3/27/2024

SIDDARTHA EDUCATIONAL ACADEMY GROUP OF INSTITUTIONS

An Integrated Campus for Engineering and MBA

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu

An ISO 9001:2015 & ISO 14001:2015 Certified Institution

(Established and Promoted by Siddartha Educational Academy)

This report is made as per the Bureau of Energy Efficiency (BEE), Ministry of Power, and Govt. of India format.

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PREFACE

An energy audit is a study of a plant or facility to determine how and where energy is used and to identify methods for energy savings. There is now a universal recognition of the fact that new technologies and much greater use of some that already exist provide the most hopeful prospects for the future. The opportunities lie in the use of existing renewable energy technologies, greater efforts at energy efficiency and the dissemination of these technologies and options.

This report is just one step, a mere mile marker towards the destination of achieving energy efficiency and we would like to emphasize that an energy audit is a continuous process. We have compiled a list of possible actions to conserve and efficiently utilize our scarce resources and identified their savings potential. The next step would be to prioritize their implementation. We look forward with optimism that the institute authorities, staff and students shall ensure the maximum execution of the recommendations and the success of this work.

To all of you, we hope that the ideas and pages that follow will give as much enjoyment and challenge as they have given us in their development, synthesis and writing. Any suggestions to further enhance the quality of this work are always welcome. Kindly email your comments and suggestions to **dreems256**@gmail.com or Visit http://www.dreems.in

Definition of Energy Audit:

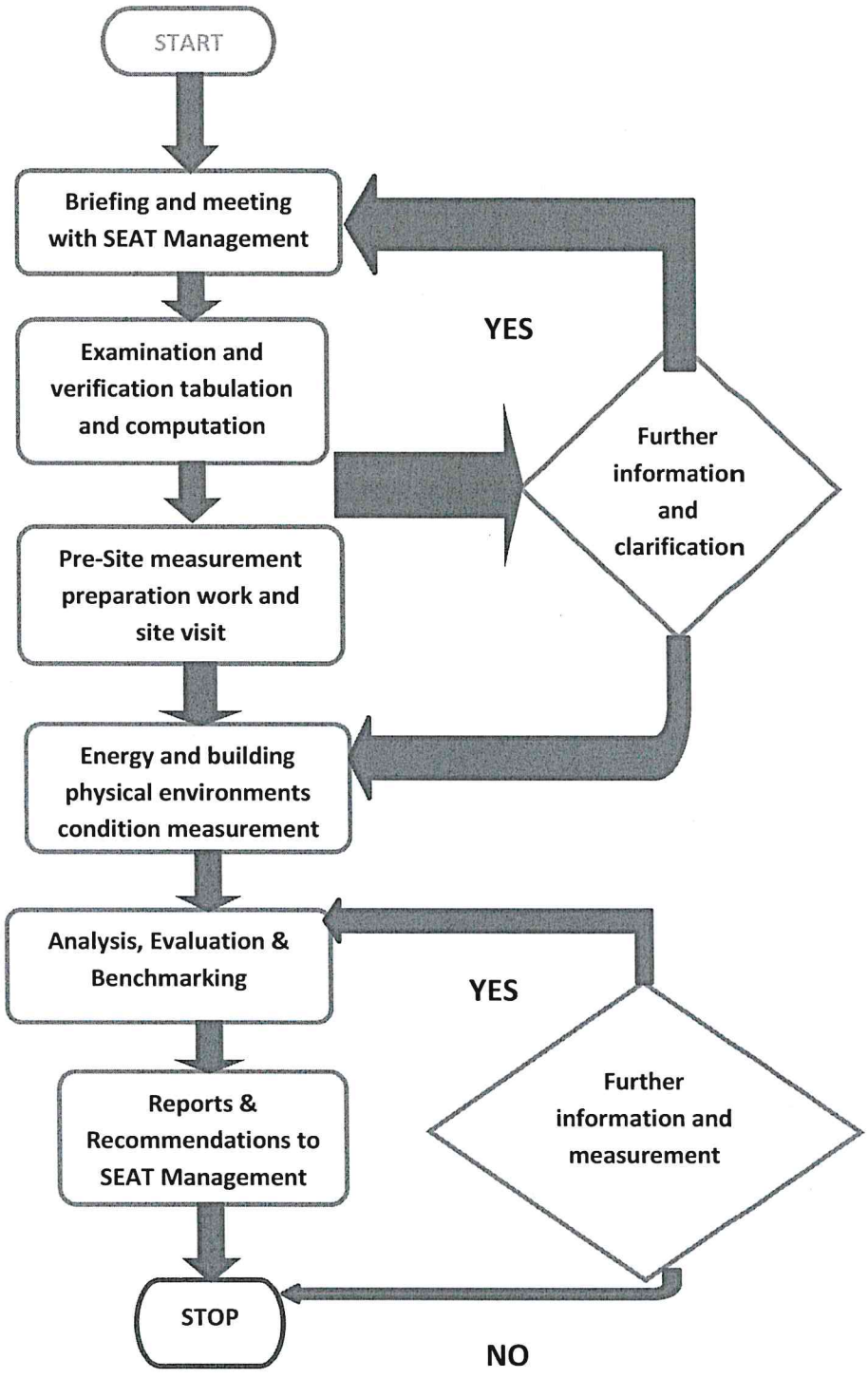
As per the Indian Energy Conservation Act 2001, Energy Audit is defined as:

"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."

Energy Audit objective:

This energy audit assumes that it was aimed at obtaining a detailed idea about the various end use energy consumption activities and identifying, enumerating and evaluating the possible energy savings opportunities. The target is to achieve savings in the electrical energy consumption to the extent of 20%. The audit was also aimed at giving the students a feel of the practical problems and difficulties in carrying out energy audits. As Energy Engineers, the students of the department enthusiastically participated in the endeavor.

