PANIPAT INSTITUTE OF ENGINEERING & TECHNOLOGY

70 Mile stone, Grand Trunk Road, Samalkha, Haryana 132102

PANIPAT INSTITUTE OF ENGINEERING & TECHNOLOGY

(Approved by AICTE, New Delhi & Affiliated to Kurukshetra University, Kurukshetra)

ENERGY AUDIT REPORT

(2023-2024)

Audit Done By

SEEC

SRISHTI ENGINEERING & ENERGY CONSULTANTS

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DIRECTOR
PANIPAT INSTITUTE OF ENGINEERING TECHNOLOGY
PATTI KALYANA (SAMALKHA)

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PATTI KALYANA (SAMALKHA)

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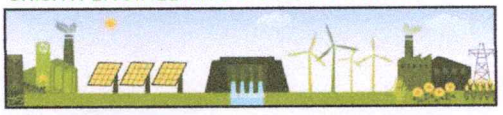

CERTIFICATE

PRESENTED TO

PANIPAT INSTITUTE OF ENGINEERING & TECHNOLOGY

70 Mile stone, Grand Trunk Road, Samalkha, Haryana 132102

Has been Assessed by Srishti Engineering & Energy Consultants for the comprehensive study of Energy Audit on institutional working framework to fulfill the requirements of

ENERGY AUDIT

The green initiatives carried out by the institute has been verified on the details submitted and was found to be satisfactory.

The efforts taken by the management and the faculty towards energy, environment and sustainability are appreciated and noteworthy

Srishti Engineering & Energy Consultants Auth. Sign.

Signature Lead Auditor

DIRECTOR
PANIPAT INSTITUTE OF ENGINEERING TECHNOLOGY
PATTI KALYANA (SAMALKHA)

Dated: 06.04.2024

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ACKNOWLEDGEMENT

SEEC would like to thank the management of **Panipat Institute of Engineering and Technology** for assigning this important work of Green Audit. We appreciate the co-operation to the teams for completion of assessment. We would also like to thank Vice Chairman - Shri. Rakesh Tayal, Director - Prof. (Dr.) J. S. Saini, Dean Academics - Prof. (Dr.) D. P. S. Chauhan, Energy Audit Coordinator – Er. Amit Dubey, Dr. Neeraj Gupta and Er. Amit Dubey and Teaching/Supporting Staff of institute has been invaluable to the success of this report., for his continuous support and guidance, without which the completion of the project would not have been possible. We are also thankful to other staff members who were actively involved while collecting the data and conducting field measurements.

Last but not the least, we would like to give **special thanks to Dr. Neeraj Gupta- Head (Information Technology) & Er. Amit Dubey** for giving us an opportunity to evaluate the environmental performance of the campus.

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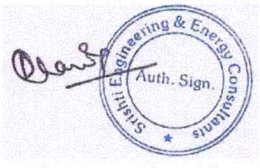
DISCLAIMER

SEEC Audit Team has prepared this report for **Panipat Institute of Engineering and Technology** based on input data submitted by the representatives of college complemented with the best judgment capacity of the expert team. While all sensible care has been taken in its preparation, details contained in this report have been compiled in good faith based on information gathered. It is further informed that the conclusions are arrived following best estimates and no representation, warranty or undertaking, express or implied is made and no responsibility is accepted by Audit Team in this report or for any direct or consequential loss arising from any use of the information, statements or forecasts in the report. If you wish to distribute copies of this report external to your organization, then all pages must be included. **SEEC**, its staff and agents shall keep confidential all information relating to your organization and shall not disclose any such information to any third party, except that in the public domain or required by law or relevant accreditation bodies. **SEEC** staff, agents and accreditation bodies have signed individual confidentiality undertakings and will only receive confidential information on a 'need to know' basis.



