KANPUR INSTITUTE OF TECHNOLOGY AND PHARMACY
A-1, UPSIDC Industrial Area, Rooma, Kanpur-208001 (U.P.) India
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Policy Documents for Environment

Director
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GREEN CAMPUS POLICY

Green Campus, Energy, and Environment Policies will create exciting new co-curricular and extracurricular initiatives that motivate learners to take the lead in bringing about great change.

Objectives-

- To create an environmentally friendly, sustainable campus..
- To teach students about the importance of the environment and the issues.
- Within the campus, to preserve and preserve natural systems and resources.

Strategies of implementation -

1. Restricted entry of Automobiles.
2. Use of Bicycle/ Battery powered vehicles.
3. Pedestrian-friendly pathways.
4. Ban on single use Plastic.
5. Landscaping with trees and plants

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ENVIRONMENT POLICY

Introduction-

The environment is a vital part of earth and necessary for living organism, without environment we can not the imagination of life on earth so that environmental policy, any measure by a government or corporation or other public or private organization regarding the effects of human activities on the environment, particularly those measures that are designed to prevent or reduce harmful effects of human activities on ecosystems.

Objective-

Environmental policy is aimed at balancing environmental protection and the conservation of natural resources with other policy goals, such as affordable energy as well as economic growth and employment.

Strategies of implementation-

EARTH DAY

The earth day is an annual celebration that honors the achievements of the environmental movement and raises awareness of the need to protect earth's natural's resources for future generation. The first earth day was held April 22, 1970. In Kanpur institute of technology and pharmacy every year of **22 April World earth day,** is celebrated with Directors pharmacy, dean academics, faculty and students by tree plantation.

WORLD ENVIRONMENT DAY

On the occasion of **"World Environment Day 5th June",** 2023 the Environment club of KITP is organizing a tree plantation program on campus. Directors, Deans, faculty members, staff members and students have taken part in the plantation program. The environmental club incharge is Dr. Ritu Kumari Singh (Dean Student's Welfare). All the activity related environmental promotion and extracaricular activity are run through DSW as per schedule on time to time.

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WASTE MANAGEMENT POLICY

The Institute realizes that integrated waste management is essential in reducing its environmental footprint and providing a safe and healthy work environment for teaching, non-teaching employees, students, residence and visitors. The Institute needs to make sure that all the campus wastes are disposed of responsibly by using proper waste segregation mechanism at the source.

Objectives:

- Ensure that waste management in campus is in accordance with all waste legislative requirements.
- Minimize waste generation and facilitate repair, reuse and recycling of wastes in a cost effective manner.
- Provide clearly defined roles and responsibilities to identify and co-ordinate activity of the waste management.
- Promote environmental consciousness in order encourage waste minimization, reuse and recycling.
- Ensure safe handling and storage of wastes in campus.
- Provide appropriate training for teacher, resident, staff and students on waste management issues.

Strategies of implementation -

- Monitoring the day to day delivery of general waste and their recycling services.
- Operational monitoring of waste management systems.
- Ensuring that no hazardous waste is disposed of through the general or waste recycling streams.
- Ensuring that waste of office and residence is disposed off responsibly through proper waste disposal system.
- The waste could either be recycled /reused or disposed of in captive or common treatment, storage and disposed facilities available in the campus or incinerated.

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Policy for E-waste Management

Waste is an outcome of product or a substance that is no longer suited for its intended use. Electronic waste also known as E-Waste or WEEE (Waste electrical and electronic equipment) comprises of a broad and growing range of electronic devices, ranging from large household devices such as refrigerators, electric motors, voltage stabilizers, air conditioners, cell phones, personal stereos, Television, LED's, CRT's, Computer systems and other consumer electronics which have outlived their lives and have been discarded by the users.

Objectives:

- To minimize generation of e-waste at source and facilitate repair, reuse and recycling where ever possible, over the disposal of wastes in a cost effective manner.
- To mobilize and sensitize stakeholders on the proper management and handling of e-waste on a sustainable basis.
- To ensure the safe handling and storage of wastes in the campus.
- To encourage use of environmentally sound e-waste recycling methods.
- To provide guidance on the standards of electronic equipment that is implemented in the campus.
- To provide appropriate training for teacher, resident, staff, students and other stakeholders on e-waste management issues

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Policy for Glass Waste Management

The educational institutions represent the main components of sustainability promotion in our society. Glass Waste Management is one of the challenges that educational institutions must face in accomplishing the sustainability goals.

Objective:

Glass Waste management is intended to reduce adverse effects of glass waste on human health, the environment, planetary resources, and aesthetics. The aim of glass waste management is to reduce the dangerous effects of such waste on the environment and human health.

Strategies for implementation:

- To provide clearly defined roles and responsibilities to identify and co-ordinate each activity of the glass waste management.
- To promote environmental awareness in order to increase and encourage glass waste minimization, recycling.
- To ensure the safe handling and storage of glass wastes in the college campus.
- To provide appropriate training for teachers, residents, staff, students and other stakeholders.
- To promote holistic approach of waste management in the campus.

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Policy for Hazardous Chemical Management

The institute realizes sustainable and holistic management and disposal of hazardous chemical essential in reducing its environmental footprint and providing a safe and healthy work environment for teaching and non-teaching employees, students, and visitors. The institute has a duty to ensure that all the hazardous chemicals from concerned laboratories are disposed of responsibly by using proper mechanism at the source and if possible, converting it into value added environment friendly product.

Objectives:

- To ensure the safe handling, storage and disposal of hazardous chemicals from concerned laboratories of the institute.
- To provide appropriate training for teacher, resident, staff, students and other stakeholders on waste management issues.

Strategies of Implementation:

- Monitoring the concerned laboratories regarding management and disposal of hazardous chemicals.
- Provision of appropriate training for all personnel who have responsibilities for management and disposal of hazardous chemicals.
- Ensure all containers of hazardous chemicals are properly labeled with the identity of the hazardous chemical(s) and appropriate hazard warnings.
- Hazardous Chemicals (waste) (liquid, solid) should be accumulated in drums or containers separately.
- Waste storage areas should be checked weekly for leaks or spills.
- Waste containers should be labeled with contents, hazards (flammable, combustible, acid, non-halogenate, halogenated etc.), and accumulation dates.
- Before disposal, pH must be checked, if acidic, before disposal it should be neutralized.
- Solvent should be recycled with the help of fractional distillation process.

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ENERGY CONSERVATION POLICY

The Energy Conservation policy monitor, conserve and manage the energy needs of the campus with the growth in the energy demands of the institute; It is the responsibility of the institute in creating awareness among the students and staff about the energy conservation measures. Also maintain green energy campus with utilization of energy management system.

Objectives:

- Improvement in Energy efficiency to reduce Energy consumption and cost.
- Minimize the energy consumption by use of energy efficient equipment.
- Maximize use of day light and natural ventilation.

Strategies of implementation -

- Maintain the Energy needs of the campus with back-up power supply system for supplying uninterrupted energy demands.
- Establishment of energy efficient utilization measures in the supply, demand systems as part of energy management of the campus.
- Replacement of the existing conventional lighting with the LED lamps.
- Monitor the electricity bills for the efficient utilization of solar power plant installed in the campus.
- Create awareness among the students and staff in energy conservation and management by the Eco-club of the college.
- The Institute shall continuously review and update the approved policy and is committed to its implementation.
- Solar panels were installed on the roof top of the college building to minimize the use of non-renewable source of energy.
- Directions are given to students are given for the proper utilization of the electronic devices in the institution.
- Ensures all the institutional electronics are turned off when not in use.
- Use of energy efficient, star labelled equipments for various purposes.
- Students and faculty members are given adequate training for energy audit procedures for sustainable institutional and household energy conservation.

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WATER CONSERVATION & MANAGEMENT POLICY

Water scarcity is one growing concerns of the present times, the ultimate solution for which is water conservation. Therefore, institute make a policy for water conservation and sustainable maintenance of resources.

Objectives:

- To increase recharge of groundwater by capturing and storing rainwater, by rain water harvesting from rooftop and run-offs.
- To ensure continuous water supply to all sections and departments in college campus.
- To recharge bore well system in monsoon season.
- To reduce wastage of water.

Strategies of implementation -

- Maximize water usage efficiency and minimize wastage of water.
- Promote investment in and maintenance of efficient water infrastructure and green infrastructure in all future development plans.
- Provide training on the water conservation measures adopted by the college to all the students, staff and other stakeholders of the college and nearby community.
- Ensure awareness about the water conservation policy of the college among all the stakeholders.
- Establish waste water treatment and recycling centres.
- Inform, educate and increase awareness regarding the importance of water to life, and the need for conservation and efficient use of water.

Director
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Kanpur-208001

Energy usage Certificate from the Auditing Agency

Energy Audit Report

of

Kanpur Institute of Technology and Pharmacy,
(Unit of Indus Technical Education Society)
Kanpur- U.P.

Conducted BY: -

M/s GANGES CONSULTANCY
KANPUR-U.P

September - 2023

Confidentiality

This document is confidential and the content of this report shall be used only Kanpur Institute of Technology and Pharmacy, (A Unit of Indus Technical Education Society) Kanpur (UP) for the purpose of implementation of the recommendations and bringing energy saving awareness among the employees.

