs 19,000/ month or Rs 2,28,000/-PA

e. No investment is required and suitable request proposals may be initiated and address the CPDCL authorities.

2.2. Replacement old Fans with new 5 Star rated Ceiling fans

a. There are about 910 number fans are available in the installations with 75-80W

b. Replace these fans with 5 star rated fans as per BEE recommendation.

c. Power saving due to replacement of these fans 910 (75-50 w) = 26208 KWh

d. Consideration 8 hrs/day,0.8 diversity factor,0.6 load factor

e. Cost of energy saving 26208 KWhs x Rs 7.65 = Rs 2,00,491 (Say 2 Lakhs)

f. Cost of investment Rs 1800/fan = 910 x Rs 1800 = Rs 16,38,,000

g. The return on investment = 8 Years approx.

h. The life of the fan is minimum of 15 years without compromising the performance.

j) Periodical greasing in the fan bearings will increase the life of the fan

k) The college management may draw an action plan to replace the old fans in a phased manner or whenever contemplating to change the old fans whichever is earlier.

2.3. Replacement of Conventional tube lights

a. There are about 900 number of conventional tube lights fans are available in the installations with 40 W tube with 13W conventional chokes =53 W

b. Replace these fans with 18 W LEDs as BEE recommendation.

c. Power saving due to replacement of LED lamps 900 (53-18 w) = 31.500 KW

d. Annual Energy savings = 94,500 KWhs/ year

e. Cost of energy saving = Rs 7,22,925

f. Cost of investment Rs300/ LED lamp = 900x Rs 300 = Rs 2, 70,000

g) The return on investment on LED lamps = 3 Years.

h) The LED is giving effective illumination more than the Convention Florescent lamps as the Lumen out put varies from 90-95 lumens /watt of LED against 55 Lumens of Florescent lamps.

j) The college management may draw an action plan to replace the florescent lamps in a phased manner or whenever contemplating to change the old FL whichever is earlier.

2.4) **Energy Saving in Operational controls in Computers.**

a. The computer LED screen and CPU will draw a power up to 50 W during log off condition and to be switched off when not in use.

b. There are about 1280 Computers are connected to the supply in different labs in the college.

d. Energy Wastage in KWh estimated for = 27,648 KWhs /Anum (Considering 50%)

e. Cost of Energy wastage per anum = Rs 7.65x 27,648 KWh = Rs 2, 11,507

f. Cost of investment is nill except the change of the attitude and habit of the users.

g. It is recommended to paste the posters with slogans at all computer labs to create an awareness among the computers users at all laboratories.

"SWITCH OFF COMPUTERS AT THE CONTROL SWITCH WHEN NOT IN USE"

SAVE ENERGY FOR FUTURE GENERATIONS.

SAVE THE MOTHER EARTH FROM POLLUTION DUE CARBON EMISSIONS

LET US MARCH TOWARDS NET ZERO EMISSIONS BY THE YEAR 2070.

LET US HONOUR OUR PRIME MINISTER COMMITMENT REGARDING REDUTION IN CARBON EMISSION AT COP 26. GLASGOW.SCOTLAND

2.5 Replacement of old Air conditioners with star rated ACs as per BEE Recommendations

a. There are about 38 Numbers of old Air conditioners consumer more power than the star rated ACs.

b. Energy saving 38(2.48-1.45 Kw) at 6 hrs usage 70,452 KWhs

c. Cost of Energy Rs 5,39,000

d. Investment Rs 11,78,000

e. Simple pay back period 2years 2 months

Chapter -3 Safety aspects in the College Electrical

3.0 Safety aspects in the College installation

1. Standard operating procedure for maintenance activities are to be prepared including solar panel systems to get more efficiency form solar system.
2. Lightning Arrestor at DP Structure to be installed
3. Personal Protective Equipment to be issued for all technicians for safe operation of system. At present no PPE is used by them
4. ELCB are to be installed in each control board of each panels as the CEA safety regulations.
5. Illumination levels are to be taken in the street lights and records maintained and lux meter is to be calibrated.
6. Transformer yard fencing to be earthed as per CEA regulations.
7. Energy meters are fixed to measure the energy of each panel inside the building. The Energy to be compared with the main energy meter and records maintained. This is useful for monitoring the total energy
8. Insulation Resistance values for all cables are to be taken periodically as per CEA regulations and records maintained.

9. Fire extinguishers are to be installed in the transformer yard.

10. It is observed that in the transformer yard earth pits not covered and not maintained properly as per IS 3043.

Two earth electrodes are driven in the earth but no pits are available at some places.

11. LAs on the DP Structure are not connected to the system. Address the CPDCL to connect them for safety from Lightning.

12. The existing transformer capacity may be increased to 500 KVA in line with present connected load.

13. Compliance should be reported for the observations made by the Dy Electrical inspectorate vide letter no HT/10/ D.No 737/21 dt 1-7-21.

14. First aid box to be made available with medicines recommended by authorized. Medical Practioner

15. Lot of unused and scrap material is stored in the control behind Electrical panels and to be removed as early possible as per IS 1646.

16. The protective insulating mats are to be replaced with synthetic mats as per IS 15652.

17. All panel rooms should be kept under lock and key.

18. The competency certificate are not available with the persons working with installation.

19. Emergency Phone numbers are to be made available inside the lifts emergency use.

20. Records for the Earth resistances for the earth pits are to be maintained

21. Energy and Safety audits are to be conducted periodically In the premises.

Chapter 4- Some of the images of the installation

Condition of Earth Pit at Mechanical labs Not as per IS Specification

Unwanted material is kept behind the panels in control room

Unnecessary material kept in fire buckets

Rewinding machine in Control room for rewinding the damaged ceiling fans

Fans kept ready for rewinding. Should be discouraged as per BEE guide lines

Staff attending the Auditor during audit

5.0 Conclusion

Metering & Monitoring System

It is said that good energy metering and monitoring can save 6-8 % energy wastage. Therefore good data collection and data management system for energy is the prerequisite for successful energy management.

Electrical Energy Metering: The total energy received at 11KV HT point is measured through a HT meter which is sealed and inspected by the APEPDCL authorities periodically. The energy read in the HT meter is inclusive of Transformer losses and for better under standing of energy use the consumption of each building to be compared with the main consumption..

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