Signature
Lead Auditor

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CONCEPT AND CONTEXT

The **National Assessment and Accreditation Council, New Delhi (NAAC)** has made it mandatory from the academic year 2019–20 onwards that all Higher Educational Institutions should submit an annual Green, Environment and Energy Audit Report. Green Audit is assigned to the Criteria 7 of NAAC, National Assessment and Accreditation Council which is a self-governing organization of India that declares the institutions as Grade A, Grade B or Grade C according to the scores assigned at the time of accreditation. Moreover, it is part of Corporate Social Responsibility of the Higher Educational Institutions to ensure that they contribute towards the reduction of global warming through Carbon Footprint reduction measures. In view of the NAAC circular regarding Green auditing, the College management decided to conduct an external environment assessment study by a competent external professional auditor. The green audit aims to examine environmental practices within and outside the college campus, which impact directly or indirectly on the atmosphere. Green audit can be defined as systematic identification, quantification, recording, reporting and analysis of components of college environment. It was initiated with the intention of reviewing the efforts within the institutions whose exercises can cause risk to the health of inhabitants and the environment. Through the green audit, a direction as how to improve the structure of environment and inclusion of several factors that can protect the environment can be commenced. This audit focuses on the Green Campus, Waste Management, Water Management, Air Pollution, Energy Management & Carbon Footprint etc. being implemented by the institution.

The purpose of the audit is to identify areas where the institute can improve its sustainability practices and reduce its environmental impact. It also helps universities demonstrate their commitment to sustainability and meet NAAC's accreditation criteria.

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1.0 Energy Audit-Introduction

An energy audit is an inspection survey and an analysis of energy flows for energy conservation in a building. It may include a process or system to reduce the amount of energy input into the system without negatively affecting the output.

1.1 NEED FOR ENERGY AUDITING

India is the 6th largest consumer of energy in World. Rapid industrialization of the country and prevailing boom in the economy has resulted in the power demand outstripping the current total generation capacity by 10%. To overcome this shortage and for meeting the ever rising electricity demand in the coming years, the nation has proposed capacity expansion by 39920 MW and 60896MW in the 10th and 11th Five Year Plans respectively. However, these capacity additions will come at a mammoth cost of nearly Rs. 900000 crore. Hence the message on the wall is clear - there is an urgent need for energy efficiency practices and energy conservation measures for a sustainable development.

Future projections, assuming a business-as-usual scenario under a GDP growth rate of 5%, show that the commercial energy demand for India for the year 2019-20 is projected to be 600 Mote (million tons of oil equivalent) compared to the 1990 consumption level of 200 Mtoe. Conservation of energy assumes great significance in lieu of economic constraints prevailing in our country. Realizing the importance of energy conservation at the national level the Indian government has enacted the energy Conservation Act 2001. The primary objective of the energy Conservation Act, 2001, is to reduce energy intensity (energy per unit GDP) in the Indian economy.

The Energy Audit gives a positive orientation to the energy cost reduction, preventive maintenance and quality control programmes which are vital for production and utility activities. Such an audit program helps to keep focus on variation which occurs in the energy costs, availability and reliability to supply of energy, decide on appropriate energy mix, identify energy conservation technologies, retrofit for energy conservation equipment etc.

In general, energy Audit is the translation of conservation ideas into realities by lending technically feasible solutions with economic and other organizational consideration within a specified time frame.

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• The primary objective of Energy Audit is to determine ways to reduce energy consumption per unit of product output or to lower operating costs. Energy Audit provides a "benchmark" (Reference point) for managing energy in the organization and also provides the basis for planning a more effective use of energy throughout the organization.

METHODOLOGY OF ENERGY AUDIT

• Historical Data Analysis: The historical data collection and analysis involves establishment of energy consumption pattern to locate base line of energy consumption and its variation with change in production volumes. This step involves finding out existing Avg. Specific Energy Consumption.

• Actual Data Analysis: This step involves actual site measurement and field trails. Tally of the energy consumption pattern against actual measurements through ABC analysis. Electrical Parameters for all electrical loads are measured with electrical online load Manger. The parameters measured are actual kW, actual Pf, actual Ampere and Voltage.

• Evaluation of Energy Conservation Opportunities: This step involves evaluation of energy conservation opportunity. It gives potential of energy saving and investment required to get expected modification with payback period. All recommendations given for reducing loses in the system with its cost benefit analysis.

• Monitoring and Control: Energy accounting followed by energy monitoring and control is the first step of serious Energy Management Program. Due to the absence of electricity sub metering, many organizations still have only their electricity bills and captive power generation log books as their only information on electricity consumption. However, with increasing energy prices, many organizations incorporated sub-metering system in their plants. Sub metering is essential for monitoring, establishing energy consumption patter, detailed engineering and energy saving after implementation of energy conservation projects.

The methodology adopted for this audit was

(i) Formation of Audit groups for specific areas and end use

(ii) Visual inspection and data collection

(iii) Observations on the general condition of the facility and equipment and

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quantification

(iv) Identification/verification of energy consumption and other parameters by measurement

(v) Detailed calculations, analyses and assumptions

(vi) Validation

(vii) Potential energy saving opportunities

(viii) Implementation

GROUPING & STRATEGY

The following groups were formed with specific target areas and end uses assigned.

