

# Energy Audit Report

(October-2025)

OF



**ASIAN EDUCATIONAL INSTITUTE**

**An Autonomous Institute accredited by  
NAAC**

**Sirhind Road, Patiala, Punjab**

Conducted by  
Certified Energy Auditors

## PREFACE

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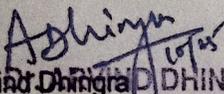
Data collection for energy audit of Asian Educational Institute, Patiala was carried out by the team during September, 2025. This audit was conducted to seek opportunities to improve the energy efficiency of the campus. Reduction of energy consumption while maintaining or improving human comfort, health and safety were of primary concern. Beyond simply identifying the energy consumption pattern, this audit sought to identify the most energy efficient appliances. Moreover, some daily practices relating common appliances have been provided which may help reducing the energy consumption.

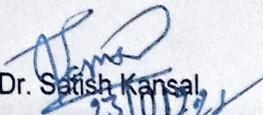
The report accounts for the energy consumption patterns of the academic area, central facilities and hostels based on actual survey and detailed analysis during the audit. The work encompasses the area wise consumption traced using suitable equipment's. The analysis was carried out with software MS-Excel. The report compiles a list of possible actions to conserve and efficiently access the available scarce resources and their saving potential was also identified. We look forward towards optimization that the authorities, students and staff would follow the recommendations in the best possible way.

The report is based on certain generalizations and approximations wherever necessary. The views expressed may not reflect the general opinion. They merely represent the opinion of the team guided by the interviews of consumers.

We are grateful to the Asian Educational Institute for their keen interest in energy solutions' portfolio and giving us an opportunity to conduct an energy audit of their college Campus Patiala-Sirhind Highway, Opposite Tricone City, Patiala, Punjab.

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## INSTITUTE MANAGEMENT

With the advent of energy crisis and exponential hikes in the cost of different forms of energy, Energy Audit is manifesting its due importance in Industrial, Commercial, and Educational Establishments.

It was with this objective that we were entrusted by Asian Educational Institute, at Campus Patiala-Sirhind Highway, Opposite Tricone City, Patiala, Punjab.

The study primarily covers the:

- Present energy scenario of the Asian Educational Institute buildings.
- Detailed analysis of the data obtained through onsite measurements using portable gadgets, discussions with concerned personnel etc.
- Recommendations for energy savings in all possible areas with cost benefit analysis.
- Technical specifications for any retrofit option.

### Contact Details of Officials from Asian Educational Institute, Patiala

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# 1.INTRODUCTION

The objective of Energy Audit is to promote the idea of Energy Conservation in the Campus of Asian Group of Colleges, Patiala. The purpose of the energy audit is to identify, quantify, describe and prioritize cost saving measures relating to energy use in the Hostels, Departments and Institute Central Facilities.

The work eligible for Energy Audit Study should be directed towards:

- Identification of areas of energy wastage and estimation of energy saving potential in Hostels, Departments and Institute Central Facilities.
- Suggesting cost-effective measures to improve the efficiency of energy use.
- Estimation of implementation costs and payback periods for each recommended action.
- Documenting results & vital information generated through these activities.
- Identification of possible usages of co-generation, renewable sources of energy (say Solar Energy) and recommendations for implementation, wherever possible, with cost benefit analysis.

## **ASIAN EDUCATION INSTITUTE. PATIALA**

Asian Educational Institute, Patiala, Punjab established in 2010 and offers full-time Certificate, Diploma, Undergraduate and Post-Graduate programs in the field of Vocational, Management, Arts, Science, Education and Computer applications, etc. The Institute is affiliated to Punjabi University, Patiala.

The Asian Educational Institute is an Autonomous Institute, having NAAC accreditation for Degree and Education Colleges.

## **1.1PROGRAMMES OFFERED (As Per NEP-2020)**

### **1.1.1POST GRADUATE DEGREE PROGRAMMES**

- M.B.A. (International Business)
- M.Sc. (Information Technology) Major with AI
- M.Sc. (Information Technology) Lateral Entry
- PGDCA
- M.Sc. (Physics)
- M.Sc. (Chemistry)
- M.Sc. (Mathematics)

- M.A. (Education)
- M.A. (Punjabi)
- Bachelor of Journalism (After Graduation)

### **1.1.2 UNDERGRADUATE DEGREE PROGRAMMES**

- B.Com./B.Com (Hons.)
- B.B.A./B.B.A. (Hons)
- B.C.A./B.C.A.(Hons.) Major with AI
- B.Sc./B.Sc. (Hons.) Physical Sciences
- B.Sc./B.Sc. (Hons.) Life Sciences\
- B.A./B.A. (Hons.)

### **1.1.3 VOCATIONAL DIPLOMA / ADVANCED DIPLOMA / DEGREE PROGRAMMES**

- B.Voc. (Food Processing & Management)
- B.Voc. (Beauty & Cosmetology)

### **1.1.4 CERTIFICATE & DIPLOMA COURSES**

- Beauty & Wellness
- Stenography (Punjabi/English)
- Tally & GST and Office Management and secretarial Practice
- Digital Marketing
- Desktop Publishing

The Institute having Boys Hostel, Canteen and Auditorium

## 1.2 ANALYSIS OF AREA OF USE

Identifying where energy is used is useful because it identifies which areas the audit should focus on and raises awareness of energy use and cost. The results of the analysis can be used in the review of management structures and procedures for controlling energy use.

Analysis of energy use can be done by installing sub-meters in different Institute locations to pinpoint actual energy usage per area. This is a good source data for allocating energy use. With this information, spreadsheet can be created and charts useful for analysis may be generated.

Important Points to Consider When Collecting Load Data:

- a. **Usage** – The usage of the equipments in terms of hours per day and days per year is collected from key persons in Hostels, departments etc. It is important to ensure the accuracy of this data because much of the potential for energy savings lies on wise allocation of the equipment's operating hours.
- b. **Actual power consumed** – Actual power consumption is measured by Wattmeter.
- c. **Supplementary Information** – Some other supplementary information is also collected such as state of insulation in case of ACs or availability of natural light etc.