2. **FLOW CHART: -** The flow chart represents the Diagrammatic representation of the Energy Audit.



ACKNOWLEDGEMENT:

THE DREEMS Team appreciates the keen interest shown by the management of SIDDARTHA EDUCATIONAL ACADEMY GROUP OF INSTITUTIONS (SEAT), C. Gollapalli, Tirupati in getting Energy Audit done for conservation of energy.

THE DREEMS Team expresses its sincere thanks to the management of SIDDARTHA EDUCATIONAL ACADEMY GROUP OF INSTITUTIONS (SEAT) for their trust and entrusting the assignment of Energy Audit of SIDDARTHA EDUCATIONAL ACADEMY GROUP OF INSTITUTIONS, C. Gollapalli, Tirupati.

THE DREEMS TEAM is grateful to Dr. K. Rajasekhar, Principal of the college, for his initiative and confidence in THE ENERGY AUDIT TEAM in awarding the mandatory energy audit study.

We are also extremely thankful to Dr. T. Sujeeth, Associate Professor of Computer Science and Engineering for his hospitality, support and guidance and co-operation in undertaking this energy audit assignment.

We profusely thankful to Sri Balasubramanyam, HOD / EEE and his Staff, who have given full co-operation and support. They took keen interest and gave valuable inputs during the course of study. We would be happy to provide any further clarifications, if required, to facilitate implementation of the recommendations.

The arrangements and support during the Energy Audit were excellent. We deeply appreciate the SIDDARTHA EDUCATIONAL ACADEMY GROUP OF INSTITUTIONS interest, enthusiasm, and commitment towards the Energy Conservation.

M. Devendranath Reddy, B.E, FIE

DREEMS,

Tirupati.

ENERGY AUDIT REPORT FOR THE YEAR 2022-23 OF SEAT, C. GOLLAPALLI, TIRUPATI.
BY DREEMS, TIRUPATI-517502

DREEMS ENERGY AUDIT TEAM

Name of the Member	Role in the Project
M. Devendranath Reddy, B.E, FIE, Chartered Engineer.	Team Leader – Chartered Engineer
N. Prathap Kumar, M.E, FIE Chartered Engineer.	Accredited Energy Auditor, B.E. E
M. Poornananda Lahari, M. Tech	Team Member – General Manager (DREEMS)

EXECUTIVE SUMMARY:

DREEMS has been entrusted with carrying out "Detailed Energy Audit" in **SIDDARTHA EDUCATIONAL ACADEMY GROUP OF INSTITUTIONS (SEAT), An Integrated Campus for Engineering and MBA** to optimize the energy consumption and to identify the energy saving opportunities in the facility. In this connection, DREEMS has conducted field measurements at the facility during March 2024 for collection of data and measuring various energy consumption parameters to analyze and find energy saving opportunities.

The major energy inputs for the facility are Electricity, Diesel, and Water. Electricity is used for Package Air Conditioners, Servers, PCs, ACs, Fans, lighting appliances and other loads. Diesel oil is being used in the DG sets to generate electricity during power failure. A detailed study was carried out with an objective to identify and prioritize the cost-effective energy conservation recommendations to decrease the energy consumption and energy costs in the facility.

Green Energy Initiatives in the campus

It is observed that 4 nos Solar P.V LED Street lights Installed in the campus.

Semi Integrated Solar Light

(In-Built Battery)

LED Light: 18 W

Battery: Li FePO4, 12.8V, 18 Ah

Solar Panel: 80W,

5 Meter Pole & accessories

Product Information:

LED Lumen Output: 130/Watt

Controller Rating: 6A/10A

Dusk to Dawn Dimming; Yes

LED Dispersion Angle: 120^0

LED Life (TA=25°C): 50000 Hrs

Colour Temperature: 2700K - 6500K

LED Driver Efficiency: >95%

Operating Temp.: -40°C to 60°C

Light Backup Time: Full Night with Dimming

CRI: 70-82

ENERGY AUDIT REPORT FOR THE YEAR 2022-23 OF SEAT, C. GOLLAPALLI, TIRUPATI.
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IMPORTANT INFORMATION

a)	Name and Address of the plant	:	SIDDARTHA EDUCATIONAL ACADEMY GROUP OF INSTITUTIONS, (SEAT) An Integrated Campus for Engineering and MBA C. Gollapalli, Tirupati Andhra Pradesh India
b)	Line of Activity	:	Educational Institution
c)	Contact Person and Details	:	Dr. K. Rajasekhar, Principal, Phone: +91 E-mail:
d)	Period of Audit	:	March- 2022 to APRIL 2023
e)	Contracted Maximum Demand (CMD)	:	85 KVA
f)	Maximum Recorded Demand (M.D)	:	73.40 KVA
g)	Minimum Recorded Demand (M.D)	:	38.98 KVA
h)	Power factor (PF)	:	0.9
i)	Annual Energy Consumption & their cost details	:	**1,62,569**; **18,65,127.85**

Table 1: List of Electricity Consumption details

Electricity Consumption details for April 2022- March 2023			
H.T-2A1: TPT/605; Cost of Electricity: Rs. 7.65/Unit KVAh			
Demand Charges: Rs. 475/kVA			
S. No	**Particulars**	**Unit**	**Value**
1	Monthly Avg. Consumption of Electricity	KVAh/Month	13,547
2	Monthly Avg. Bill of Electricity	Rs. / Month	1,55,427
3	Yearly Consumption of Electricity	KVAh/Year	**1,62,569**
4	Yearly Bill of Electricity	Rs. / Year	**18,65,127.85**
5	Maximum Electricity Consumption (May-2022)	KVAh/Month	**17,306**
6	Minimum Electricity Consumption (November-2022)	KVAh/Month	3,667

WATER SYSTEM

Majority of water source for SEAT campus is met with from their internal borewells. Apart from that, management has also made arrangement for water supply by private tankers for meeting the deficit demand of entire campus. Multiple pumps of various types and capacities have installed across the different location of campus for water transportation. Further from the overhead tank, water pipelines of different size (1.5", 2" and 3") are drawn for gravity distribution to different blocks of the College etc. Several water sumps are constructed at individual building blocks of campus for water storage and regulated utilization. Two submersible pumps (5 HP) are found installed. Normally operates continuously 6 hours in a day for supplying water at central locality of campus. Estimated efficiency was found to be very low mainly due to ageing of pumps and suspected silt accumulation near the foot valves leading restricted flow.