GANGES CONSULTANCY

Kanpur

Certificate

This part shall indicate certification by ACCREDITED ENERGY AUDITOR (AEA)

Stating that —

- The Energy Audit has been carried at Kanpur Institute of Technology and Pharmacy, (A Unit of Indus Technical Education Society) Kanpur U.P. in September - 2023
- The site data collection has been carried out diligently and truthfully;
- All reasonable professional skill, care and diligence had been taken in preparing the Energy Audit report, and the contents thereof are a true representation of the facts.
- Adequate training has been provided to personnel involved in daily operations after the recommendations for the implementation; and the energy audit has been carried out in accordance with EC ACT 2001.

Signature:
Name of the Accredited Energy Auditor:
Anoop Kumar Gupta
B.E.E. AEA No. - 0125

Contents

List of Tables

ACKNOWLEDGEMENT

M/s Ganges Consultancy, Kanpur expresses sincere thanks to the Kanpur Institute of Technology and Pharmacy, (A Unit of Indus Technical Education Society) Kanpur, for expressing their willingness and assigning us the Energy Audit of their college.

We are also thankful to the management of the Kanpur Institute of Technology and Pharmacy, Kanpur U.P. We also express our thanks to the Director, HOD, Assistant Professor & staffs, who have rendered their valuable assistance directly or indirectly to carry out this Energy Audit study,

M/s GANGES CONSULTANCY
KANPUR-UP-INDIA

Abbreviation

◊ A	➢ Ampere
◊ A.Cs	➢ Air Conditioners
◊ APFC	➢ Automatic Power Factor Correction
◊ CD	➢ Contract Demand
◊ Cons.	➢ Consumed/ consumption
◊ CO_2	➢ Carbon dioxide
◊ ENCONs	➢ Energy Conservation Opportunities
◊ kV	➢ kilovolt
◊ KVA	➢ kilovolt Ampere
◊ kVAh	➢ kilovolt Ampere hour
◊ kVAr	➢ kilovolt Ampere (Reactive)
◊ kW	➢ kilowatt
◊ kWh	➢ kilowatt hour
◊ LED	➢ Light Emitting Diode
◊ P.F	➢ Power Factor
◊ PIR	➢ Passive Infrared
◊ Qty	➢ Quantity
◊ SFC	➢ Specific Fuel Consumption
◊ SQM	➢ Square Meter
◊ tCO2	➢ Ton of carbon dioxide
◊ TR	➢ Ton of Refrigeration
◊ UPS	➢ Uninterrupted Power Supply
◊ V	➢ Phase to Neutral Voltage

Executive Summary

With the advent of energy crisis and exponential hikes in the costs of different forms of energy, The Energy Audit is manifesting its due importance in buildings. Energy Audit helps to understand more about the ways energy and fuels are used in any establishment and help to identify areas where waste energy may occur and scope for improvement exists.

The Energy Audit is the preliminary systematic approach for decision-making in the area of energy management as it attempts to balance the total energy inputs with its use and serves to identify all the energy streams in a facility/ establishment.

With this objective, M/s Ganges Consultancy Kanpur was entrusted with the job of conducting an Energy Audit involving the analysis of electrical consumption in last two financial years, Lighting System, ACs etc. at **Kanpur Institute of Technology and Pharmacy**, **Kanpur - UP.**

Basic Details

A		
Brief description of assignment	**:**	To carry out Energy Audit of **Kanpur Institute of Technology and Pharmacy**, **Kanpur - UP**
Name & Address of Institution / agency on behalf of energy audit conducted	**:**	**Kanpur Institute of Technology and Pharmacy, A-1, UPSIDC. Industrial Area Rooma, Kanpur - UP**
Address of communication of auditing agency	**:**	M/s GANGES CONSULTANCY, 273 /Y - 1, Block Kidwai Nagar Kanpur-UP
	:	gangesconsultancy@gmail.com 9464005209/ 85108109
B		
Nature of building	**:**	Academic Institute
C		
Working hours	**:**	8 hr
Annual working days	**:**	250 days

D		
Area	:	
Total area	:	8093.89 m^2
Total Build area	:	6389.0 m^2
Total no. floor	:	4 (G+3)
E		
Connected load	:	1092.85 kW (Whole Campus)
Sanctioned connected load	:	450 kVA
Annul grid import power consumption FY 2022-23	:	400308 kWh
Annul solar export power to grid FY 2022-23	:	407112 kWh
Annul electricity bill FY 2022-23	:	Rs. 47.39 Lakh (from Nov-2020 to Oct-2021)
Tariff	:	1) Fixed Charges Rs. 430/ kVA 2) Energy Charges a. Energy Charges Rs. 8.32/ kVAh b. Excess SPV power is fed to grid and it adjusted to import power c. Max adjustable solar is equivalent limit is import power kWh
D		
Net import power cost to institute FY 2022-23	:	Rs. 12.00/ kWh*
HSD Cost	:	Rs. 90.25 /litre*

***cost considered for all onward calculation**

IDENTIFIED ENERGY SAVING OPPORTUNITIES

ENCONs

Energy Saving Measures	Annual Energy Saving		Estimated Investments	Simple Payback Period
	kWh	(Rs Lakh)	(Rs Lakh)	(Months)
To increase of cleaning frequency of solar panel and external audit	19887	1.65	1.00	8
To replacement of 575 no. (fluoresce tube Light) with 20 w Led tube light	71300	8.54	2.88	5
To replace 1757 no ceiling fans of 60 W with 30 W energy efficient BLDC in phase manner	85200	10.20	35.50	42
To replace 235 no 40W Wall fans with 20 W BLDC Wall fans in phase manner	7520	0.90	4.70	63
To teplace 72 no 100 W Wall exhaust fans with 20 W BLDC exhaust fans in phase manner	11520	1.38	1.80	16
Total	195427	22.68	45.88	25

Energy Saving in toe (Tonne of oil equivalent)

1 kWh = 860 kcal

1 toe =1000000 kcal

Total Energy Saving = 16.8 toe

Other Energy Saving Measures

- Installation of Occupancy sensors in offices/ class rooms and galleries. Now, PIC based technology occupancy sensors are available in market, which operates on vibration and temperature difference technology.
- Periodic cleaning ACs suction filters,
- Installation of an energy meter at each DG Set, for better monitoring of the performance of DG Set.
- Installation of a water level controller in an overhead water storage tank to avoid over flow of tanks.

CHAPTER-1
INTRODUCTION

With the widening demand-supply gap, reliability of energy supply, increasing energy cost, and the huge impact of unsustainable energy consumption on the environment, energy conservation and efficiency have assumed enormous important of late. Commercial Building owners are facing significant challenges with rising operating budgets directly attributed to increase of energy cost for lighting, air-conditioning and office services etc.

Energy cost in buildings is the key issue and plays a major role to maintain ECO-III norms/ star rating. With the advancement of energy efficiency practices and technologies, it is possible to cut down energy cost significantly in these new technology facilities without affecting any ECO-III norms. This can normally be achieved by the office management by initiating a systematic energy assessment/ audit of their entire building, followed by implementation of cost-effective energy efficiency measures.

1.1. Kanpur Institute of Technology and Pharmacy (KITP), Kanpur

Since, its inception in 2009, Kanpur Institute of Technology and Pharmacy (KITP) has been successfully shouldering the monumental responsibility of producing capable health care professional and highly skilled with positive mind-set person. Run by a team of visionary and motivated IIT alumni, KITP is counted among the top-rated Pharmacy institutes of North India. Kanpur Institute of Technology and Pharmacy runs B. Pharma, M. Pharma and Diploma courses. The institute is affiliated to Dr. A.P.J. Abdul Kalam Technical University, Lucknow (formerly U.P.T.U., Lucknow) with College Code 550. The courses are approved by The Pharmacy Council of India (PCI) and affiliated to AKTU (550) & BTE (3380), Lucknow. The institute is very easily accessible; it is located in Rooma, on Kanpur – Allahabad Highway, 6 Kilometres away from Ramadevi round over.

Kanpur Institute of Technology and Pharmacy proudly boasts of a sprawling and lush green campus with elegant buildings and state-of-the-art infrastructure, it has qualified, experienced and dedicated faculty for various courses, always ready to help the students in understanding the concepts related their area of study. Kanpur Institute of Technology and Pharmacy has a highly impressive placement track record, with students getting placed in various MNCs at good annual packages.

The institute fulfils its promise of academic excellence. Every year, Kanpur Institute of Technology and Pharmacy produces university rank holders in various streams. The students are given exposure to various skills development programs during the course of their study at KITP. This helps them to gain an edge over others and prove themselves better for placement opportunities. The institute leaves no stone unturned to provide the best and conducive study environment to the students. Laboratories studded with modern equipment, computer centers, fully Wi-Fi campus, video lecture rooms, projector-based, air-conditioned classes, air-conditioned seminar halls are just a glimpse of the facilities that the students get at KITP, add to it the personal attention showered by the teachers to explain the intricate concepts to the students in the most lucid way.

Last but not the least; the institute shall continuously strive for maintaining excellence in higher technical and professional education, through a student centric approach, aiming to bring out the best in them and transforming the students into industry ready professionals.