### 1.2.1 IDENTIFICATION OF TARGET AREAS

Opportunities for energy savings can range from the simplest, such as lighting retrofits, to the most complex such as the installation of a solar PV grid connected plant. After the preliminary identification of opportunities, more time should be spent on those which have shorter payback periods.

### 1.2.2 COST BENEFIT ANALYSIS

The identified energy conservation opportunities should be analysed in terms of the costs of implementing the project versus the benefits that can be gained. Say for example, if we wish to install a heat plate exchanger to recover waste heat, we must calculate the total cost of installation and compare that with the savings derived from recovering waste heat

### **1.3 ACTION PLAN TO SET IMPLEMENTATION PRIORITY**

After passing the cost benefit test, an action plan should be developed to ensure that the opportunities identified are implemented. The action plan should include all the major steps for implementing the opportunity as well as the people responsible. Furthermore, there should be a plan for monitoring the results.

## 2. ENERGY AUDIT METHODOLOGY

The methodology adopted for this audit was a three-step process comprising of:

1. **Data Collection** – In preliminary data collection phase, exhaustive data collection was performed using different tools such as observation, interviewing key persons, and measurements.
2. **Data Analysis** - Detailed analysis of data collected was done using MS-Excel. The database generated by MS-Excel was used for producing graphical representations.
3. **Recommendation** – On the basis of results of data analysis and observations, some steps for reducing power consumption without affecting the comfort and satisfaction were recommended along with their cost analysis.

### 2.1 DATA COLLECTION

For suggesting any corrective measures to reduce power consumption, it is first necessary to know the power consumption pattern in detail. For this, the exhaustive data collection exercise was performed at all the departments, academic centres, hostels, and other supporting entities such as library, computer centre, auditorium, canteen etc.

Following steps were taken for data collection:

- The team went to each department, centre, hostels etc.
- Information about the general electrical appliances was collected by observation and interviewing.
- The power consumption of appliances, rated power was used (CFL for example).
- The details of usage of the appliances were collected by interviewing key persons e.g. Warden (in case of hostels), caretaker (in case of departments) etc.
- Light intensity was measured using luxmeters at the places where light intensity was either very low or very high.
- In case of Air Conditioning, insulation was checked by visual inspection.

Approximations and generalizations were done at places with lack of information.

### 2.2 DATA ANALYSIS

In data analysis, the data collected is processed to draw significant conclusions to pinpoint loopholes and identify the areas to focus upon. Analysis of the power consumption

observations obtained was used to obtain the power consumption pattern and also to get the information about the points where electric power is wasted.

## **2.3 RECOMMENDATION**

Energy as well as cost analysis of different appliances were performed and recommendations were made based on the capital cost recovery time.

Following were the steps involved in this process:

- The capital cost involved in replacing an appliance and/or process was estimated. The energy saving by the move was calculated in terms of price of energy per year.
- These two costs were compared to calculate the capital cost recovery time which is defined as the total time by which the saving in energy bill balances the capital cost involved.

If capital cost recovery time is less than the product life, the move can be supported. Some other recommendations were also made which are based on lighting intensity, AC insulation etc.

### 3. ANALYSIS OF POWER CONSUMPTION

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

#### 3.1 OVERALL CAMPUS

There are 31 classrooms, 08 laboratories, 5 staff rooms, one auditorium, one central canteen, one hostel and supporting infrastructures like central library and administrative block (Main Building) in Asian Group of Colleges campus. The campus has a connected load of 94.58kW. The consumption detail for last 12 months is shown graphically below.

The first figure shows the variation of electricity consumption for the year 2024-25.