Water Storage Details

Pump Identification	Type	Capacity HP	Total Numbers
Main Campus	Submersible	5 H. P	2
Garden Motors	Submersible	1.5 H. P	1

Total Students Strength as on rolls in 2022-23 Academic Year: 1365 nos

Water Consumption details

Water Consumption Details for April 2022- March 2023			
S. No	Particulars	Unit	Value
			Water
1	Yearly Water. Consumption	KL/year	55,440
2	Monthly Water. Consumption	KL/Month	4,620
3	Daily Water Consumption	KL/Day	154

Total Students Strength as on rolls in 2022-23 Academic Year: 1365 nos

Drinking Water Consumption Details for April 2022- March 2023			
S. No	Particulars	Unit	Value
			Water
1	Yearly Water. Consumption	KL/year	850
2	Monthly Water. Consumption	KL/Month	71
3	Daily Water Consumption	KL/Day	2.5

ENERGY AUDIT REPORT FOR THE YEAR 2022-23 OF SEAT, C. GOLLAPALLI, TIRUPATI.
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INTRODUCTION

GENERAL DETAILS

The **SIDDARTHA EDUCATIONAL ACADEMY GROUP OF INSTITUTIONS (SEAT), An Integrated Campus for Engineering and MBA** is a private college that was established in the year 1991. The educational Society is formed, registered under the section 9 of the Societies Registration Act 2001 with Society Registration No; 513 of 1991 and since then managed and promoted by Academicians in C. Gollapalli, Tirupati, India. The college offers instruction to 1200 undergraduate students in seven branches of engineering The institution also offers Master of Business Administration program affiliated to Jawaharlal Nehru Technological University, Anantapur. The Institute encourages collaborative learning between industry and academia as a means of reinforcing its curriculum with practical and real-world experiences.

Programmes Offered by SEAT

Sl No	Name of the Branch	Intake as per AICTE norms Nos
1	Civil Engineering (C.E)	30
2	Electrical and Electronics Engineering (EEE)	30
3	Mechanical Engineering (M.E)	30
4	Electronics and Communications Engineering (ECE)	120
5	Computer Science and Engineering (CSE)	180
6	CSC – Artificial Intelligence and Machine Learning	90
7	CSC- Artificial Intelligence	60
	Total Intake	**540**

Academic Year	Total Seats (B. Tech, M. Tech, MBA) Sanctioned by AICTE	Total Admissions	Remarks
2018-19	2772	1336	
2019-20	2712	1292	
2020-21	2640	1478	
2021-22	2628	1470	
2022-23	2628	1365	
2023-24	2628	1407	

SCOPE OF THE STUDY:

The Energy Audit covered an in study of the Distribution transformers, Pumps, Blowers, Air conditioning system, DG set and lighting system. The energy audit covered study of all the major energy consuming equipment.

The major energy consuming loads of the facility are

- HVAC (Package AC units, Split AC units, Window AC units)
- Lights and Fans
- Water Pumps and Fire Water pumps
- PCs, Servers (UPS load)

DESCRIPTION OF ENERGY SYSTEMS

ENERGY SYSTEMS DESCRIPTION

The major inputs for the facility are

i. Electricity from APSPDCL,
ii. Diesel oil for DG sets as a backup for power and
iii. Water for domestic use and fire fighting
iv. Solar Energy for Solar LED Street Lights

- Electricity is the major input energy and used for HVAC, Lighting, Pumping and running the office equipment like Servers, Computers, Printers, etc.
- Diesel oil is used in DG sets to generate power in case of power failure.
- Water is being used for drinking, cooking, washrooms, gardening and firefighting.

ELECTRICAL ENERGY ANALYSIS

The electricity is sourced from APSPDCL. The following are the details of the electrical supply.

- The SEAT has a Maximum Contract Demand (CMD) of 85 kVA.
- The SEAT has installed 1 No of Transformer of capacity: 100 kVA
- The plant has 2 DG sets of ratings 62.5 kVA and 25 KVA and are pressed in to service in the event of power failure.
- Grid supply is available at 11 kV and is stepped down to 415 Volts. The average power factor is maintained at 0.9 (avg.)
- The annual electricity consumption of plant is **1,62,569 KVAh** (Units) from APRIL-2022 to APRIL-2023.
- The electricity consumption is found varied from **1,62,569** KVAh to 3667 KVAh and the average monthly electricity consumption is 13,547 KVAH.