1.2. Ganges Consultancy, Kanpur

M/s Ganges Consultancy Kanpur is a registered organization under Partnership act 1932. M/s Ganges Consultancy Kanpur is a BEE empanelled organization for **PAT M & V (placed at 46th position) & BEE ESCO Grading 4.** **M/s Ganges Consultancy Kanpur** is a team of experienced **BEE (Bureau of energy efficiency) Accredited Energy Auditor, Certified Energy Auditor** and young, experienced, and futuristic sector experts with an extensive technocrat professional background. It provides consultancy for technical services in the areas of energy, environment study, renewable energy and utility & process designing system, waste energy management, energy conservation, and provides appropriate training modules for improving awareness in the society about energy efficiency.

M/s Ganges Consultancy provides a comprehensive and integrated consultancy package in the field of Energy Management through its experienced team of engineers, which includes industry/ specific technology experts as well as specialists in Chemical, Electrical, and Instrumentation fields, backed up by an extensive data bank, library and latest sophisticated instrumentation. The team is an expert in following functions:

- Collection of all type of data & information including equipment designing, their energy consumption pattern and historical data etc.
- Compilation and analysis of data collected at site.
- Trying to establish specific energy consumption index for the client.
- In-depth analysis of the plant operations, equipments and systems established for improvement energy efficiency in plant/ building.
- Suggesting specific measures for energy saving/ conservation.
- On the Spot Assistance to the plant/ building management for implementation of the measures recommended for Energy Savings.
- Training the staff in the client companies in the specifics of Energy Conservation to enable them in implementing the recommendations and for monitoring the progress thereafter.

1.3. Scope of Work

To carry out Energy Audit of Kanpur Institute of Technology and Pharmacy, Kanpur Uttar Pradesh with following objectives,

- **Purchased Power Analysis**

- Purchased power bill analysis for last one year with pf, kWh, kVAh, and over all power cost to college. Study of Contract demand and for this, college has to provide monthly electricity bills copy.

- **Capacitor Bank**

- Measure performance of each capacitor bank, Identify the default capacitor bank, study their location and suggest further improvement if feasible.
- Study the location of capacitor banks.

- **DG Set**

- Study of the Power Generated vis-à-vis fuel consumption; evaluate the specific Fuel consumption kW/ litre and suggest measures for improvements if any

- **AC**

- Study of the present package AC system and possibility to installation of new energy efficient ACs.

- **Study of Pump Performance**

- Study of operation of different pumps installed in campus and suggests if any energy conservation measures possible.

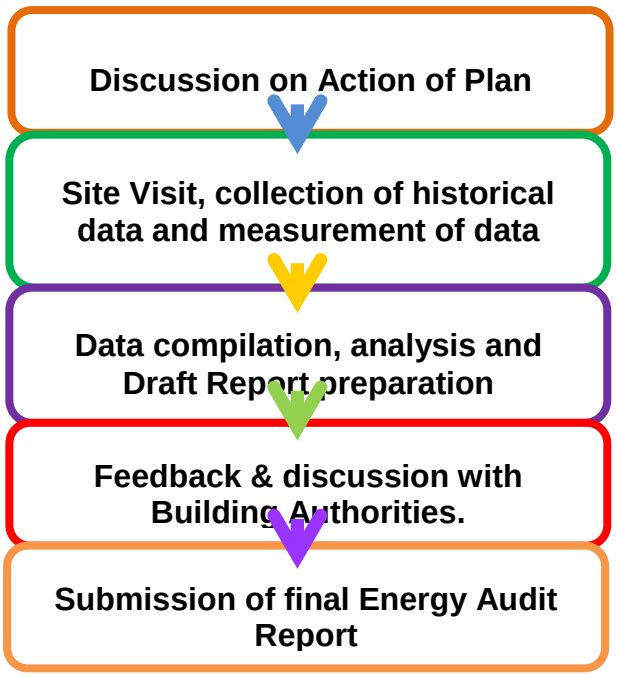
➢ **Lighting & Fans System**

➢ Study of the Lighting systems in respect installation of type of fixtures and their control system.

1.4. Methodology

Methodology adopted for achieving the desired objectives viz: assessment of the current energy consumption pattern in college.

1. Discussions with the concerned officials for identification of major areas of focus and other related systems.
2. Discussions with the concerned officials/ supervisors to collect data/ information of the operations and power consumption in the college.
3. The data was analyzed to arrive at a **base line energy consumption pattern**.



Computation and **in-depth analysis** of the collected data, including utilization of computerized analysis and other techniques considered appropriate were adopted to draw inferences and to evolve suitable energy conservation plan/s for improvements/ reduction in specific energy consumption.

1.5. List of Equipment Installed

Detail of equipment installed is depicted as below Tables,

Table 1-1: List of Transformer Installed

Sr. no.	Make	Rating kVA	Voltage Ratio	Year of Manufacturing
1	Kiloskar Electrical CO. Ltd	1000	11 kV/ 433 V	1997
2	Kiloskar Electrical CO. Ltd	250	11 kV/ 433 V	2004

Table 1-2: List of DG Installed

Sr. no.	Make	Rating kVA	Voltage Output	Year of Manufacturing
1	Cummins/Jackson	380	415 V	2007
2	Cummins/Jackson	125	415 V	2004
3	Cummins/Jackson	62.5	415 V	2004

Table 1-3: List of Water Pump Installed

Sr. no.	Type	Name	Motor Rating	Head m	Capacity Litre/min
1	Submersible Pump	Varuna	3 HP	50	100
2	Submersible Pump	CRI	3 HP	50	120
3	Submersible Pump	CRI	3 HP	50	120
4	Submersible Pump	Varuna	3 HP	50	130
5	Submersible Pump	Varuna	3 HP	50	130
6	Submersible Pump	Kisan	2HP	30	75

ACs

Table 1-4: Window/ split ACs

Sr. no.	Capacity TR	Number	Type	BEE Star
1	1.0	1	Window	-
2	1.5	3	Window	3
3	2.0	4	Window	3
4	1.0	4	Split	-
5	1.5	8	Split	3
6	2.0	6	Split	3
7	2.5	4	Split	3
8	4.0	5	Tower	-
9	4.0	16	Duct Spit	-

Table 1-5: Package AC Installed

Sr. no.	Capacity TR	Number	No. of AHU connected	AHU Fan cfm	Fan drive motor rating kW
1	5.5	46	-	-	-
2	8.5	1	-	-	-
3	11	3	-	-	

Sr. no.	Capacity TR	Number	No. of AHU connected	AHU Fan cfm	Fan drive motor rating kW
4	16.5	4	-	-	-
5	22	2	-	-	-

Table 1-6: Light Fixture Installed

Sr. no.	Type	Watt Including Choke	No.
1	Florescent Tube/CFL	36	1150
2	LED tube light	20	1350
3	LED Bulb	9	150
4	LED panel 2X2	30	50
5	LED Lamps	15	52
6	LED Street light	45	52
7	LED Security Guard	200	20
8	LED Focus light	70	35
9	Pole Light	500	5

Table 1-7: Fan Installed

Sr. no.	Type	Watt	No.
1	Ceiling Fan	60	1775
2	Wall Fan	40	235
3	Exhaust Fan	100	72

SOLAR POWER GENERATION SYSTEM

Table 1-8: SPV System

Sr. no.	Description	Capacity kW
1	Rooftop Grid Connected SPV System	450

CHAPTER-2
POWER CONSUMPTION

2.1. Grid Power Supply

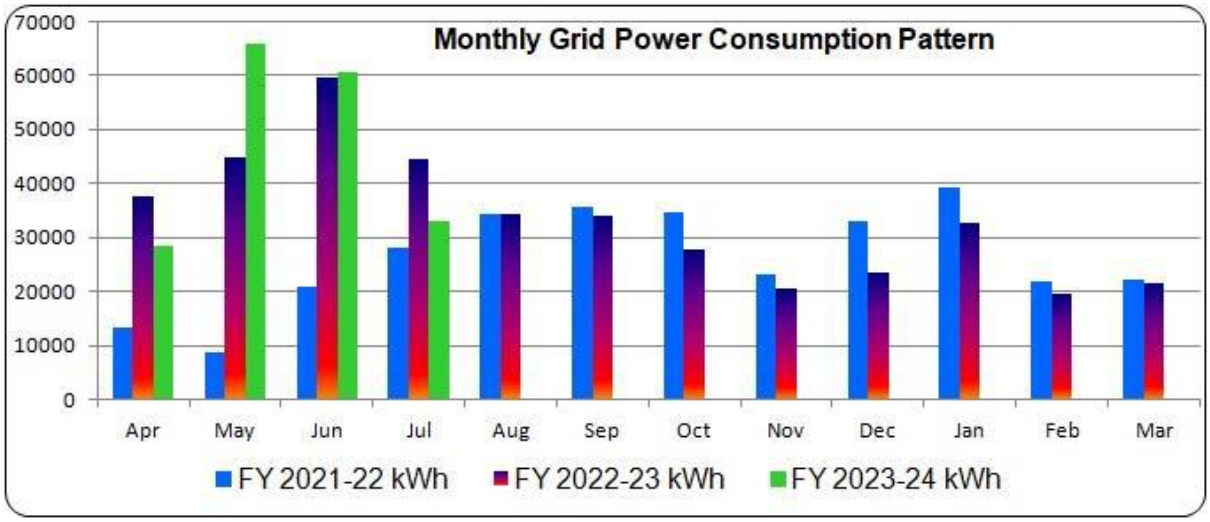
Power is supplied mainly two sources, one is from grid and another is from 450 kW grid connected solar power plant installed at roof of institute building. Net metering is installed, so that whenever, solar power gets excess after internal consumption, export to grid.