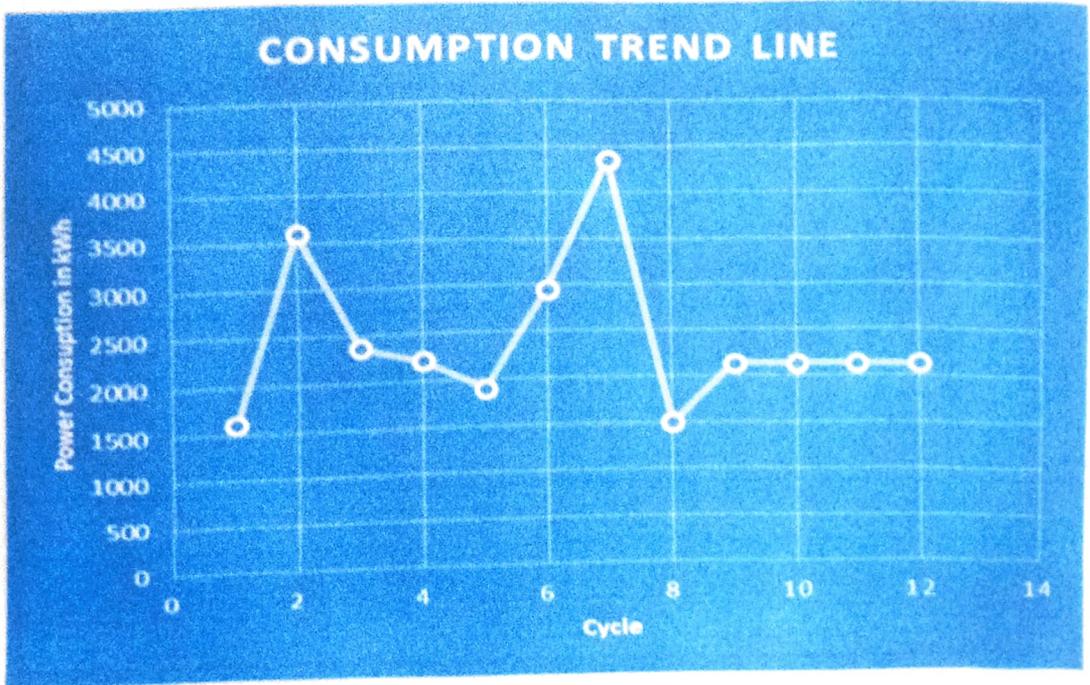


Fig. 3.1 Variation of Power Consumption Per Cycle

The following graph shows the trend line for maximum demand in 2024-25



Fig 3.2 Trend line for MDI

The following figure shows trend line for kVAh consumption

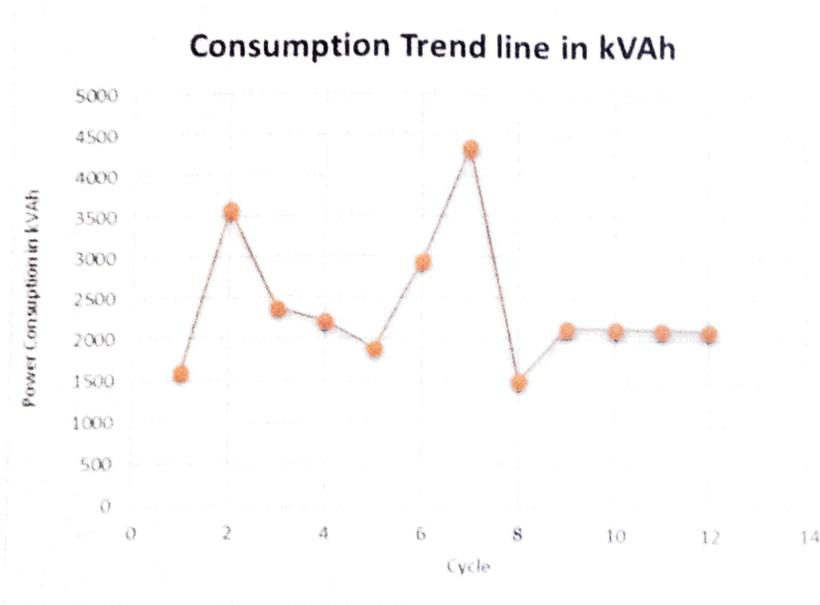


Fig 3.3 Trend line for kVAh consumption

From the above trend lines, it is seen that power consumption is peaking in month of September reflected in bills for month of October. The power factor is hovering around 0.90.

### 3.1.1 LOCATION WISE ANALYSIS OF CAMPUS:

The location wise distribution of power consumption in the campus has been shown in the following chart

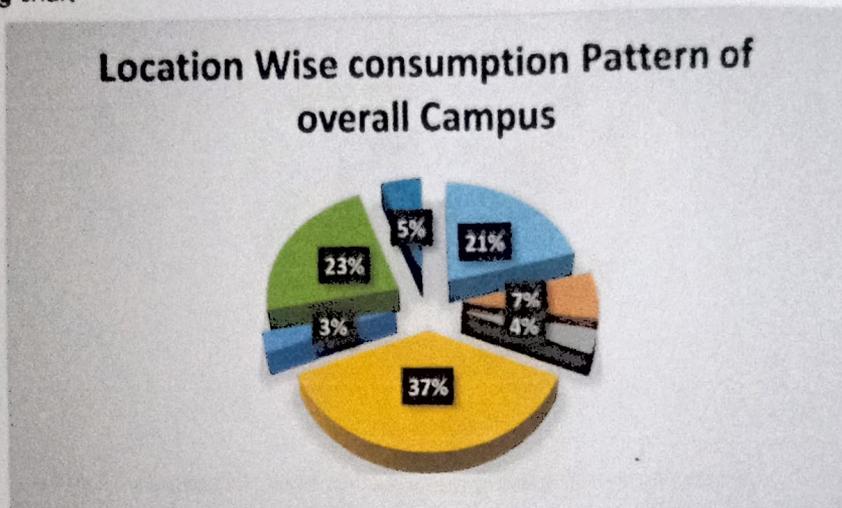


Fig 3.4 Location wise consumption pattern

As the chart suggests, major power consuming areas are central facilities (23%) and classrooms (37%). After that there are laboratories & auditorium (21%), hostel rooms (7%), toilets (5%), other offices (4%), canteen (3%).

Laboratories & auditorium with 21% share in power consumption are very important area to focus for improving energy efficiency of the campus. In case of computer labs, wise use of computers and ACs is required to reduce the consumption. In other auditorium also, wise use of lighting and other appliances can largely reduce the consumption.

Rooms in hostels are major contributor to energy inefficiency due to poor practices. Also, for any replacement of old light fittings, it is advised that LED tube lights should be used for lighting and star rated/BLDC fans should be used. Corridors and toilets are the areas where automation through use of sensors can be used to reduce the consumption largely.

### 3.1.2 APPLICATION WISE ANALYSIS OF CAMPUS:

Application wise analysis of overall campus has been carried out to find out the application areas with relatively higher power consumption. The results of the application wise analysis of power consumption in Asian Educational Institute have been summarized in the following chart

### Application wise consumption pattern of overall campus

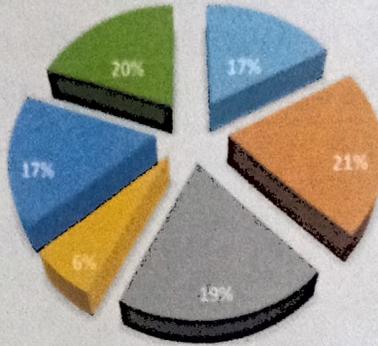


Fig 3.5 Application wise consumption pattern of overall campus

It's quite clear from the chart that maximum power is used in comfort applications (19%) such as room coolers, air conditioners, room heaters etc. To reduce the consumption in these applications, awareness about the energy conservation is very important and effective step.

Lighting with 21% of total power consumption is an application where energy efficiency can be achieved very easily by replacing old appliances by new efficient ones.