Group 1: Lighting & fans in Main building and all departments, all other buildings including auditoriums, seminar halls, multipurpose sports complex, gymnasium, guest house, health center, hostels, offices, canteen, library, classrooms and laboratories.

Group 2: Lighting common areas covering street lights, grounds, corridors, play ground etc.

Group 3: Electric water heating and wash rooms /ironing loads in hostels and guest house

Group 4: Energy used in Kitchen of hostels and canteen of various faculties,

Group 5: Central Air-conditioning of Library, and all other places where ductable AC is installed including unitary Air-conditioned machines installed in all buildings of the institute.

Group 6: Computers, printers, servers installed in all the Departments and all other buildings on the campus.

Group 7: Water pumps, water coolers and other electric equipment on the campus in various buildings. Group 8: Benchmarking of electricity consumption.

INSTRUMENT USED

• The instruments used by the audit team have been depicted below:

. 1 Clip – On Meter ORPAT, ODCM-400

2 Digital temperature meter MASTECH, ST - 9283A/B/C

3 Power Analyser MECO, 4500

4 Digital Anemometer MASTECH, MS-6250

5 Digital Lux meter MASTECH, MS 6610

6 Digital Tachometer LUTRON, DT-2234

7 Ultrasonic Flow meter SHENITECH,STUF-200H

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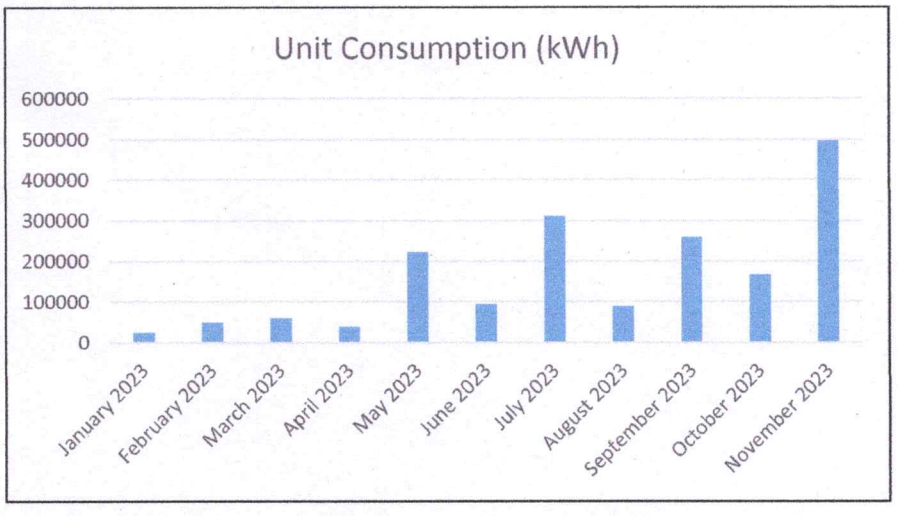
8 Harmonics Analyser KRYKARD,ALM-32

9 Psychrometer

1.0 BASELINE ENERGY DESCRIPTION

The building is consuming different sources of energy - Grid electricity, electricity from diesel generating sets. Electricity is generally used for all electrical devices while diesel is used to operate the DG sets. The building is obtaining the power supply from Uttar Haryana Bijli Vitran Nigam Limited through 11kV line which directly feeds into transformer which steps down voltage from 11kV to 433V. **Graph shows the total billed amount in KWH**



Lighting, pump/ motor load and HVAC are the major energy consuming components in the building, followed by diesel (very less consumption) used in DG sets.

The building utilizes various energy resources to provide best of the amenities in the management, break up of different resources is given below and this consumption of resources forms the baseline/ benchmarking of the energy use.

2.0 Electricity Details (in Units)

As per the details received from the UHBVN

Month	Unit Consumption (kWh)	Solar Plant Generation (kWh)
January 2023	24747	39060
February 2023	49170	24850
March 2023	60590	41720
April 2023	38391	19530

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May 2023	221334	48580
June 2023	94515	18550
July 2023	310728	46900
August 2023	88850	13230
September 2023	259270	38430
October 2023	166736	21140
November 2023	495928	19740
Total	**1810259**	**331730**

Building is getting the power supply from Uttar Haryana Bijli Vitran Nigam Limited through 11kV line which directly feeds into the transformer that is of 500 KVA, which steps down voltage from 11kV to 433V. Details of transformers are given below.