Grid is supplied by “KANPUR ELECTRICITY SUPPLY COMPANY LTD” at 11 kV voltage level, which is step down to 433 volt by transformer of rating 1000 kV installed in campus, after step down of power voltage, it supply to distribution panel. Where, it is further distributed to whole campus. Another transformer of 250 kVA is kept as stand by incase of trouble in 1000 kVA.

Beside the above power resources, three DG sets of rating 380 kVA, 125 kVA and 62.5 kVA are installed to supply power, in case restriction grid and solar power is available at low rate or completely not available (evening or in night).

Table 2-1: Grid Power Consumption Pattern

Months	Grid Power Supply kWh	Grid Power Supply kVAh	Months	Grid Power Supply kWh	Grid Power Supply kVAh	Months	Grid Power Supply kWh	Grid Power Supply kVAh
Apr-21	13386	16137	Apr-22	37725	38358	Apr-23	28425	29802
May-21	8553	9978	May-22	44811	45342	May-23	65796	70860
Jun-21	20697	25836	Jun-22	59523	59523	Jun-23	60654	63834
Jul-21	28002	35292	Jul-22	44568	45696	Jul-23	33084	34575
Aug-21	34482	42036	Aug-22	34251	34818			
Sep-21	35538	43341	Sep-22	33849	34386			
Oct-21	34692	41718	Oct-22	27897	28551			
Nov-21	23274	28689	Nov-22	20625	21114			
Dec-21	33084	39201	Dec-22	23376	24006			
Jan-22	39294	44718	Jan-23	32580	33306			
Feb-22	21705	23043	Feb-23	19425	19884			
Mar-22	22131	22563	Mar-23	21678	22128			
Total	**314838**	**372552**		**400308**	**407112**		**187959**	**187959**



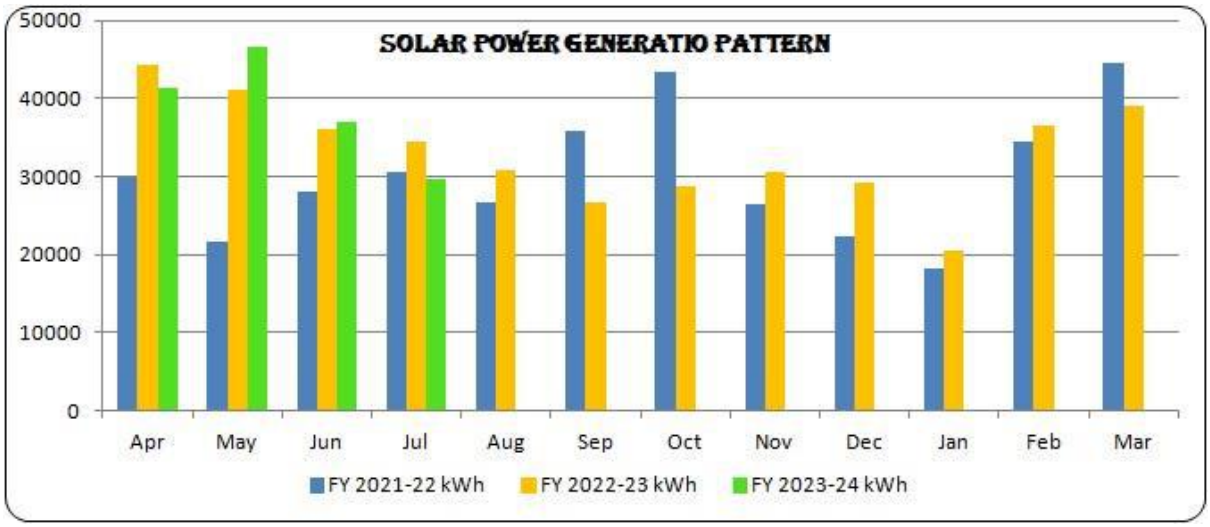
- In FY 2022-23, Grid power consumption has increased by 27.1% as compared to grid power consumption in FY 2021-22.

2.2. Solar Power Generation

Monthly solar power generation last 28 months is depicted below in table,

Table 2-2: Solar Power Generation Pattern

Months	Solar Power Generation		Months	Solar Power Generation		Months	Solar Power Generation kWh	
	kWh	kVAh		kWh	kVAh		kWh	kVAh
Apr-21	29881	34965	Apr-22	44260	45395	Apr-23	41293	42482
May-21	21570	23954	May-22	41053	42433	May-23	46617	47253
Jun-21	28087	40645	Jun-22	36040	37247	Jun-23	36949	38253
Jul-21	30639	59172	Jul-22	34533	35238	Jul-23	29701	31071
Aug-21	26665	37600	Aug-22	30686	31679			
Sep-21	35931	48208	Sep-22	26681	28256			
Oct-21	43472	51982	Oct-22	28759	29598			
Nov-21	26467	43247	Nov-22	30480	31295			
Dec-21	22269	37538	Dec-22	29127	29630			
Jan-22	18153	23045	Jan-23	20596	24289			
Feb-22	34568	37467	Feb-23	36606	37106			
Mar-22	44598	45345	Mar-23	38928	39532			
Total	**362300**	**483168**		**397749**	**411698**		**154560**	**154560**



- In FY 2022-23, solar power generation has increased by 9.8% as compared to solar power generation FY 2021-22.

2.3. Net Power Consumption

Net (grid + Solar) power consumption is depicted below,

Table 2-3: Daily Solar Power Generation KITP, Kanpur

Months	Import Power		Solar Generation		Solar Export		Net Power Consumption	
	kWh	kVAh	kWh	kVAh	kWh	kVAh	kWh	kVAh
Apr-21	13386	16137	29881	34965	11196	13101	18685	32071
May-21	8553	9978	21570	23954	11022	12240	10548	19101
Jun-21	20697	25836	28087	40645	8085	11700	20002	40699
Jul-21	28002	35292	30639	59172	2880	5562	27759	55761
Aug-21	34482	42036	26665	37600	5955	8397	20710	55192
Sep-21	35538	43341	35931	48208	7305	9801	28626	64164
Oct-21	34692	41718	43472	51982	16857	20157	26615	61307
Nov-21	23274	28689	26467	43247	3621	5916	22846	46120
Dec-21	33084	39201	22269	37538	3951	6660	18318	51402
Jan-22	39294	44718	18153	23045	8148	10344	10005	49299
Feb-22	21705	23043	34568	37467	20286	21987	14282	35987
Mar-22	22131	22563	44598	45345	10395	10569	34203	56334
Apr-22	37725	38358	44260	45395	8889	9117	35371	73096
May-22	44811	45342	41053	42433	3480	3597	37573	82384
Jun-22	59523	59523	36040	37247	3135	3240	32905	92428
Jul-22	44568	45696	34533	35238	3722	3798	30811	75379
Aug-22	34251	34818	30686	31679	5286	5457	25400	59651

Months	Import Power		Solar Generation		Solar Export		Net Power Consumption	
	kWh	kVAh	kWh	kVAh	kWh	kVAh	kWh	kVAh
Sep-22	33849	34386	26681	28256	2694	2853	23987	57836
Oct-22	27897	28551	28759	29598	9736	10020	19023	46920
Nov-22	20625	21114	30480	31295	7740	7947	22740	43365
Dec-22	23376	24006	29127	29630	10944	11133	18183	41559
Jan-23	32580	33306	20596	24289	6006	7083	14590	47170
Feb-23	19425	19884	36606	37106	14709	14910	21897	41322
Mar-23	21678	22128	38928	39532	12381	12573	26547	48225
Apr-23	28425	29802	41293	42482	11979	12324	29314	57739
May-23	65796	70860	46617	47253	5061	5130	41556	107352
Jun-23	60654	63834	36949	38253	2805	2904	34144	94798
Jul-23	33084	34575	29701	31071	2601	2721	27100	60184
Total FY 2021-22	**314838**	**372552**	**362300**	**483167**	**109701**	**136434**	**252599**	**567437**
Total FY 2022-23	**400308**	**407112**	**397749**	**411698**	**88722**	**91728**	**309027**	**709335**
Increase/ Decrease	**27.1%**	**9.3%**	**9.8%**	**-14.8%**	**-19.1%**	**-32.8%**	**22.3%**	**25.0%**

- Monthly solar Power generation has reduced from the month Jun 2023 to Jul-2023 by approx 20%.
- Similarly Monthly solar Power generation has reduced from the month Jul 2023 to Aug-2023 by approx 19.6%.

2.4. Tariff

Electricity Distribution Division-II, Varanasi has adopted two tier tariff structures i.e. fixed charges based on MDI or min CD and variable energy charges based on total power consumed in a particular month.