Office applications include computers, printers, scanners, Xerox machines etc. and contribute as high as 17% of total consumption. Replacing CRT monitors by LCD monitors can drastically reduce consumption of this application area.

Air circulation appliances (fans) having share of 17%, are also among major culprits in energy inefficiency.

Washing/bathing/cleaning include geysers, water coolers, water purifiers etc. accounting for 6% of total consumption.

Others include various load on power plugs which has a share of 20% of load.

#### 3.1.3 EQUIPMENT WISE ANALYSIS OF CAMPUS:

Equipment wise analysis has been performed in order to identify the equipments, within same application area, which consume more power as compared to others. During equipment wise analysis of the overall campus, the equipments with power consumption less than 1% of total

power consumption of the campus were ignored so as to make the analysis results simple and easy to observe. Following chart summarizes the results of equipment wise analysis of power consumption

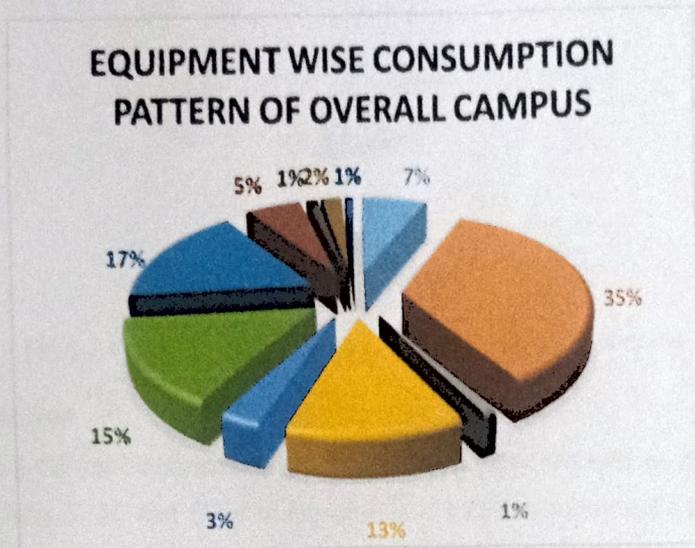


Fig 3.6 Equipment wise consumption pattern of overall campus

AC consumes 17% of total power. For lighting, dominant appliance is the conventional Ballast [Choke] tube light with 13% share and relatively efficient electronic Ballast[Choke] tube lights and lamps have negligible share. CFL & LEDs have 3% share in total power consumption.

Computers also have a contribution of 15% to total power consumption.

Resistance regulated fans have 42% share (35% new fans and 7% old fans) and electronic regulated fans and efficient wall fans have negligible share in total power consumption.

Geysers with 5% share in total consumption are another significant contributor. Water coolers (2%) and refrigerators (1%) are other significant appliances.

### 3.1.3.1 Classrooms

The college has 31 classrooms having 144 FTLs including a very few <15 LED baton lights and 186 fans. The following pie chart shows the energy usage of fans viz a viz FTLs.

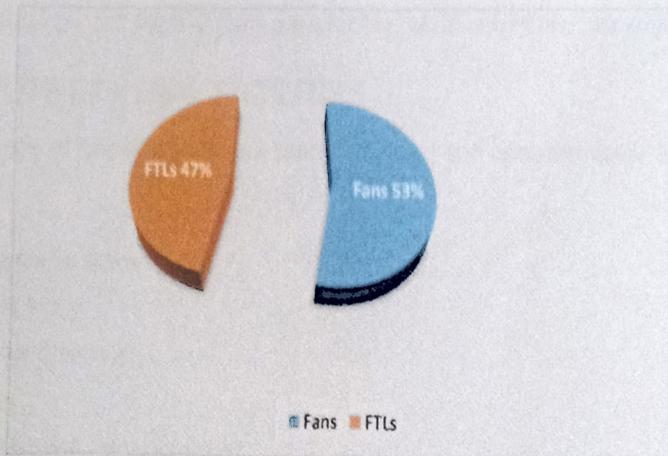


Fig 3.7 Equipment wise energy consumption in classrooms

### 3.1.3.2 Laboratories

The institute has 8 different laboratories including the computer laboratories and one store. The total number of fans is 56 and FTLs is 40 (approx.) including mirror optic fittings installed in computer labs, 5 exhaust fans, 8 wall fans, six LED lamps, one pedestal fan, 2 split ACs. The energy consumption distribution is as shown below:

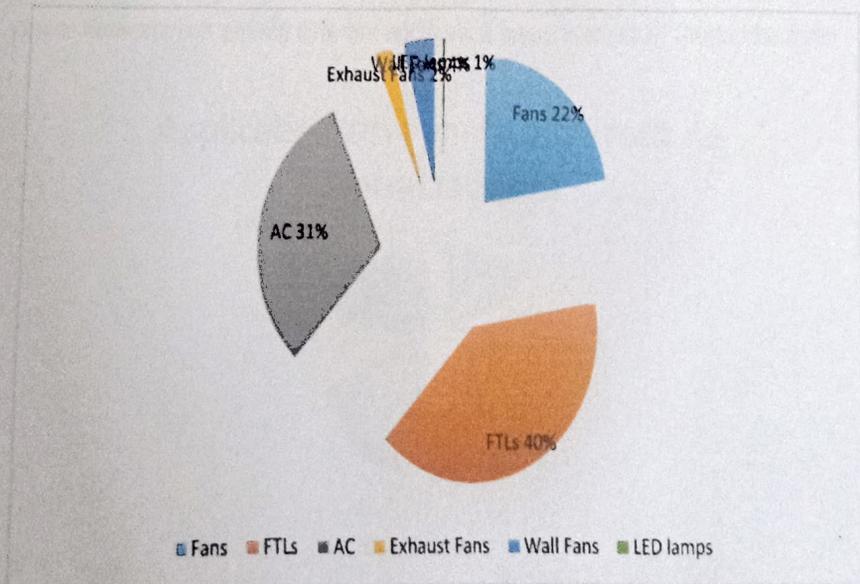


Fig 3.8 Equipment wise energy consumption in Laboratories

## 3.2 HOSTELS

There are in one hostel in Asian Educational Institute Patiala having 8 rooms. The Capacity of the boy's hostel is approximately 50-55 students.