ENERGY AUDIT REPORT FOR THE YEAR 2022-23 OF SEAT, C. GOLLAPALLI, TIRUPATI.
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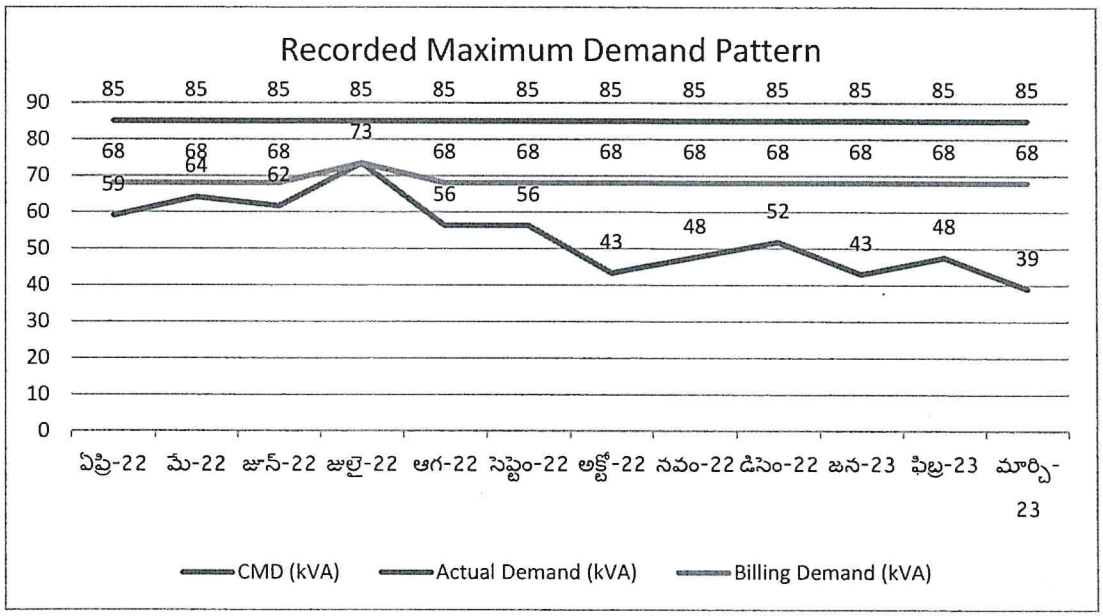
HTSC No: 605/TPT; Category: HT-2A2; CMD: 85 KVA; M.F: 1.0

Voltage Level; 11 KV /433 V; Transformer Capacity: 100 KVA

Month & Year	CMD (kVA)	Actual Demand (kVA)	Billing Demand (kVA)	Consumed Units (KVAh)	Demand Charges Rs.475/- per kVA	Energy Charges Rs.7.65 per unit	Electricity Duty Re.1.00 per unit	TOD Charges if any	Customer Charges	Total amount paid
April-22	85	59	68	14713	32,300	1,12,554.45	882.78	2,087.00	1406.00	149230.00
May-22	85	64.1	68	**17306**	32,300	**132390.90**	**17306.00**	2343.00	1406.00	185746.00
June-22	85	61.6	68	14747	32,300	112814.55	14747.00	1793.00	1406.00	163061.00
July-22	**85**	**73.40**	**73.40**	**17202**	**34,865**	**131595.30**	**17202.00**	**2121.00**	**1406.00**	**187189.00**
Aug-22	85	56.3	68	15424	32,300	117993.6	15424.00	2081.00	1406.00	172491.00
Sep-22	85	56.3	68	15909	32,300	121703.85	15909.00	**2472.00**	1406.00	177077.00
Oct-22	85	43.3	68	13379	32,300	102349.75	13379.00	2050.00	1406.00	154771.00
Nov-22	85	47.60	68	3667	32,300	28052.55	3667.00	622.00	1406.00	69334.00
Dec-22	85	51.76	68	13159	32,300	100666.35	13159.00	2047.00	1406.00	152865.00
Jan-23	85	42.90	68	13832	32,300	105814.50	13832.00	2302.00	1406.00	158941.00
Feb-23	85	47.52	68	11000	32,300	84150.00	11000.00	1787.00	1406.00	148890.85
Mar-23	85	38.98	68	12231	32,300	93567.15	12231.00	2086.00	1406.00	145532.00
Total				**1,62,569**						**18,65,127.85**
Maximum				**17306**						**187189.00**
Minimum				3667						69334.00

RECORDED MAXIMUM DEMAND PATTERN

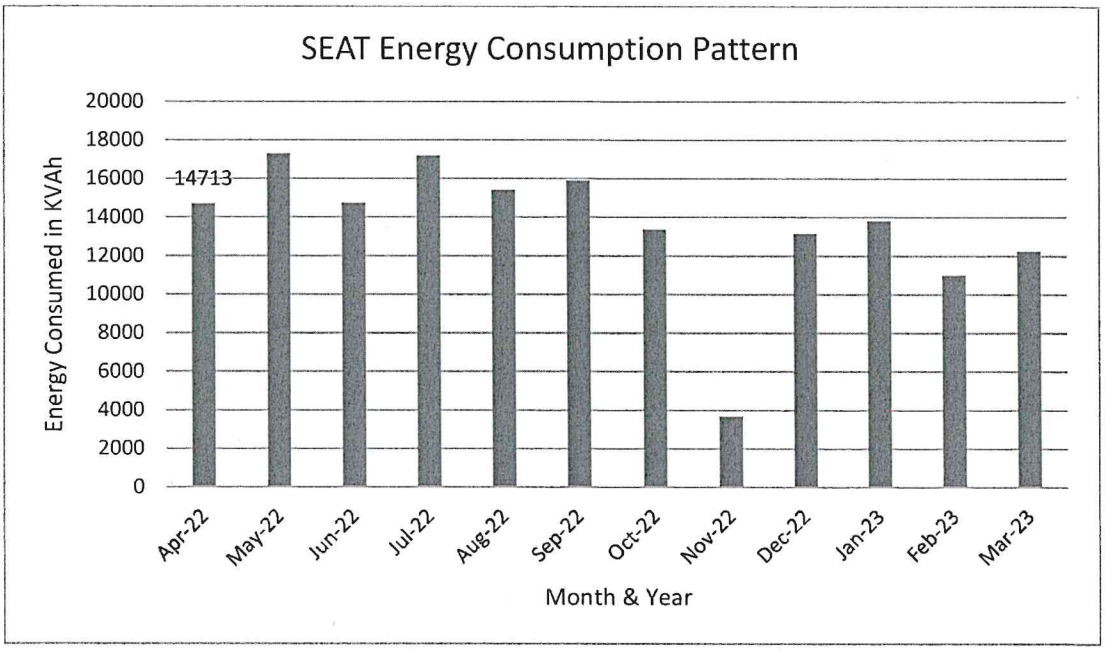
The Below is the recorded demand pattern of the facility from April- 2022 to March-2023.