1) Fixed Charges Rs. 430/ kVA
2) Energy Charges
   a. Energy Charges Rs. 8.32/ kVAh POWER COST

Power Cost per unit is depicted as below,

Table 2-4: Power Cost

Month	Net Power kWh	Monthly Electrical Bill Rs.	Power Cost Rs./ kWh
Apr-22	29241	427890	14.63
May-22	41745	544565	13.05
Jun-22	56283	680219	12.09
Jul-22	41898	530746	12.67
Aug-22	29361	418615	14.26
Sep-22	31533	438041	13.89
Oct-22	18531	321751	17.36
Nov-22	13167	273776	20.79
Dec-22	12873	271146	21.06
Jan-23	26223	390548	14.89
Feb-23	4974	200497	40.31
Mar-23	9555	241470	25.27
Apr-23	17478	312333	17.87
May-23	65730	776931	11.82
Jun-23	60930	763344	12.53
Jul-23	31854	440912	13.84
Aug-23	29241	427890	14.63

- Power cost varies from Rs.11.82 per kWh to Rs. 40.31 per kWh.
- Average power cost from Aug 2022 to Jul -2023 is Rs. 11.98 per kWh
- **For all onward calculation, average power cost Rs. 12.00 per kWh is considered and for solar power is Rs. 8.32 per kWh**

2.5. Recommendation

Total 450 kW grid connected roof top solar generation plant is installed. Cleaning of solar panel is done weekly.

As Ministry of New & Renewable Energy solar power generation tool, annual solar power generation should be near to 6.00 Lakh units. But max recorded annual solar power generation is 3.97 Lakh units, which is too low and needs for further action to increase solar generation.

1. Frequency of solar panel cleaning should be increased.
2. External audit of solar plant.

Solar Rooftop Calculator

Average solar irradiation in UTTAR PRADESH state is 1156.39 W / sq.m
1kWp solar rooftop plant will generate on an average over the year 4.6 kWh of electricity per day (considering 5.5 sunshine hours)

1. Size of Power Plant	
Feasible Plant size as per your Capacity :	450kW
2. Cost of the Plant :	
MNRE current Benchmark Cost (without GST) :	Rs. 35886 Rs. / kW
View Benchmark Cost List	
Without subsidy (Based on current MNRE benchmark without GST) :	Rs. 16148700
With subsidy 0 (Based on current MNRE benchmark without GST) :	Rs. 16148700
3. Total Electricity Generation from Solar Plant :	
Annual :	621000kWh
Life-Time (25 years):	15525000kWh
4) Financial Savings :	
a) Tariff @ Rs.14.01/ kWh (for top slab of traffic) - No increase assumed over 25 years :	
Monthly :	Rs. 725018
Annually :	Rs. 8700210
Life-Time (25 years) :	Rs. 217505250

Carbon dioxide emissions mitigated is	12731 tonnes.
This installation will be equivalent to planting	20369 Teak trees over the life time. (Data from IISc)

Disclaimer: The calculation is indicative in nature. Generation may vary from location to location.

Thus, it is suggested here to increase frequency of solar panel and also remove trouble root cause by external audit. These action will increase at least 5% annual solar generation,

Solar Power generation 2022-23	397749	kWh
% increase of solar power generation increase of cleaning frequency and attend trouble cause	19887.45	kWh
Power cost	8.32	Rs./kWh
Annual saving	1.65	Rs. Lakh
Investment	1.00	Rs.Lakh
Simple payback period	8	Month

CHAPTER-3
POWER DISTRIBUTION

3.1. Tranformer

One number transformer of rating 1000 kVA is installed to supply power to whole campus and technical detail of it is depicted as below in Table 3-1

Table 3-1: Monthly Grid Power Consumption Pattern

Description	Technical Detail	Unit
Make	Kirloskar Electrical CO. Ltd	
Rating	1000	kVA
HV	11	KV
LV	433	V
HA	52.476	Amp
LA	1333.1	Amp
Phase	3	phase
Type of Cooling	ON AN	
Frequency Voltage	50	Hz
Manufacturing Year	1997	
TAP Change	Manual	

Standard no-load and load of different rating transformer is depicted below in table,

Table 3-2: Typical 3 Phase Transformer Losses

Typical 3 Phase Transformer losses of various capacities (for CRGO Core Transformers)		
Rating (KVA)	**No Load Loss (W)**	**Load Loss (W)**
100	320	1950
160	455	2800
250	640	4450
500	900	6450
630	1260	9300
1000	1800	13300
1600	2600	19800
2000	3200	21000
3150	4600	28000
5000	6500	38000
6300	7700	45000
10000	11000	63000
12500	13000	77000
20000	18000	107000
31500	25000	150000
40000	30000	180000

Source: Siemens Electrical Engineers Hand Book

From above table, as the rating of transformer increases, no load losses and load loss also increases. Thus, high capacity of transformer more than 30%, increases annual loss.

3.2. Transformer Loading

Transformer Loading is depicted as below,

Table 3-3: Main Transformer Power Loading

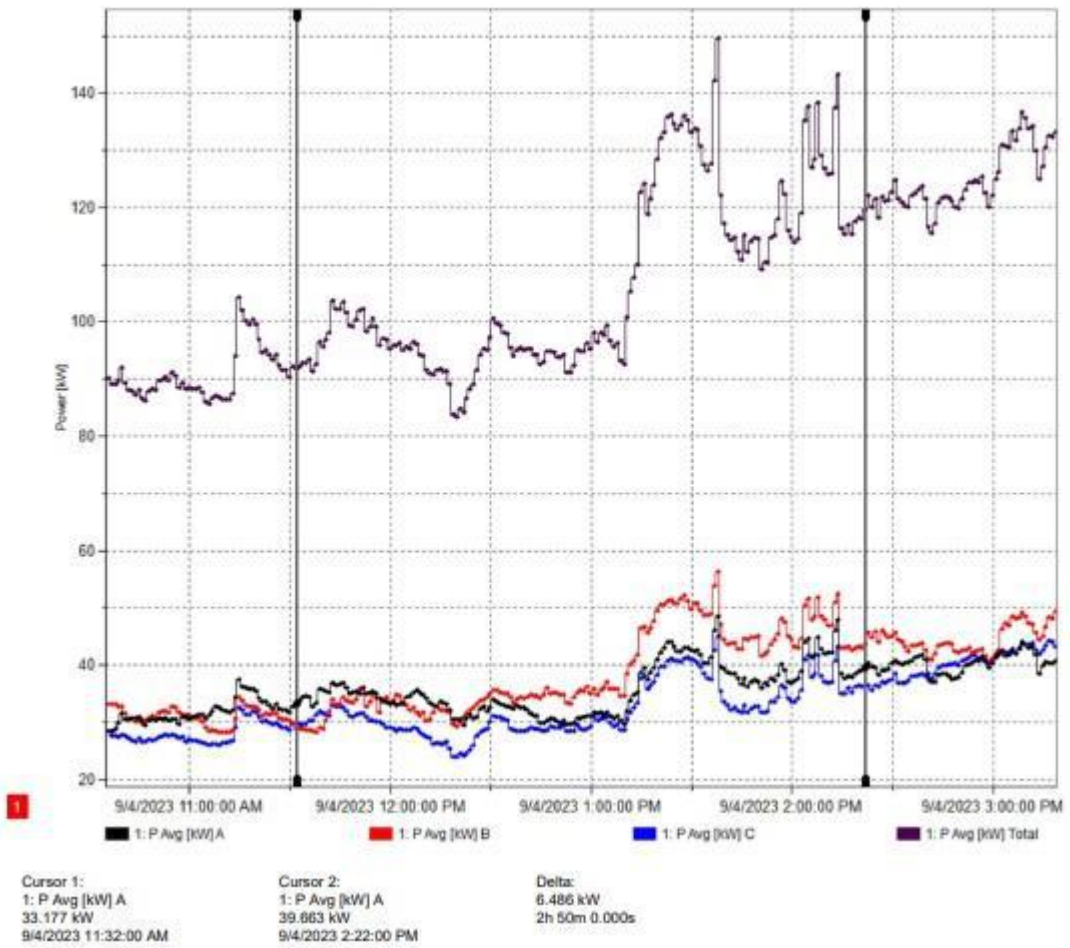
	Voltage			**Current**			**Pf**	Power	
	Ur	Uy	Ub	Ar	Ay	Ab		kWh	kVAh
Transformer 1000 kVA									
Min	367	369	368	143.5	137.6	127.1	0.85	83.4	95.8
Max	392	394	394	243.5	282.5	222.0	0.95	149.6	164.5
Avg	380	382	382	172.4	185.7	159.2	0.92	107.2	116.7

- Supply voltage is lower side and need to maintain near 420 V or above. It may be maintain by adjustment of tap changer of transformer. At low voltage, current supply will be high, which ultimately increases distribution losses (cable los is proportional to square of current flow in cable).