Most of the rooms are 6-8 seaters. Each room having, six tube light and four ceiling fans.

### 3.3 INSTITUTE CENTRAL FACILITIES

The energy audit of following units has been conducted and analyzed under Institute Central Facilities:

1. Administrative Block
2. Central Library
3. NSS & NCC rooms
4. Canteen
5. Management & Principal Office
6. Others which include Sports complex, Auditorium.

#### 3.3.1 APPLICATION WISE ANALYSIS OF INSTITUTE CENTRAL FACILITIES:

Application wise analysis of power consumption in Institute Central Facilities indicates the domination of comfort (AC, room cooler, room heater etc.) and office (computer, printer, scanner, xerox machine etc.) appliances in these units and others include Refrigerator, water cooler, coffee machine and power plug load. Following chart gives the distribution of power consumption among different application areas in Institute Central facilities:

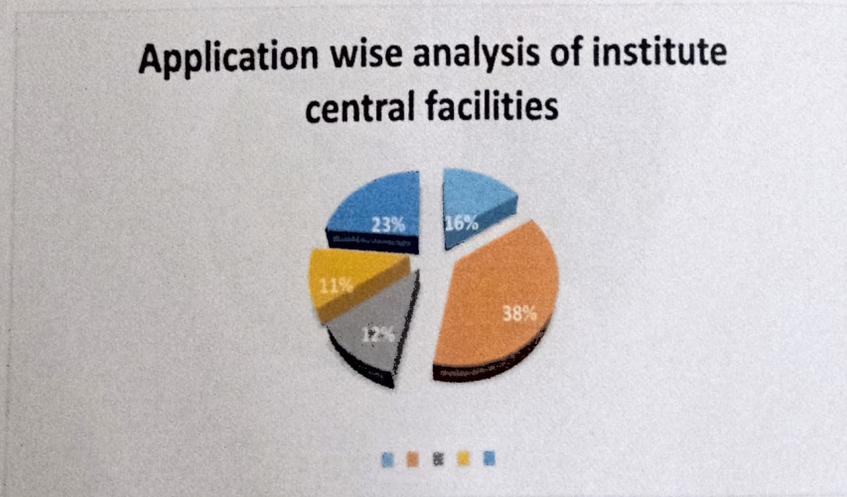


Fig 3.9 Application wise Analysis of Central Facilities

Comfort has a maximum of 38% share in total power consumption. Most of the places in the Institute Central Facilities are air conditioned and also their usages are relatively higher.

Office appliances have a share of 11% and dominant in this is the consumption of computers. During the data collection, most of the computers in Library, Computer Center as well as in offices were found to be in standby mode.

Lighting accounts for 12% of the total power consumption in Institute Central Facilities. Here dominant lighting appliance shifts from conventional tube lights & CFLs with LED. Most of the places in Institute Central Facilities use FTLs for lighting.

The per cent consumption of air circulation appliances is as low as 16% due to use of old fans. Other major loads share 23% of the total power.

### 3.3.2 EQUIPMENT WISE ANALYSIS OF INSTITUTE CENTRAL FACILITIES:

Equipment wise analysis of power consumption in Institute Central Facilities makes the picture clearer. Following chart summarizes the results

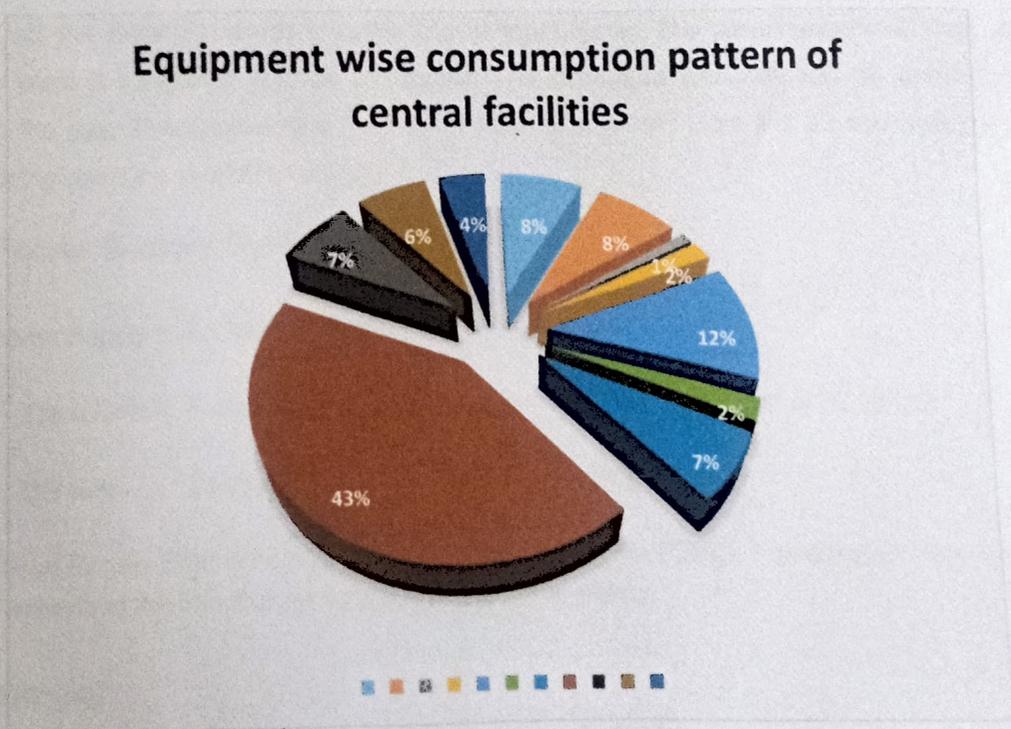


Fig 3.10 Equipment wise Analysis of Central Facilities

It is important to state here that this equipment wise analysis has been carried out by ignoring a large number of appliances having consumption less than 1% to make the analysis work simpler.