Transformer name plate		
Make & Model No.	**Capacity (kVA)**	**No Load Voltage (kV)**
TR (on loading)	630	HV-11/LV-0.433

Per unit charge for the building is Rs 11.3/kWh.

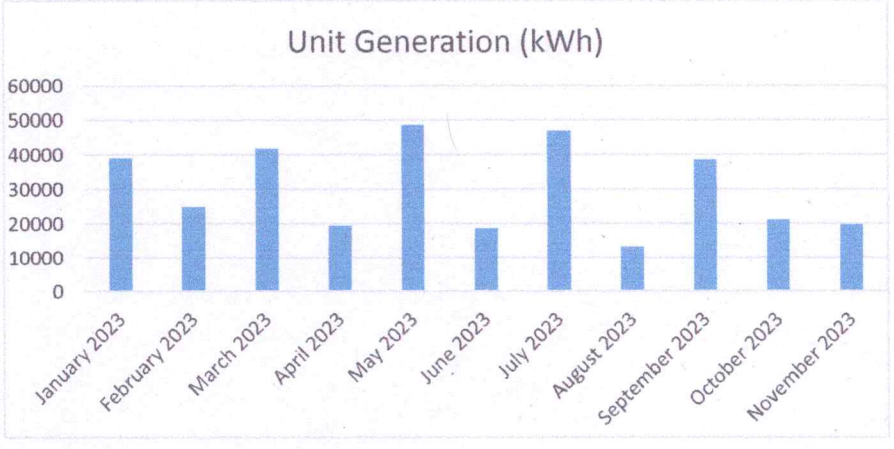
Months	**Avg. Unit Price (Rs./KVAh)**
Mar 2019 – Feb 2020	11.3

Billing is done on KWH basis so there is no need to maintain the power factor at current situation.

Solar Unit Gene ration detailed below:

Total 270KWH solar plant installed at PIET.

- 170 KWH solar plant (Make – Bosch)
- 100 KWH solar plant (Make – Tata)



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3.0 ELECTRICAL LOAD MEASUREMENT

List of equipment installed at PIET are tabulated below:

Location	Equipment Description	UOM	Qty	Capacity (W)
A-Block-Chemistry lab	Hot air oven	Nos	2	2000
	B.O.D. Incubator	Nos	1	2000
	Heater	Nos	4	1000
	Muffle Furnace	Nos	1	1000
B-Block-civil Engineering Lab	Devel Attrition machine	Nos	1	1HP
	Dorry Abrasion machine	Nos	1	1HP
	Mixture	Nos	1	1HP
	Digital oven	Nos	1	2000w
Textile lab-Tcp La b	Water bath	Nos	4	2000w
	Hot air oven	Nos	1	2000w
	Washing fastness testing machine	Nos	1	1HP
	Heater with water	Nos	1	1hp
Textile lab-testing lab	Air motor	Nos	1	0.5HP
	Pilling tester	Nos	1	0.5hp
	Warp reel	Nos	1	0.5HP
	Tensile strength tester	Nos	1	1HP
	Bursting strength tester	Nos	1	0.5HP
Textile lab-Knitting lab	Over lock machine	Nos	2	1.5HP
GEAT LAB	Sewing Machine	Nos	11	1HP
MOS Lab-Mechanical Engineering	Universal testing machine	Nos	1	1.5HP
	Universal testing machine	Nos	1	0.37KW
	Muffle Furnace	Nos	1	2000w
	Fatigue testing machine	Nos	1	1HP
	Torsion testing machine	Nos	1	0.37kw
	Polishing Machine	Nos	2	0.5hp
ICGT Lab	Centrifugal Blower test rig.	Nos	1	1HP
	Air Compressor	Nos	1	2HP
	Motor	Nos	1	1HP
Workshop	Lathe machine	Nos	7	1.5HP
	Drilling Machine	Nos	1	0.75HP
	Shaper machine	Nos	1	1.5HP
	Surface Grinder machine	Nos	1	0.75HP
	Tool & cutter Grinder machine	Nos	1	0.5HP
	Milling Machine	Nos	1	1.5HP
	Slotter Machine	Nos	1	0.75HP
	Power Hacksaw	Nos	1	0.5HP
	Kaplan Turbine	Nos	1	5HP