ELECTRICITY CONSUMPTION PATTERN:

The following is the electricity consumption pattern for the facility from April -2022 to March 2023. The electricity consumption is high during the May- 2022 and consumption is low in the month of November-2022.

Month wise Electrical Energy consumption pattern

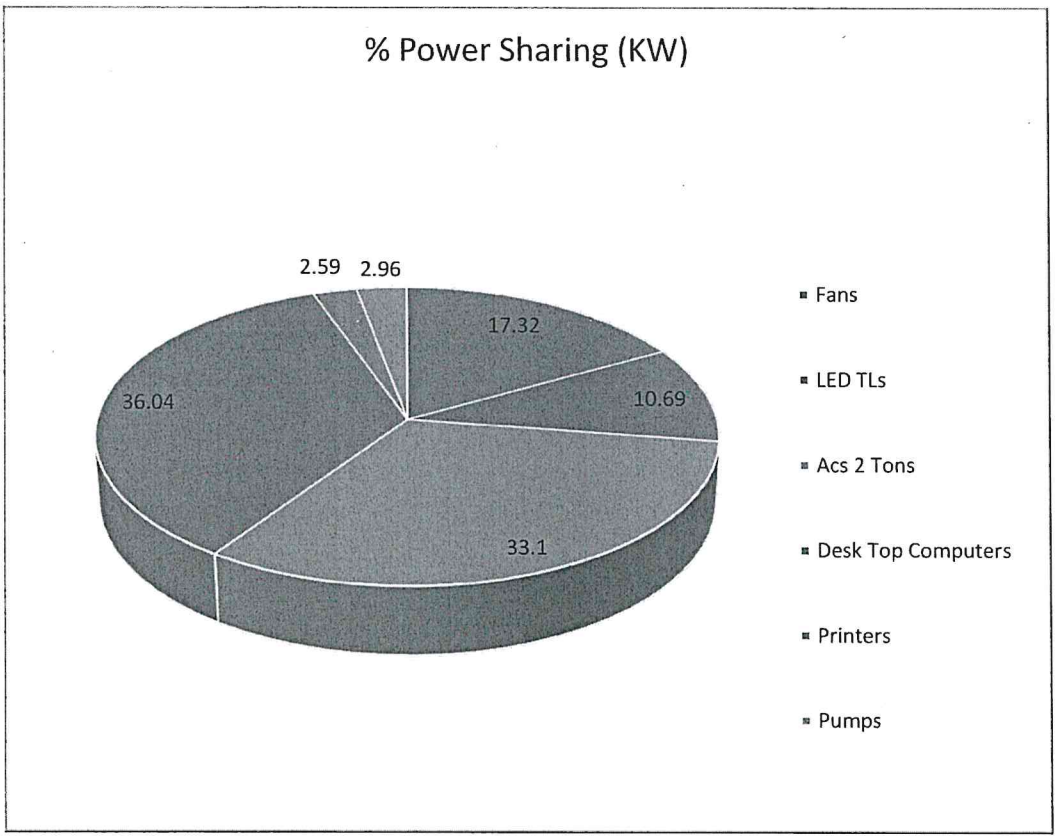


POWER DISTRIBUTION:

The distribution of electricity is presented in the following pie-chart.

% Energy share pattern of the SEAT, C. Gollapalli

Sl. No	Appliance	Nos	Power (kW)	% Sharing of Power (kW)
1	Fans	628	50.240	17.32
2	LED Tube Lights	775	31.000	10.69
3	AC (2 tons)	48	96.000	33.10
4	Desk Top Computers	402	104.520	36.04
5	Printers	30	7.500	2.59
6	Submergible Pumps	3	8.576	2.96
	Total		297.836 or say 298 KW	



Diesel Generators: Two Generators of rating 62.5 KW; 1 No and 25 KW: 1 No are found installed.

The Name plate Details of the Generators are given below.

1. Name of the Firm:	POWERICA Limited
Product Name:	Silent DG Set
Rating:	50/62.5 KW/ KVA
Model Family No:	DS 62.5 SL/ F 11
Noise Limit:	75 db (A) at 1 meter distance
Sl no:	01/12/09/3863
Year of Manufacture:	2009
Website:	www.powericaltd.com
Second Generator:	
Name of the Firm:	Cummins Power Generation
Product Name:	Silent DG Set
Rating:	20/25 KW/ KVA
Model Family No:	DXP 25-5
Noise Limit:	75 db (A) at 1 meter distance
Genset Sl no:	L1 31107876
Alternator Sl No:	G13L518597
Engine Sl No:	F35031
Year of Manufacture:	12/2013
Prime Current @ 0.8 P.F:	35 Amp
Rated Voltage:	415 V
Frequency:	50 HZ
Rated RPM:	1500
Battery Voltage:	12 V DC
Genset Max weight:	620 Kgs

Registered Office: Cummins India Limited,
LHPBU, 36/A/1/2,
Erandwane, Pune-411 038

The Data logging Register of Diesel Generators is found not maintained. It is advised to maintain by Electrical wing the Data logging Register duly recording the parameters to monitor the Performance of the Generators.