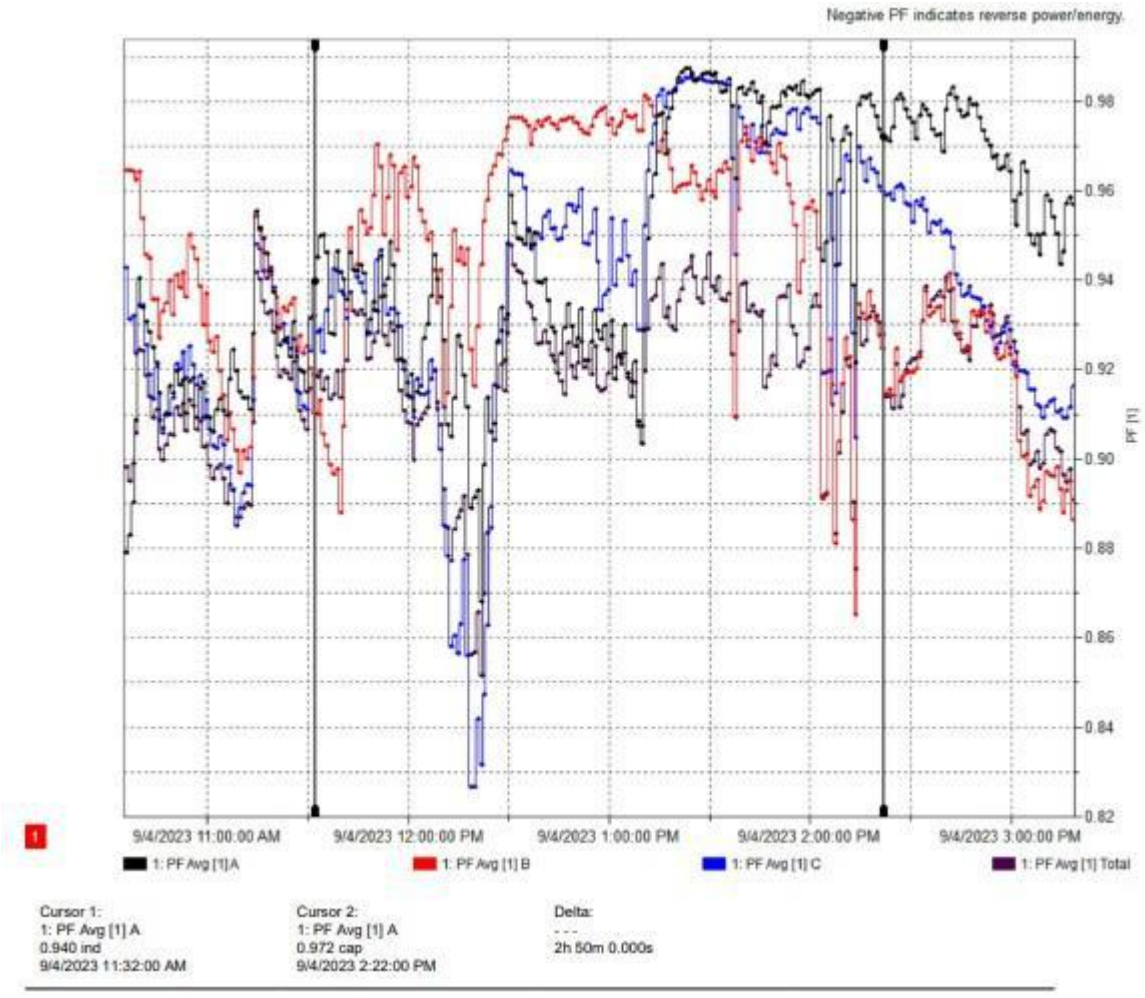
Table 3-4: Harmonics at Main Transformer in Working Hrs

	Freq	Voltage Harmonics			Current Harmonics		
Transformer 630 kVA							
	Hz	**Thd Ur**	**Thd Uy**	**Thd Ub**	**Thd Ar**	**ThdAy**	**Thd Ab**
Min	49.8	1.0	1.0	0.9	12.8	12.3	14.6
Max	50.2	1.6	1.6	1.6	23.6	26.6	26.4
Avg	50.0	1.2	1.2	1.2	19.3	20.8	21.5

- Voltage harmonics at transformer end is found below 5%.
- Yellow highlighted current harmonics is found above IEEE limit.



Power Factor

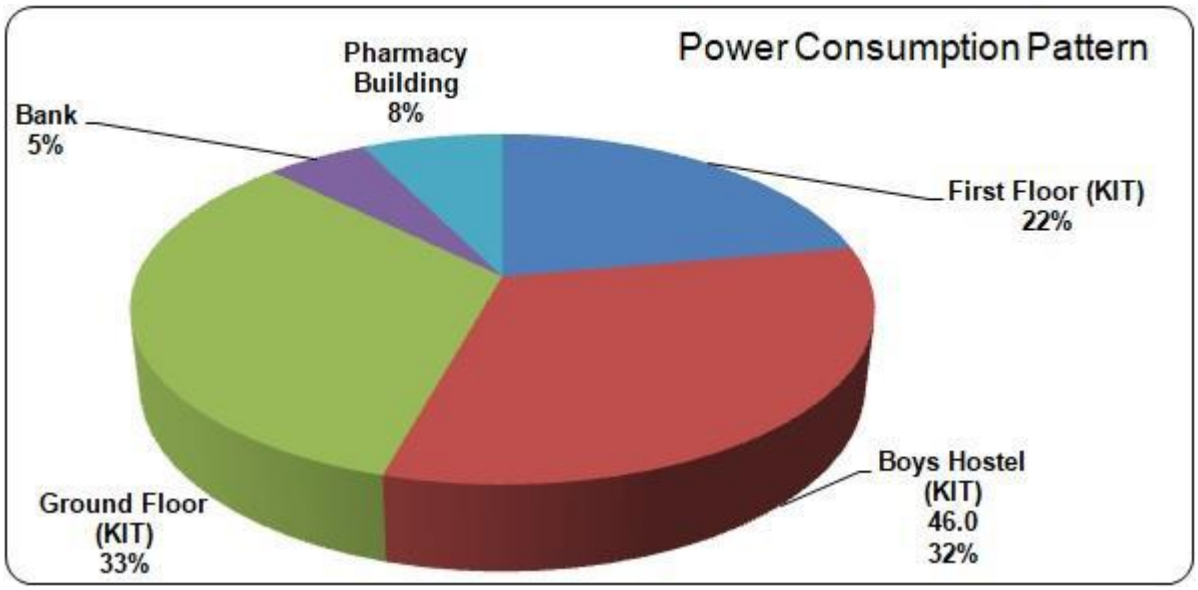


- As the load decreases power factor is also, thus need to adjust lower capacity rating (1, 2, 3 and 5 kVAr rating) capacitor banks.

3.3. Power Consumption Patter of Diiferent Block

Power Consumption in Pharmacy and other building depicted below in table (power distribution),

Building Name	First Floor (KIT)	Boys Hostel (KIT)	Ground Floor (KIT)	Bank	Pharmacy Building
Voltage	393.2	391.4	389.7	394.9	393.2
Current	54.9	91.7	73	18.4	15.8
KW	31.8	46.0	47.3	7.6	10.5
P.F	0.85	0.74	0.96	0.6	0.98



- Pharmacy Block consumes only 8% of total power consumption in KITP Kanpur.

3.4. Oberservation

- Supply voltage is too low and needs to adjust it, by changing of tap position. (Increase tap position manually).
- Each equipment draw power from supply power to do useful work. If supply voltage is lower side, then, equipment draw more current for same work and cable loss is equal to I^2R. Where, R= Resistant, which is constant. While I= current. If current is an increase then, cable loss will increase more.

.

CHAPTER-4
DG SET

4.1. System Installed

Three DG Sets of capacity 380 kVA, 125 kVA, & 62.5 kVA are installed in KITP Kanpur, for in-house for power generation, in case of failure of grid supply and restriction. In solar power generation.

Technical Specification of 380 kVA, 125 kVA, & 62.5 kVA, as shown in below Table,

Table 4-1: 380 kVA, 125 kVA & 62.5 kVA Set Technical Specification

Rating	380 kVA	125 kVA	62.5 kVA	Unit
Make	Cummins/ Jackson			
Engine Power	457	200	66	kW
AC VOLT	415	415	425	V
AC Amp	529	200	87	A
Phase	3	3	3	
Pf	0.8	0.8	0.8	PF
RPM	1500	1500	1500	RPM
Connection	STAR	STAR	STAR	STAR
Insulation Class	H	H	H	Class

Normally, 380 kVA DG set is taken on load, in case of grid failure as per requirement. 62.5 kVA DG set is used for lighting load particularly in night.

4.2. 380 kVA DG Set Loading

Power loading of 380 kVA is recorded and summary of it is depicted as below table,

Table 4-2: 380 kVA DG Power Loading Pattern

	Voltage			Current			Pf	Power	
	Ur	Uy	Ub	Ar	Ay	Ab		kWh	kVAh
380 kVA DG									
Min	394.7	393.7	402.0	253.7	242.6	219.0	0.80	140.6	175.2
Max	412.1	411.2	417.7	431.7	384.0	360.3	0.92	254.2	284.4
Avg	410.3	409.1	415.6	373.2	344.9	320.7	0.88	221.0	249.5

- Average loading is recorded 65.7% (approx).