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Fluid Machines Lab	Pelton Turbine	Nos	1	5HP
	Francis Turbine	Nos	1	5HP
	Reciprocating pump	Nos	1	1HP
	Centrifugal pump	Nos	1	1HP
	Ram pump	Nos	1	1HP
	Gear pump	Nos	1	1HP
	Calibration of Venturi meter	Nos	1	0.5HP
	Calibration of Orifice meter	Nos	1	0.5HP
	verify Bernoulli Theorem	Nos	1	0.5HP
	Determination of Minor Loss	Nos	1	0.5HP
	Determination of Friction Loss	Nos	1	0.5HP
	Hydraulic Coefficient of Discharge	Nos	1	0.5HP
	Determine Reynolds Numbers	Nos	1	0.5HP
	Notch Apparatus	Nos	1	0.5HP
	Venturi meter/Orifice meter	Nos	1	0.5HP
Textile lab-Spinning Lab	Speed Frame	Nos	1	10HP
	Draw Frame	Nos	1	5HP
	Carding	Nos	1	5HP
	Compressor	Nos	1	3HP
Fabric Manufacturing lab	Power loom with Dobby	Nos	1	01HP
	Power loom with Jacquard	Nos	1	01HP
	Sectional warping machine	Nos	1	03HP
	Pirn winding machine	Nos	1	02HP
	Rapier loom machine	Nos	1	5.5KW
	SERVO MOTOR	Nos	2	0.55KW
	Cone winding machine	Nos	1	01HP
Old Workshop - Mechanical Workshop	Drill Machine	Nos	4	01HP
	Grinder Machine	Nos	1	01HP
	Arc Welding machine	Nos	2	7500W
Old Workshop-Civil Engineering	Mixture	Nos	1	02HP
	Los Angeles Abrasion testing Machine	Nos	1	02HP
	Digital Compression Testing machine	Nos	1	02HP
	Flow Table test Machine	Nos	1	01HP
	Relative Density Test Machine	Nos	1	01HP
	Digital Oven	Nos	1	2000W
	MOTOR	Nos	1	1HP
	MOTOR	Nos	1	1HP

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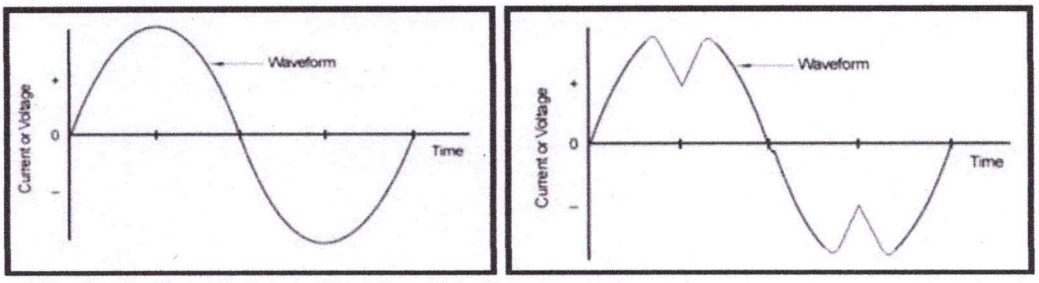
	MOTOR	Nos	1	0.5HP
	MOTOR	Nos	1	1HP
Bus workshop	Air compressor	Nos	1	3HP

4.0 Total Harmonic Distortion

Total harmonic distortion (THD) is an important figure of merit used to quantify the level of harmonics in voltage or current waveforms. Power sources act as non-linear loads, drawing a distorted waveform that contains harmonics. These harmonics can cause problems ranging from telephone transmission interference to degradation of conductors and insulating material in motors and transformers. Therefore, it is important to gauge the total effect of these harmonics. The summation of all harmonics in a system is known as total harmonic distortion (THD).



Major devices which causes harmonics are:

- ☐ Computers, UPS
- ☐ Transformers operating at saturation levels
- ☐ Motors
- ☐ TV Sets, Air Conditioners, Washing Machines, Microwave Ovens
- ☐ Fax Machines, photocopiers, printers

Voltage Distortion Limits

Bus Voltage at PCC	Individual Voltage Distortion (%)	Total Voltage Distortion THD (%)
69 kV and below	3.0	5.0
69.001 kV through 161 kV	1.5	2.5
161.001 kV and above	1.0	1.5
NOTE: High-voltage systems can have up to 2.0% THD where the cause is an HVDC terminal that will attenuate by the time it is tapped for a user.		