Diesel Consumption Particulars:

Month and Year	Units Generated (KWH)	Diesel consumption (Liters)	Diesel Expenses/Month Rs	Average Grid Supply Failures (Hours/Month

A generator maintenance checklist typically includes:

1. Physical and visual checks of the diesel generator
2. Leakage checks of engine, exhaust, cooling, fuel, and DC electrical systems
3. Oil and lubrication services
4. Battery testing
5. Overall condition assessment
6. Signature, date, and time of inspection.

Generator Daily Fuel Consumption Register

Format No.:

Month / Year: _____/ _____ Generator Operator Name: _____

Date	Generator Name	Capacity	Location	Time		Meter Reading		Fuel Add. (Ltr.)	Fuel Added by	Total Hours	Total Meter	Eng. Signature
				Start	End	Start	End					

Remarks (After Month) By Manager – Electrical

Signature – Manager - Electrical

Distribution Transformer Particulars:

Make: Toshiba Transformer
Rating; 100 KVA
Serial No: 2104504
H.V Voltage: 11000 V
L.V Voltage: 433 V
H.V Current: 5.249 Amps
L.V Current: 133.337 Amps
Impedance Voltage: % 4.47
Conductor: H.V/L. V Aluminum
Core Material: Amorphous Metal
Year of Manufacture: 2015
Guaranteed Maximum Temperature rise in Oil/Winding: 35/40 Centigrade
Maximum Guaranteed BEE Losses at 50%/100% Loading: 435/1500 Watts
Completely Self Protected type & BEE 5 Star rating
Type of Cooling: ONAN
Oil (First Filling): 220 Liters
Core/Winding: 282/86 Kgs
Vector Group: Dyn 11
Total Mass: 820 Kgs

CAPACTOR DETAILS

The SEAT has installed a total capacitor bank of 50 KVAr mainly to reduce the kVA demand of the facility (Reactive Power Management).

Name of the Manufacturer: Ekadantha Switchgears & Services, Bengaluru-540 078

TRANSFORMER LOAD MANAGEMENT

Based on the loading pattern of the main transformer, the following parameters like percentage loading, best efficiency point and all-day efficiency are calculated. Transformer performance parameters, Transformer rating (kVA). Best Efficiency point (40.1 %) Loading (32.4 %) it is seen that the load on the transformer is operating less than its 'Best operating point 'or 'Optimal loading point' and transformer operating losses are on minimum side. The annual transformer losses accounts to 1.5% of the total facility annual energy consumption.

Canteen

During the canteen study, we came across the following observations

- LPG is the main source of energy for cooking and hot water generation, with monthly consumption of total 20-30 cylinders.
- Apart from that significant organic solid waste generated as mentioned below: ¬

Wet waste - 290 kg / day

Dry (vegetable waste) - 40 kg /day

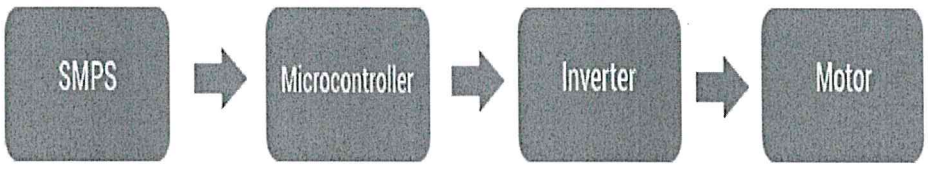
Cooked Food - 110 kg / day

Garden Waste (Plantation) - 500 kg /day

RECOMMENDATION: 1

A: Title of Recommendation	:	**Retrofit Ceiling Fan with Brushless DC (BLDC) Fans**
B: Description of Existing System and its operation	:	Existing Ceiling Fans which consume 80 W
C: Description of Proposed system and its operation	:	Retrofit Ceiling Fan with energy efficient BLDC fan to reduce the energy consumption. The BLDC Fan will consume 40 W.
D: Energy Saving Calculations		
Present No. of Ceiling Fans		628
Present Ceiling Fan Consumption KW	:	50.240 KW
Proposed of BLDC Fan Consumption	:	628x40 W= 24,800 Watts= 24.800 KW
Achievable power savings (KW)	:	25.44 KW
Operating Hours (@ 4 hrs./day & 300 D/Y)	:	1200 hrs
Total Energy Savings kWh/year	:	30,528 KWh
E: Cost Benefits		
Energy Saving Potential / year	=	30,528 KWh
Cost Savings / year@ unit cost Rs. 8.65/ unit	=	30,528x 8.65= Rs 2,64,067.20
Investment (@ Rs. 3000/Fan)	=	628x3000= Rs 18,84,000/-
Payback Period in months	=	Rs 18,84,000/2,64,067.20= 7.134 years or say 7 years

Brushless DC (BLDC) Drive Fans:
In bldc drive following main component is use.



SMPS: SMPS is use for convert ac supply into dc supply.
Microcontroller: Microcontroller is use for receiving the input data from remote control and give output data accordingly to inverter.
Inverter: After receiving signal from microcontroller inverter drive to motor.
So bldc fan working principle is when we turn on fan the SMPS convert AC supply to DC supply then after microcontroller receives the input signal from the remote control and accordingly input signal microcontroller sends the signal to the inverter, then after inverter drives the BLDC Motor.

RECOMMENDATION 2: Installation of 100 K. Wp Solar PV Roof-Top Power Plant with Net metering Facility with APSPDCL, Tirupati.

Quality and Reliability:

Manufacturing activity thrives on energy input and its cost has a direct impact on competitiveness of manufactured goods especially in the regional markets. Power supply outages, power dips or similar disturbances damage product quality. Process control becomes intractable, in-process material may have to be discarded, equipment cleaned and fresh feeds re-loaded. This is expensive. Industrial and commercial consumers have, therefore, acquired backup generators to alleviate this situation but it is a very costly alternative as the diesel rates are galloping on daily basis. Back-up generators will actually not supplement mains power because of cost of acquisition and operation.