ACs are found to be consuming as much as 43% of the total power consumption in Institute Central Facilities.

Computers account for 7% of total power consumption in Institute Central facilities.

CFLs and conventional tube lights have shares of 2% and 12% respectively in the total power consumption of Institute Central facilities.

Fans account only for 19% (8% new and 8% old) power consumption.

### **3.4 Exterior Lighting**

LED lights, 1000W each, 12-15 are dominant lighting source in the external lighting.

### **3.5 Solar Power Plant**

The Asian Educational Institute, Patiala has Installed 25kW Grid connected Solar Power Plant to extract the Solar Power as a renewable energy source. The power generated from solar power plant is integrated with the LT supply. The generated electricity can be used directly during the day. The approximate generation from solar power plant lies 80-110 kwh per day depending upon the available sunlight.

### **3.6 Power Supply System**

The Power Supply to the Asian Educational Institute is sourced from:

- Transformer -Punjab State Power Corporation Limited with Load of 94.58 kW
- DG Sets – 2 Nos. DG sets of 50 kVA & 5 kVA rating.

The Three Phase, Four Wire 415/230V is obtained from the PSPCL Transformer. The rated specifications of the transformer & DG Sets are given below:

#### **Transformer:**

Rating of Transformer:	100kVA, 3-Phase, 4-Wire
Voltage Rating:	415/230V
Current Rating:	140 Ampere
Frequency:	50Hz
Connections:	Delta/Star

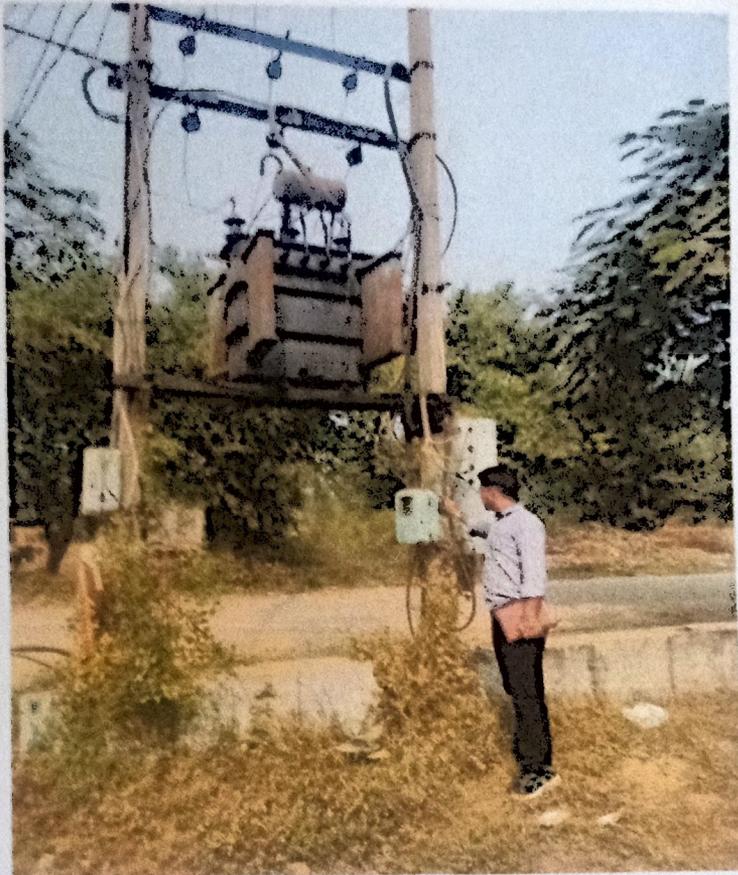


Fig.3.11 PSPCL Transformer

### 3.7 DG Set Details:

Table-1 DG Set Details

Diesel-Generator Details			
Engine		AC Generator	
Make: Mohindra & Mohindra		Make: Stamford	
Model	4725GM	Rated (kVA)	50
Rated (HP)/kW	72/53	Voltage (Volts)	415
Engine No.	V4E10S2542	Current (Amps)	70
		Power Factor	0.8
		Speed (rpm)	1500
Year of Mfg	31 May 2010	Year of Mfg	2010



FIG 3.12 DIESEL GENERATOR

TABLE-2 ANNUAL ENERGY CONSUMPTION DATA

Particulars	Values
<b>Power Supply from PSPCL Transformer</b>	Asian Educational Institute has one Utility Transformer connection from Punjab State Power Corporation Limited with load of 94.58 kW.  Billing is done on kVAh basis.
Supply Voltage	415/230V
Units Billed (PSPCL supply)	<u>Period from October 2024 to October 2025</u>  29007 kWh  Annual Bill: Rs 2.78 Lakhs
<b>Self-Generated Power through DG Set</b>	Two DG sets of 50 kVA & 5 kVA rating are installed in the College.  There is no energy meter installed on the DG sets, thus the annual kWh generation is not available.