Table 4-3: 380 kVA DG Harmonics Level

	Freq	Voltage Harmonics			Current Harmonics		
380 kVA DG							
	Hz	Thd Ur	Thd Uy	Thd Ub	Thd Ar	ThdAy	Thd Ab
Min	48.6	2.5	2.5	2.2	5.6	5.1	5.8
Max	50.6	3.5	3.6	3.4	9.0	8.2	8.4
Avg	50.0	3.1	3.2	2.9	6.4	5.8	6.5

- Voltage and current harmonics is found within the IEEE limit.
- Since fuel tank dimension is not known, that why, unable to calculate specific fuel consumption.

4.3. DGs Operation History

Operating hours and fuel consumption of all DGs is depicted in below table,

Table 4-4: DG data analysis

Month	Avg Load			HSD consumption			Running Hours		
	380 kVA	125 kVA	62.5 kVA	380 kVA	125 kVA	62.5 kVA	380 kVA	125 kVA	62.5 kVA
	kW	kW	kW	Litre	Litre	Litre	Hrs	Hrs	Hrs
Jul-23	177.95	570	0	275	204	0	6.2	13.8	0.0
Jun-23	159.92	64.02	0	1143	419	0	34.5	25.5	0.0
May-23	165.75	56.37	0	555	265	0	17.7	16.5	0.0
Apr-23	113.79	54.35	0	695	379	0	21.7	23.3	0.0
Mar-23	112.75	55.87	0	717	247	0	25.4	17.0	0.0
Feb-23	104.97	52.84	0	135	83	0	5.0	5.1	0.0
Jan-23	92.11	44.92	0	232	22	0	9.1	1.2	0.0
Dec-22	102.17	53.09	0	218	110	0	8.0	7.1	0.0
Nov-22	115.2	54.95	0	209	56	0	6.1	3.1	0.0
Oct-22	162.16	55.02	48	136	83	6	3.0	6.1	0.1

Sep-22	169.36	58.67	23.33	836	100	27	28.0	8.1	4.1

Table 4-5: DG loading data analysis

Month	380 kVA DG		125 kVA DG		62.5 kVA DG	
	% power Loading	HSD cons Litre/ hr	% Power Loading	HSD cons Litre/ hr	% Power Loading	HSD cons Litre/ hr
Jul-23	58.5%	44.6	57.0%	14.7	0.0%	-
Jun-23	52.6%	33.1	64.0%	16.4	0.0%	-
May-23	54.5%	31.4	56.4%	16.1	0.0%	-
Apr-23	37.4%	32.1	54.4%	16.2	0.0%	-
Mar-23	37.1%	28.2	55.9%	14.5	0.0%	-
Feb-23	34.5%	27.0	52.8%	16.2	0.0%	-
Jan-23	30.3%	25.6	44.9%	19.1	0.0%	-
Dec-22	33.6%	27.3	53.1%	15.4	0.0%	-
Nov-22	37.9%	34.2	55.0%	18.0	0.0%	-
Oct-22	53.3%	44.8	55.0%	13.6	96.0%	51.4
Sep-22	55.7%	29.9	58.7%	12.4	46.7%	6.6

Table 4-6: HSD Consumption In DG Standard

Generator Size	Approximate Diesel Fuel Consumption			
	¼ Load (litres/hr)	½ Load (litres/hr)	¾ Load (litres/hr)	Full Load (litres/hr)
8kW / 10kVA	0.9	1.2	1.7	2.1
10kW / 12kVA	1.0	1.4	2.1	2.6
12kW / 15kVA	1.3	1.8	2.6	3.2
16kW / 20kVA	1.7	2.4	3.5	4.3
20kW / 25kVA	2.1	3.0	4.3	5.4
24kW / 30kVA	2.6	3.6	5.2	6.4
32kW / 40kVA	3.4	4.8	7.0	8.6
40kW / 50kVA	4.3	6.0	8.6	10.7
60kW / 75kVA	6.4	9.0	12.7	16.1
80kW / 100kVA	8.3	11.9	16.1	21.4
120kW / 150kVA	10.9	17.3	24.1	32.1
160kW / 200kVA	14.1	22.9	32.7	42.8
200kW / 250kVA	17.4	28.6	40.8	53.5
280kW / 350kVA	23.7	39.3	56.0	74.9
400kW / 500kVA	33.3	55.6	79.6	107.0

4.4. OBSERVATION

- HSD consumption in all three DG sets is found on lower side except in 62.5 kVA DG set in Oct 2022.

CHAPTER-5
CAPACITOR BANK

5.1. Performance of Capacitor

One number APFC panel of rating 175.5 kVAr is connected with the main LT panel in KITP Kanpur. Details of capacitor banks installed in the APFC panel are depicted below in Tables,

APFC Panel

Table 5-1: Capacitor Bank

Sr. no.	Capacitor Bank Rating	No.	Total Capacitance
1	1 kVAr	1	1 kVAr
2	2 kVAr	2	4 kVAr
3	4 kVAr	2	8 kVAr
4	7.5 kVAr	1	7.5 kVAr
5	15 kVAr	1	15 kVAr
6	20 kVAr	7	1400kVAr
	Total		**175.5kVAr**

5.2. Obeservation

- From above Table 5-1, performance of each capacitor bank is found satisfactory.

CHAPTER-6
ILLUMINATION & FANS

6.1. Light Fixtures

KITP Kanpur established in the year 2009 and conventional light fixtures were installed for illumination purpose. New technology developed, and new energy efficient light fixtures LED got available later in the market with reasonable price. KIP authority has also taken a step towards energy efficiency and replacing conventional light fixtures with LED light fixtures in phase manner. The detail of light is shown in below Table,

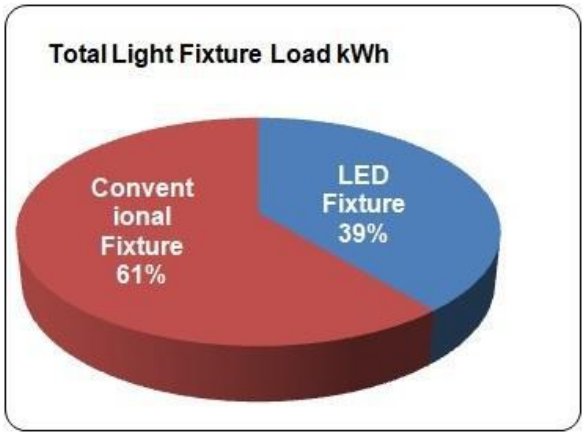
Table 6-1: Light Fixture

Sr. no.	Description	Watt	no.	Total Load kWh
1	Florescent Tube / CFL (Choke=15 W)	36	1150	58.65
2	LED Tube Light	20	1350	27.00
3	LED Bulb	9	150	1.35
4	LED Panel 2X2	30	50	1.50
5	LED Lamp	15	25	0.38
6	LED Street Light	45	52	2.34
7	LED Security Light	200	20	4.00
8	LED Focus Light	70	35	2.45
9	Pole Light Halogen	500	5	2.50
10	**Total**		**2837**	**100.17**

Share of LED fixtures and conventional fixtures load is given below in Table 5-2,

Table 6-2: Light Load

Sr. no.	Description	Total Load kWh
1	LED Fixture	39.02
2	Conventional Fixture	61.15
3	Total	100.17



6.2. Fans

Different type of fans are installed in KIP Varanasi and detail of them are depicted below in a Table 6-3,

Table 6-3: Fans

Sr. no.	Fans	No.	Total Load - kWh
1	Ceiling Fan 60 Watt	1775	106.5
2	Wall Fan 40W	235	9.4
3	Exhaust Fan 100 Watt	72	7.2
	Total	2082	123.1

6.3. Lux

Value of Lumen per square meter is called lux or lux level in that area.
As per *Illuminating Engineers Society Recommendations Handbook* the recommended lux level is depicted below in a Table 6-4,

Table 6-4: Standard Lux Level

ACTIVITY	CATEGORY	LUX	FOOTCANDLES
Public spaces with dark surroundings	A	20-30-50	2-3-5
Simple orientation for short temporary visits	B	50-75-100	5-7.5-10
Working spaces where visual tasks are only occasionally performed	C	100-150-200	10-15-20
Performance of visual tasks of high contrast or large size	D	200-300-500	20-30-50
Performance of visual tasks of medium contrast or small size	E	500-750-1000	50-75-100
Performance of visual tasks of low contrast or very small size	F	1000-1500-2000	100-150-200
Performance of visual tasks of low contrast or very small size over a prolonged period	G	2000-3000-5000	200-300-500
Performance of very prolonged and exacting visual tasks	H	5000-7500-10000	500-750-1000
Performance of very special visual tasks of extremely low contrast	I	10000-15000-20000	1000-1500-2000

A-C for illuminances over a large area (i.e. lobby space)
D-F for localized tasks
G-I for extremely difficult visual tasks

The first value in the above table is lower limit (min requirement of lux), second value is average value and last value is indicating the higher level of Lux.

6.4. Measured Lux Level

Lux level of offices, class rooms and Laboratory etc has been measured and result is depicted as below,

Table 6-5: Lux Level Measured

Sr. No.	Location	Lux Level Measured
	Ground Floor	
1	Panel Room	204
2	Pharmaceuticals Lab I	222
3	Director Sir Room	167
4	Pharmacy Practice Lab	160
5	HOD Room	154
6	Main Office	237
7	Examination Room	169
8	Faculty Room	152
	First Floor	
9	Class Room 204,201,203	250
	Second Floor	
10	Class Room 301,302,303	257

- Lux level at above location found satisfactory.