In order to level off the load profile, a more attractive and pragmatic approach should be designed to encourage industry to shift their load time away from the peak demand time. Efforts aimed at higher efficiency and conservation must be kept in the conscience of electricity users.

Sustainable Sun's Energy:

The search for Alternate New and Renewable Energy sources gained momentum in 1970s following the oil crisis when the cost of energy in the form of fossil fuels rose drastically and energy insecurity was very much felt. Apart from the limitations of fossil fuels availability and faster depletion, ecological considerations coupled with the production of the greenhouse gasses and global warming, are other driving forces in promoting the Renewable Energy Sources. The obvious choice of clean energy source, which is abundant everywhere and could provide security for the future growth, the Solar Energy.

As per the MNRE Central Financial Assistance (CFA) for Grid Connected Rooftop Solar P.V Power Plants Notice dated 19/11/2015, No CFA will be provided ***for commercial and industrial establishments in the private sector*** as they are eligible for other benefits such as accelerated depreciation, custom duty concessions, excise duty exemptions and tax Industrial and commercial electricity tariff for them is usually high and hence these sectors do not need any

Government CFA to make solar attractive. Further, whenever they go to the State Regulators for project specific tariff, the tariff depends on whether CFA is availed or not, and the tariff is decided accordingly. Hence, CFA will give no net benefit to the commercial and industrial establishments in the private sector.

The Domestic Content Requirement (for modules made in India) will be applicable only for those installations where CFA will be provided. No Domestic Content Requirement will be applicable to the commercial and industrial establishments in the private sector where CFA is not applicable.

SOLAR P.V POWER PLANT COMPONENTS:

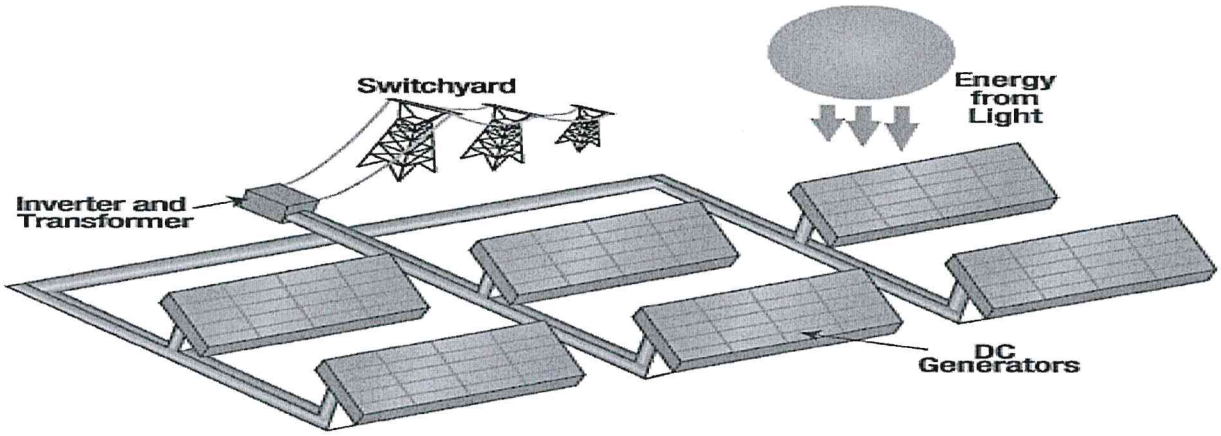
1. SOLAR PHOTO-VOLTAIC MODULES:

It is not the solar cells, but solar P.V Modules that are installed in the field to supply the electric power. Solar p v modules are made of solar cells by connecting many cells in series and parallel. The P.V Modules are encapsulated properly so that they work in the open atmosphere for a very long period. The module power output depends on the individual cell's power output. By choosing appropriately sized cells, modules of given power rating can be obtained.

Power generated by a solar cell depends on its efficiency. Depending on the cell efficiency, the power generated per unit area is usually in the range of 10 milli Watt/cm^2 to 25 milli Watt/cm^2 corresponds to 10% to 25%of cell efficiency. The maximum area of a single, wafer based solar cell is 15*15=225cm^2. With 15% cell efficiency, the peak power generated by this cell would be 3.37 Wp. Solar power to produce electricity is not the same as using solar to produce heat. Solar thermal principles are applied to produce hot fluids or air. Photovoltaic principles are used to produce electricity. **A solar panel (PV panel) is made of the natural element, silicon, which becomes charged electrically when subjected to sun light.**

Solar panels are directed at solar south in the northern hemisphere and solar north in the southern hemisphere (these are slightly different than magnetic compass north-south directions) at an angle dictated by the geographic location and latitude of where they are to be installed. Typically, the angle of the solar array is set within a range of between site-latitude-plus 15 degrees and site-latitude-minus 15 degrees, depending on whether a slight winter or summer bias is desirable in the system. Many solar arrays are placed at an angle equal to the site latitude with no bias for seasonal periods.

The intensity of the Sun's radiation changes with the hour of the day, time of the year and weather conditions. To be able to make calculations in planning a system, the total amount of solar radiation energy is expressed in hours of full sunlight per m^2, or Peak Sun Hours. This term, Peak Sun Hours, represents the average amount of sun available per day throughout the year. **It is presumed that at "peak sun", 1000 W/m^2 of power reaches the surface of the earth. One hour of full sun provides 1000 Wh per m^2 = 1 kWh/m^2 - representing the solar energy received in one hour on a Cloud less summer day on a one-square meter surface directed towards the sun.**



The Solar radiation assessment: The technical and economic performance of the solar photovoltaic, solar collectors, and solar thermal devices depends on the amount of solar radiation falling at a given location and time. Hence, the measurement and estimation of solar radiation is an important aspect of work in establishing a solar power plant.