<b>Solar Power Plant</b>	25 kW Grid connected solar power plant, generating 80-110 units per day depending upon the Sun Light/sessions.
<b>Particulars</b>	<b>Values</b>
<b>Total Power Consumption &amp; Bill</b>	
Annual Electricity Consumption (PSPCL Connection + DG Power)	<u>Period: Oct.-24 to Oct.-25</u> Transformer: 29007 kWh per annum DG Power 9600 kWh per annum <b>Total 38607 kWh per annum</b>
Energy Bill (PSPCL Connection + DG Set)	<u>Period: Oct-24 to Oct.-25</u> PSPCL: Rs 3.07 Lakh per annum DG Power Rs 1.08 Lakh per annum <b>Total Rs 4.15 Lakh per annum</b>

**Table-3 Annual Energy Consumption in TOE Terms**

Source of Energy	Annual Consumption	Calorific Value	kCal/annum	TOE/annum	Total Bill (Rs Lakhs / annum)
Power Purchased from the PSPCL	29007 kWh	860 kCal/ kWh	24946020	2.49	3.07
HSD for DG Sets	1200Ltr	9783 kCal/ltr	11739600	1.17	1.08
				<b>3.6</b>	<b>4.15</b>

### ENERGY USAGE IN TERMS OF TOE

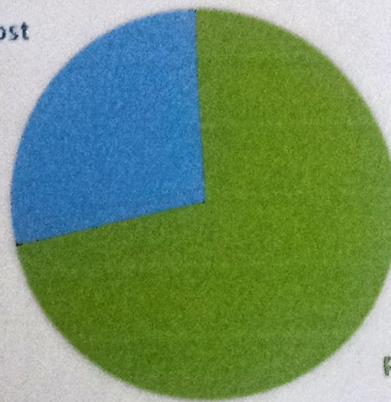
■ DG Power Generation   ■ Power Purchased From PSPCL



Fig 3.13 Energy Usage in Terms of TOE

### ENERGY COST CONTRIBUTION

DG Power  
Generation Cost  
28%



Power  
Purchased from  
PSPCL  
72%

Fig 3.14 Energy Cost Contribution

## 4.RECOMMENDATIONS FOR BETTER ENERGY EFFICIENCY

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

**TABLE-4 DETAILS OF INSTALLED EQUIPMENT'S IS AS FOLLOWS**

S.No.	EQUIPMENT	RATING (WATTS)	NUMBER	TOTAL LOAD (kW)
1	CEILING FANS	60	354	21.24
2	FLUORESCENT TUBE LIGHTS	40+5 BLAST LOSS =45	177	7.97
3	LED TUBE LIGHTS	28 (FOR SAME LUMENS)	117	3.28
4	FLOODLIGHTS	1000	15	15.00
5	AIR CONDITIONERS	2500	25	62.5
6	SUBMERSIBLE PUMP	1500	2	3.0
7.	PARK LIGHTS	200	16	3.2
<b>TOTAL LOAD</b>				<b>116.19</b>

### 4.1 AIR-CONDITIONING SYSTEM:

#### BETTER PRACTICES FOR AC:

The institute has in total 25 ACs which make a very large part of total energy consumption of the campus. Most of the AC's are without star rating. Also, there are several non-star rated / 2 star rated ACs. Some of them are very old and consume lot more energy than the models available today.

Summarized below are some guidelines for most efficient use of ACs:

**Proper Insulation** – Good quality insulation must be maintained in the air conditioned rooms by keeping all doors and windows closed properly so as to prevent cool air go out and hot air come in.

**Curtains** – Always keep curtains on windows to prevent direct sunlight inside the room to avoid heating of cooled air. This reduces AC load significantly.

**Maintenance** – Proper maintenance and cleaning of ACs is required at regular intervals to make it work at highest efficiency. Any dirt in filter may reduce efficiency of ACs very significantly.

**Operating** – The ACs should be switched on 15 minutes before actual use and should be switched off before leaving the room.

## **RECOMMENDATIONS: -**

### **Replacement of 2 Star ACs with 5 Star Rated / Inverter A/Cs**

Star rating of ACs is a dynamic & continuous process and the Indian Seasonal Energy Efficiency Ratio of the ACs is upgraded from time to time. However, it is not viable to replace all the ACs and upgrade them to the latest star rating levels. Therefore, the Institute could consider replacement of ACs of 2 star/ non-Star rating with five star rated / inverter ACs.

With technology advancements, today the 5 Star rated split ACs have an energy efficiency ratio of more than 3.5 w/w as against 2.62 w/w for the existing 2 star/non-star ACs. Therefore, replacement of the 2 Star/non-star ACs with 5 star rated / Inverter ACs has been suggested. Initially 10 number ACs should be replaced in the first stage.

**TABLE-5 ENERGY SAVING, INVESTMENTS & SIMPLE PAYBACK PERIOD**

PARTICULARS	EXISTING 2 STAR RATED ACS	NEW 5 STAR RATED / INVERTER ACS
DESIGN COOLING CAPACITY	6245 W	6245 W
DESIGN POWER INPUT	2385 W	1787 W
DESIGN SPECIFIC POWER CONSUMPTION	1.34 KW/TR	1.0 KW/TR
DESIGN ENERGY EFFICIENCY RATIO	2.62 w/w	3.50 w/w
EQUIVALENT POWER SAVING	0.60 KW PER AC	
NUMBER OF 2 STAR A/Cs CONSIDERED FOR REPLACEMENT	10 NOS	
TOTAL POWER SAVING	6.0 KW	

Particulars	Existing 2 star rated ACs	New 5 star rated / Inverter Acs
Working Hours per annum (08 hrs/day x 200 days/annum)	1600 hrs/annum	
Annual Power Saving	9600 kWh/annum	
Weighted average power rate	Rs 10.54 per kWh	
<b>Monetary Benefits</b>	<b>Rs. 1.1 Lakhs/annum</b>	
Estimated Investment (for 10 AC's each with cooling capacity of 6245 watts)	Rs. 4.0 Lakhs	
Simple Payback period	36-39 months	
Annual reduction in TOE	0.83 TOE/annum	
Annual Emission Reduction	7.9 tCO <sub>2</sub> /annum	

## 4.2 Replacement of conventional lights with LED Lights

The conventional tube lights (TL) have low efficacy and can be replaced by the high efficacy LED lights for the same lumen output. Therefore, it is suggested that conventional Lights (approximately 160 number out of total 258 tube lights) which are yet to be replaced may be replaced with energy efficient LED lights of appropriate rating.