6.5. Recommendation

- **Replacement of 36 W Tube Light with 20 W LED fittings in phase manner.**

Conventional 36 W fluoresce tube light consumes total 51 W power per fixture (including 15 W choke) and produces around 2800 lumen. The operating life of T8 is approx 10000 hrs and these types of tube light have environment issues & contain mercury.

Energy saving has been worked out after replacement all above conventional tube light with 20 W LED tube fixture is depicted below in Table,

Basis:-

Total fluoresce tube/ CFL =1150 no.

Considering fluoresce tube =50% of Total =575 no.

Table 6-6: 36 W Tube Light Fixture Replacement

Considering 50% fluoresce tube Light	575	no.
Power consumption in one Tube light	51	Watt
Power consumption in LED tube light	20	Watt
Difference in power consumption	31	Watt
Annual operating hrs (250 day for 8 hrs)	2000	hr
Annual power saving	71300	kWh
Power cost	12.0	Rs./kWh
Annual Energy saving	8.54	Rs. Lakh
Investment @Rs. 500 per LED tube	2.88	Rs. Lakh
Simple payback period	**5**	**Month**

- **Replacement of Fans with BLDC Based motor Fans**

For years, ceiling fans used to come with the same hardware of induction motor which typically consumed **60-80 watts** for a standard ceiling fan. But in the last few years, a new technology called **BLDC** is being used to make fans consume a lesser amount of energy, without compromising much on the air delivery. **BLDC** stands for **brush-less direct-current motor**, a special type of motor which has permanent magnet instead of electromagnets found in a conventional induction motor. BLDC motor has important advantages over induction motor like low electricity consumption, lesser noise generation and better lifespan.

Efficiency is all about achieving the same results while using lesser electricity. Typical ceiling fans/ wall fans made with the conventional design are made of single-phase induction electric motor. Most of the prevailing fan manufacturers used aluminum than copper in the fan, as it is cheaper. But aluminum is less energy efficient. The end result is that most of the traditional technology fans consumed about 8**0-100 watts** of electricity. The air delivery of these fan ranges between **210 to 250 m^3/min**

BEE 5 star rated fans consumes about 30 **watts** of electricity which were also called **super-efficient fans and** deliver between **230-270 m3/min air flow.**

Prominent advantages of BLDC motor over induction motor is depicted as below,

Lower Electricity Consumption (65% savings)

Longer backup on Inverters (even on Solar)
Improved reliability
Noise reduction
Longer lifetime
Now energy efficient BLDC motor based wall fans & cabin fans are also available in the market and they consumes max power 30 Watt each.

- **Replacement of 60W Conventional Fans With BLDC Fans**

Thus, it is advise here to replace all conventional 60 W fans with 20 W BLDC based motor fans in a phase manner and annual energy saving has been estimated below in Table,

Table 6-7: Ceiling Fan Replacement

No. of 60 W Ceiling Fans installed	1775	no.
Power consumption in 60 W Ceiling Fan	60	Watt
Power consumption BLDC Fans	30	Watt
Difference in power cons.	30	Watt
Annual operation hrs (200 days for 8 hrs)	1600	Hrs
Annual power saving	85200	kWh
Power cost	12.0	Rs./kWh
Annual energy saving	10.20	Rs. Lakh
BLDC Ceiling Fans cost @Rs.2500/ Fan	35.5	Rs. Lakh
Simple payback period	**42**	**Month**

- **Replacement of 40 W. Conventional Wall Fans With BLDC Fans**

Similar BLDC ceiling fan, BLDC wall fans are also available in market with 20 Watt power rating. Thus, it is advise here to replace all conventional 40 W wall fans with 20 Watt BLDC based motor wall fans in a phase manner and annual energy saving has been estimated below in Table

Table 6-8: Wall Fan Replacement

No. of 40 W Wall Fans installed	235	no.
Power consumption in 40 W wall Fan	40	Watt
Power consumption BLDC Wall Fans	20	Watt
Difference in power cons.	20	Watt
Annual operation hrs (200 days for 8 hrs)	1600	Hrs

Annual power saving	7520	kWh
Power cost	12.0	Rs./kWh
Annual energy saving	0.90	Rs. Lakh
BLDC wall Fans cost @Rs.2000/ Fan	4.70	Rs. Lakh
Simple payback period	63	Month

- **Replacement of 100 W Conventional exhaust fans With BLDC Fans**

Similar BLDC ceiling fan, BLDC exhaust fans are also available in market with 20 Watt power rating. Thus, it is advise here to replace all conventional 40 W wall fans with 20 Watt BLDC based motor wall fans in a phase manner and annual energy saving has been estimated below in Table

Table 6-9: Exhaust Fan Replacement

No. of 100 W exhaust fans installed	72	no.
Power consumption in 100 W exhaust fan	100	Watt
Power consumption BLDC exhaust fans	20	Watt
Difference in power cons.	80	Watt
Annual operation hrs (200 days for 10 hrs)	2000	Hrs
Annual power saving	11520	kWh
Power cost	12.0	Rs./kWh
Annual energy saving	1.38	Rs. Lakh
BLDC exhaust fans cost @Rs.2000/ piece	1.80	Rs. Lakh
Simple payback period	16	Month

- **Installation Occupancy sensor**

PIR, dual sensors based on (vibration and thermal based) occupancy sensors are available in the market. These sensors switch off power supply to light fixtures, fans and ACs etc. If there is no occupancy in offices, class rooms, lobbies, wash rooms etc.

Actual energy saving by installation of occupancy saving is not possible, trend has shown the used of occupancy sensor-based system, which gives at-least 10 - 15 % energy saving in lighting & fan system.

CHAPTER-7
PUMP

7.1. Pump Installed

Six submersible pumps area installed at different location and their detail is depicted below in a Table 7-1.

Table 7-1: Pump

Sr. no.	Type	Name	Motor Rating	Head m	Capacity Litre/min
1	Submersible Pump	Varuna	3 HP	50	100
2	Submersible Pump	CRI	3 HP	50	120
3	Submersible Pump	CRI	3 HP	50	120
4	Submersible Pump	Varuna	3 HP	50	130
5	Submersible Pump	Varuna	3 HP	50	130
6	Submersible Pump	Kisan	2HP	30	75

Water requirement in KITP Kanpur is fulfilled from bore water pump. Bore water pump draws water underground water and supply water to storage tanks installed on roof of institute buildings.

There is no water level controller is installed in water storage tank installed. It is advised to install level control in water storage tanks in a series and synchronize with bore water pump. It will not only save wastage of water but also save energy.

Water flow and power consumption of running pump has measured and results are depicted as below,

Table 7-2: Pump Measurement

Pump Identification	Unit	Flag Lawn	KIHE/ Polytechnic	LT Block	Mesh /Girls Hostel	Pharmacy/ Boys Hostel
Measured Flow	m^3/hr	7.2	4.4	4.9	7.3	7.2
	LPM	120	73	82	122	120
Power Consumption	Voltage	220	221	222	225	224
	Current	14	6.5	16	6.5	12
	KW	**2.1**	**1.2**	**2.0**	**1.1**	**1.9**

Pump Identification	Unit	Flag Lawn	KIHE/ Polytechnic	LT Block	Mesh /Girls Hostel	Pharmacy/ Boys Hostel
	P.F	0.68	0.82	0.57	0.76	0.7
Electrical Loading	%	94%	79%	90%	50%	84%

CHAPTER-8
PACKAGE AC

8.1. System Installed

Total six package AC units are installed to maintain air conditioning atmosphere in class room, offices & laboratory etc. The detail of package ACs is given below a Table 8-1,

Table 8-1: Package AC

sr. no.	Type	TR	No.	BEE Star
1	Window	1	1	
2	Window	1.5	3	2- 3 star
3	Window	2	4	2- 3 star
4	Split	1	4	
5	Split	1.5	8	2- 3 star
6	Split	2	6	2- 3 star
7	Split	2.5	4	2- 3 star
8	Package AC	5.5	49	
9	Package AC	8.5	1	
10	Package AC	11	3	
11	Package AC	16.5	4	
12	Package AC	22	2	

8.2. Suggestion

Now inverter AC is available in Indian market, which can save energy by 30% as claimed by its manufacturer. The detail benefits and their function is described as below,

The inverter technology is the latest advancement concerning the electromotor of compressors. An inverter is used to regulate the speed of the compressor motor in order to adjust the temperature. The main feature of an **inverter AC** is its ability to control its compressor motor speed. The regulated speed allows the unit to maintain the temperature without having to power down its motor. This means an inverter air conditioning unit is way more energy-efficient than non-inverter ones.

Key Advantages of Inverter AC

- Consumes less power in comparison to a traditional AC.
- No voltage fluctuation.
- Keeps constant room temperature.
- Effective cooling.
- Suitable for small and large spaces.
- Safe for residential wiring due to lower power consumption.
- Environment-friendly.

  - Inverter AC cost is too high, thus, it is advise here, whenever new AC is going to be procure. Procure only an inverter, it will save around 30% power consumption.