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Current Distortion Limits for General Distribution Systems (120 V Through 69 000 V)

Maximum Harmonic Current Distortion in Percent of I_L						
	Individual Harmonic Order (Odd Harmonics)					
I_{sc}/I_L	<11	$11 \le h < 17$	$17 \le h < 23$	$23 \le h < 35$	$35 \le h$	TDD
<20*	4.0	2.0	1.5	0.6	0.3	5.0
20<50	7.0	3.5	2.5	1.0	0.5	8.0
50<100	10.0	4.5	4.0	1.5	0.7	12.0
100<1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	1.4	20.0

Even harmonics are limited to 25% of the odd harmonic limits above.

Current distortions that result in a dc offset, e.g., half-wave converters, are not allowed.

*All power generation equipment is limited to these values of current distortion, regardless of actual I_{sc}/I_L.

where

I_{sc} = maximum short-circuit current at PCC.
I_L = maximum demand load current (fundamental frequency component) at PCC.

The limits on voltage harmonics are thus set at 5% for THD and 3% for any single harmonic. It is important to note that the suggestions and values given in the IEEE Std. 519 standard are purely voluntary. However, keeping low THD values on a system will further ensure proper operation of equipment and a longer equipment life span.

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5.0 MAIN INCOMER

During the audit phase we had installed one power analyzer on the main incomer of PIET on transformer 630 KVA during on load, for monito ring the loading pattern of the building and collected all the parameters like power, current, voltage, power factor and harmonics. We had collected all the parameters at 0.44kV (LT) Level.

630 KVA TRANSFORMERS:

Parameters	Avg.	Max.	Min.
Frequency (F)	49.99	50.15	49.80
Ampere- R phase	72.16	261.5	12
Ampere- Y phase	92.58	252.5	0
Ampere- B phase	81.52	236.5	8.5
Ampere- Neutral	71.15	164.8	30.8
Phase to Neural Voltage- R phase	421.9	434.2	375.8
Phase to Neural Voltage- Y phase	420.4	429.5	371.4
Phase to Neural Voltage- B phase	419.7	435.2	370.4
P.F. Total	0.783	0.977	0.552
KW- Total	69.89	89.57	30.36
V THD % R phase	1.982	3.4	1.4
V THD % Y phase	1.897	3.3	1.3
V THD % B phase	1.656	3.0	0.9
I THD % R phase	37.26	313.6	11.4
I THD %Y phase	42.10	178.7	16.5
I THD % B phase	37.71	344.3	7.2
Voltage Unbalance %	0.335	0.7	0
Current Unbalance %	24.54	81.30	0.8