**Table-6 Energy Saving, Investments & Simple Payback Period**

Existing Scenario				Post Implementation scenario	
Type of Lights	Wattage	Qty	Total Wattage	Wattage of Proposed LED Light	Total wattage of new LED Lights
Tube Light	40+5 =45	160	7200	28	4480
<b>Total</b>			<b>7200</b>		<b>4480</b>

Particulars	Values
Power Saving Potential	2.72 kW
Annual Operational hours considering 50% utilization factor	1650 hours
Weighted average power rate	Rs 10.54 per kWh
Energy Saving potential	4488 kWh per annum
<b>Net Monetary Benefit</b>	<b>Rs 47,303 per annum</b>
Estimated Investment for 160nos of 28 W LED Tube Lights (@Rs 250 per LED light of 20 W)	Rs 40,000
Simple Payback Period	08-10 months
Annual reduction in TOE	0.38 TOE/annum
Annual Emission Reduction	3.68 tCO <sub>2</sub> /annum

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

### **4.3 Installation of Energy Efficient Ceiling Fans**

As listed above around 263 ceiling fans are installed in the College campus. These ceiling fans are of 60 W ratings.

With advancements in the technology, super-efficient ceiling fans having a power consumption of around 30 watts (Energy Efficient BLDC Motor Ceiling Fan) are now available these

could replace the conventional 60 watt ceiling fans.

As a long term measure, replacement with BLDC super energy efficient ceiling fans could be considered in a phased manner. As all the fans cannot be replaced in one go. Replacement could be considered as a failure replacement policy initially replacement of around 25% ceiling fans has been considered for estimation of savings

**Table-7 Energy Saving, Investments & Simple Payback Period**

Particulars	Values
Total number of ceiling fans installed	263 nos
Number of ceiling fans considered for initial replacement (25%)	65 nos
Average Power drawn by the existing ceiling fans	60 W
Average Power drawn by the new energy efficient ceiling fans	30 W

Particulars	Values
Net power saving per ceiling fan	30 W
Working hours per annum	2400 hrs per annum
Energy Saving potential	4680 kWh per annum
Weighted average power rate	Rs 10.54 per kWh
<b>Monetary Benefit</b>	<b>Rs 49,327 per annum</b>
Estimated Investment	Rs 1,62,500
Simple Payback Period	36-38 months
Annual reduction in TOE	0.40 TOE/annum
Annual Emission Reduction	3.84 tCO <sub>2</sub> /annum

## CUMULATIVE ENERGY EFFICIENCY MEASURES

**Table-8 Cumulative Energy Saving Measures, Investments & Payback Period**

Particular	Annual Energy Saving				Estimated Investment in Rs.	Simple Pay-back Period in (Months)
	kWh	TOE	tCO <sub>2</sub>	Rs.		
Replacement of 2 star rated ACs with 5 Star Rated / Inverter A/Cs	9600	0.83	7.90	1,10000	4,00000	36-39
Replacement of conventional lights with LED Lights	4488	0.38	3.68	47,303	40,000	8-10
Installation of Energy Efficient Ceiling Fans	4680	0.40	3.84	49,327	1,62,500	36-38
<b>Total</b>	<b>18,768</b>	<b>1.61</b>	<b>15.42</b>	<b>2,06,630</b>	<b>6,02,300</b>	<b>27-30</b>

**Table-9 Energy Saving Potential**

Particulars	In Monetary terms	In TOE Terms
Power Purchased from PSPCL	Rs 3.07 Lakhs/annum	2.49 TOE/annum
HSD for DG Sets	Rs 1.08 Lakhs/annum	1.17 TOE/annum
<b>Total</b>	<b>Rs 4.15 Lakhs/annum</b>	<b>3.66 TOE/annum</b>
Energy Savings Identified	Rs 2.07 Lakhs/annum	1.68 TOE/annum
<b>Percentage Energy Saving Potential</b>	<b>48.9%</b>	<b>45.9%</b>

#### 4.8 SOME GENERAL OBSERVATIONS

The lighting arrangements are not proper in most of the rooms as the position of FTLs is not proper. Also in the Administrative room where most of the accounting part is being done has poor lighting arrangement inspite of number of luminaires installed (Old 4x20W Mirror optics, downlighters (square & round), FTLs), lux level is around 150-160lux whereas the recommended lux level is 300 lux. It is recommended that these luminaires be replaced with LED panels which consume much less power. Corridor lighting is also not proper as at most places in college FTLs and LED bulb mix is being used but the number is insufficient.

#### Lighting

- Wipe lamps clean at regular intervals. Lamps that are exposed to substantial amounts of dirt, dust, grease, or other contaminants should be cleaned more frequently than lamps in a relatively clean atmosphere
- Maintain luminary efficiency by properly cleaning the reflecting surfaces and shielding media
- Replace lens shielding that has yellowed or become hazy with a clear acrylic lens with good non-yellowing properties. A clear glass lens can be considered if it is compatible with the luminary and does not present a safety hazard
- Clean ceilings, walls, and floors frequently to improve reflective qualities
- If day lighting contributes to lighting, wash windows frequently to maintain illumination levels

- Replace all lamps used for area illumination after they have been in service for a substantial portion (approximately 70 percent) of their rated life, instead of simply replacing lamps one at a time as they burn out.

#### **Fans**

- Check for excessive noise and vibration and correct as necessary
- Clean fan blades
- Inspect and lubricate bearings regularly
- Inspect drive belts for proper tension. Adjust or replace as necessary to ensure proper operation
- Keep inlet and discharge screens on fans free of dirt and debris

## **5. EQUIPMENTS AND SOFTWARE USED**

We would like to list here the equipment's

and software used in the project to make the measurements and analyze the data.

### **5.1 DIGITAL LUXMETER**

Digital Luxmeters are the devices used to measure luminosity level. Luminosity measurements were performed at critical points.

### **5.2 Energy Analyzer**

We used AR5 Energy Analyzer to check power quality and consumption.

### **5.3 MS-Excel**

Datasheets were made in MS excel. Thereafter equipment wise analysis, application wise analysis and location wise analysis was performed. This data was then exported into excel file for graphical representation.

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