Cost analysis of the Project:

The following benefits are also available for installation of Grid Connected Rooftop and Small Solar Power Plants in the country besides.

- Accelerated depreciation benefits for industrial and commercial buildings
- Custom Duty Concessions and Excise Duty Exemptions
- 10 years tax holiday
- Provision of bank loans as a part of home loan/ home improvement loan
- Loans for system aggregators from Indian Renewable Energy Development Agency at concessional interest rate (9.9% to 10.75%)
- Loans available up to Rs. 15 crores for renewable energy projects and up to Rs. 10 Lakhs for individual loans under Priority Sector Lending.

- **Accelerated Depreciation: –** Tax relief due to availing higher rate of depreciation more often is termed as Accelerated Depreciation, under section 32 of Income Tax act. The accelerated depreciation accounts for major relief in the upfront cost of solar Power Project by providing a tax break in the first 4 years of operation.

Estimated cost of 100 K. Wp Roof-top P.V Power Plant proposed to install in SEAT Premises:

Sl. No	Details	Amount
1	SOLAR PV Roof-Top System 100 K. Wp Capacity with Net-Metering	40,00,000.00
2	Net Metering equipment, Approvals and Synchronization	3,00,000.00
	Total Solar System Price	**43,00,000.00**
2	Add GST @ 5% on 70% of System Price	1,50,500.00
3	Add GST @ 18% on 30% of System Price	2,32,200.00
	Total 100 K. Wp Solar Rooftop System Price including GST	**Rs 46,82,700.00 or say Rs 47,00,000/-**

Total Project Cost: (Rupees Forty-six lakhs, eighty-two thousand, seven hundred only.)

- PROJECT PROPONENT: **SIDDARTHA EDUCATIONAL ACADEMY GROUP OF INSTITUTIONS (SEAT)**
- LOCATION: C. Gollapalli (Chintagunta) (Village)
- INSTALLED CAPACITY=100 K. Wp
- PROJECT LIFE =25 YEARS
- SHADE FREE AREA required = 10,000 Sq. ft
- Solar P.V Power Plant PLF =19%
- TOTAL PROJECT COST = Rs **47,00,000.00**
- DEBT: EQUITY RATIO: 70:30
- DEBT: Rs 32,90,000.00
- EQUITY: Rs 14,10,000.00
- **ENERGY YIELD/YEAR =100 K. Wp X 5.0 KWh/ day/ K. Wp X 300 days = 1,50,000 KWh**

- ***APSPDCL Average H.T Cat 2D Tariff = Rs 7.65/KWh***
- ***Electricity duty = Rs 1.00/KWh***
- ***Total APSPDCL Cost of Electricity = Rs 8.65 /KWh***
- Total revenue on energy generated/annum = 1,50,000 x Rs 8.65= Rs 12,97,500.00
  Total Energy Consumption during April 2022 to March 2023 = **1,62,569** KVAH
- Approximate investment in 100 KW power plant = Rs 47,00,000/-
- SIMPLE PAYBACK period = Initial investment/Annual cash in flow
- ***Simple Payback period***= Rs **47,00,000.00 /**12,97,500.00 ***=3.62 years***

It is evident from the cost analysis that, remarkable savings in C.C Charges could be made by installing Solar PV Power Plant of 100 KW capacity Roof-Top power plant in the premises of **SIDDARTHA EDUCATIONAL ACADEMY GROUP OF INSTITUTIONS (SEAT), An Integrated Campus for Engineering and MBA** at C. Gollapalli, Village, Tirupati.

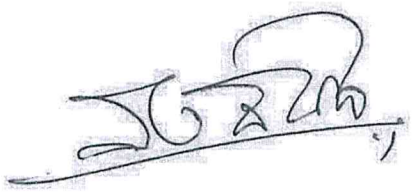
ENERGY EFFICIENT PRACTICES BEING IMPLEMENTED IN CAMPUS

- Good ventilation and lighting during the daytime because of the building design.
- Installation of 5-star rating Distribution transformer with Amorphous Core to avoid the Load and no-load losses.
- Use of drip irrigation in some places.
- Using of bore water for RO treatment in Canteen.
- Efficient usage of water and less leakages.
- Use of Dusk to Dawn Photo Sensitive Devices control for the streetlights to switch on and off.

ENERGY EFFICIENT PRACTICES SUGGESTED TO BE IMPLEMENTED IN SEAT CAMPUS:

- It is recommended to install the sub-meters in all the Labs, Canteen, office, and each block and recording the monthly readings systematically. The power consumption of different departments and sections may be analyzed and intimated to reduce the consumption.
- Frequent seminars and workshops, awareness Programs on Energy Conservation, adopting alternative Sources of Energy like Solar, Wind may be conducted.

- It is advised to conduct awareness Programs on Energy Conservation in the rural areas by the students.
- It is recommended to install the water flow meters to the delivery section of the Submersible motors and record the monthly consumption of water.
- It is also suggested to maintain the Disel Consumption Particulars Register, Daily Generator diesel Consumption, Energy generated and other parameters register. The Registers may be reviewed at least once in a week by the in charge of Electrical Department.
- As it is evident from the cost analysis that remarkable savings in C.C Charges could be made by installing Solar PV Power Plant, it is recommended to go for 100 K. Wp capacity Roof-Top power plant in the premises of **SIDDARTHA EDUCATIONAL ACADEMY GROUP OF INSTITUTIONS (SEAT), An Integrated Campus for Engineering and MBA** at C. Gollapalli, Village, Tirupati.



27-03-2024

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