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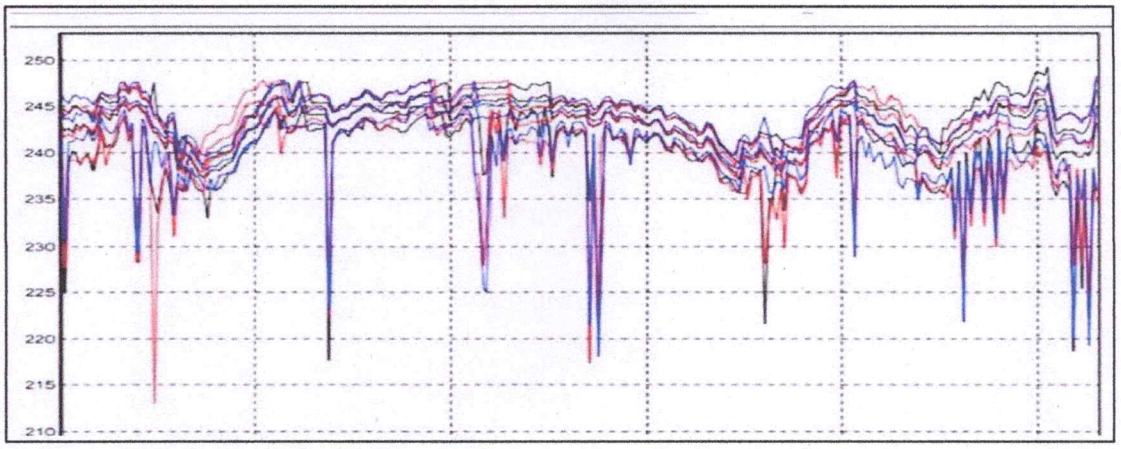
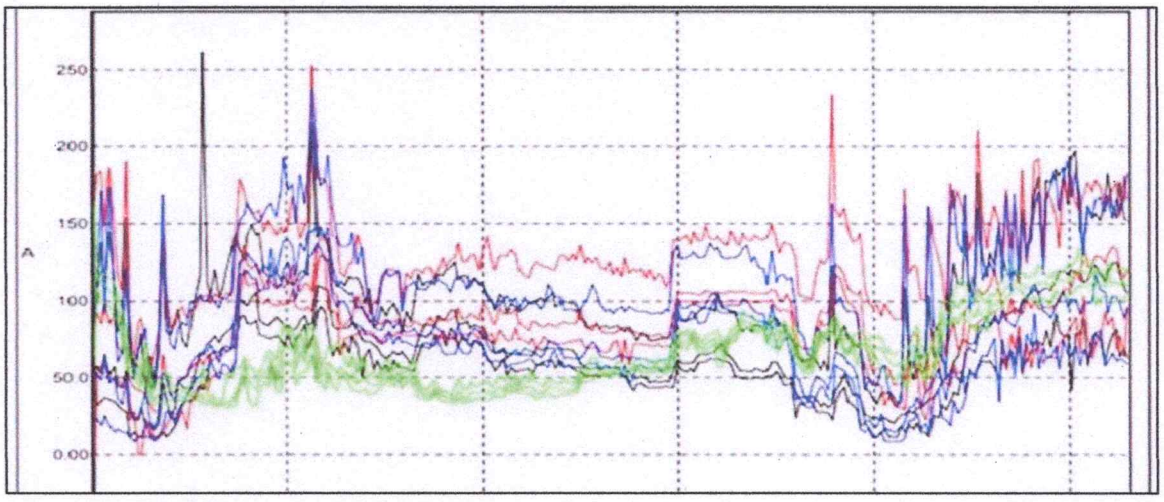
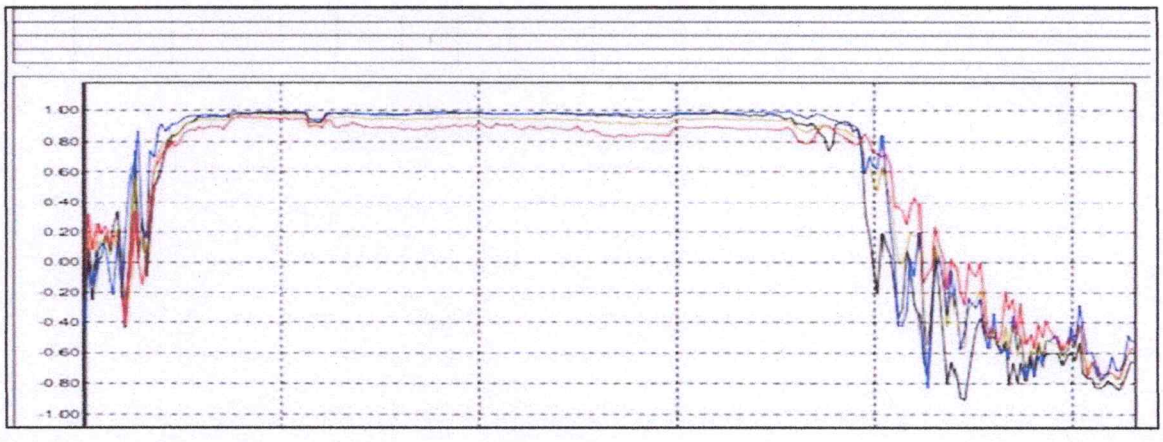
Voltage (V1-R Phase, V2- Y Phase, V3- B Phase)



Current (A1-R Phase, A2- Y Phase, A3- B Phase, AN- Neural)



Power Factor (PF1-R Phase, PF2- Y Phase, PF3- B Phase)



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6.0 Sound dB Monitoring

Sound db monitored at PIET site and details as under.

Sr No.	Location	Max. dB	Min. dB
1	Girls Entry Gate	49	41
2	Girls Hostel Badminton Area	55	47
3	Girls Hostel Corridor ground floor	44	33
4	Girls Hostel Corridor first floor	46	37
5	Girls Hostel Corridor second floor	38	30
6	Girls Hostel Corridor third floor	41	29
7	Girls Hostel Room ground floor	42	29
8	Girls Hostel Room first floor	49	41
9	Girls Hostel Room second floor	51	47
10	Girls Hostel Room third floor	43	41
11	Old Guest House	39	35
12	Cow Shelter	60	56
13	Laundry	65	58
14	Old Boys Hostel Corridor Grd. Floor	51	47
15	Old Boys Hostel Corridor First Floor	53	46
16	Old Boys Hostel Corridor Second Floor	49	42
17	Old Boys Hostel Corridor Third Floor	45	41
18	Old Boys Hostel Room ground floor	47	43
19	Old Boys Hostel Room first floor	51	41
20	Old Boys Hostel Room second floor	39	31
21	Old Boys Hostel Room third floor	38	32
22	Pole light 100 watt	29	21
23	Store room	25	21
24	Kitchen	28	23
25	Canteen ground	33	30
26	Canteen 1st floor	39	35
27	Block A Corridor ground floor	23	21
28	Block A Corridor first floor	22	20
29	Block A Corridor second floor	20	20
30	Block A Corridor third floor	20	20
31	Admin Block Reception	40	38
32	Central Library	28	27
33	Admin Block first floor lobby	25	25
34	Security Office	30	24
35	DG Room Area	36	32

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Recommended sound level as set in CPCB-Environmental Standards- Noise (ambient standards) dB (A)

SCHEDULE

(see rule 3(1) and 4(1))

Ambient Air Quality Standards in respect of Noise

Area Code	Category of Area / Zone	Limits in dB(A) Leq*	
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

Note:- 1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.
3. Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

* dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

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7.0 LIGHTING SYSTEM

The building management had already changed all the old high energy consuming light with the energy efficient LED lights.

AREA WISE LUX LEVEL

Sr No.	Location	Max. Lux	Min. Lux
1	Girls Entry Gate	170	150
2	Girls Hostel Badminton Area	120	80
3	Girls Hostel Corridor ground floor	54	45
4	Girls Hostel Corridor first floor	55	50
5	Girls Hostel Corridor second floor	61	45
6	Girls Hostel Corridor third floor	52	40
7	Girls Hostel Room ground floor	150	90
8	Girls Hostel Room first floor	140	85
9	Girls Hostel Room second floor	141	111
10	Girls Hostel Room third floor	118	95
11	Old Guest House	110	85
12	Cow Shelter	85	64
13	Laundry	138	120
14	Old Boys Hostel Corridor Grd. Floor	195	120
15	Old Boys Hostel Corridor first Floor	180	110
16	Old Boys Hostel Corridor Second Floor	170	116
17	Old Boys Hostel Corridor Third Floor	178	112
18	Old Boys Hostel Room ground floor	195	180
19	Old Boys Hostel Room first floor	199	180
20	Old Boys Hostel Room second floor	195	175
21	Old Boys Hostel Room third floor	200	176
22	Pole light 100 watt	82	76
23	Store room	105	95
24	Kitchen	75	50
25	Canteen ground	65	45
26	Canteen 1st floor	65	45
27	Block A Corridor ground floor	85	80
28	Block A Corridor first floor	84	80
29	Block A Corridor second floor	82	78
30	Block A Corridor third floor	80	70
31	Admin Block Reception	129	107
32	Central Library	185	168
33	Admin Block first floor lobby	148	145
34	Security Office	120	110
35	DG Room Area	95	85

OBSERVATIONS

It was observed that the building has opted the Energy efficient lighting system that is LED which was good option to save energy and we personally felt good to observe it and checked whether the lux level we are getting is sufficient or

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not and was observed that the lux level was good. It was observed that the lux level in some of the areas is within limits and in some areas, it is bit more. Photo sensors are installed in few outdoor lights for automation and control. It is recommended to install photo sensor for all the outdoor lights.

8.0 Air Conditioning

The Building is having the Ceiling fans for air circulation and Air coolers to get comfort and also having window and split AC's for air conditioning.

List of Fan:

Sr. No.	Type	Location	Qty.
1	Ceiling Fan (60 W)	Building	1550
2	Exhaust Fan (200 mm)	Old Boys Hostel	76
3	Exhaust Fan (18")		26
4	Exhaust Fan (12")	Girls Hostel	50
5	Exhaust Fan	A, B, C, D, E & Admin block	32
Total			184

List of AC:

Location	UOM	Qty	Capacity (TR)	Total Capacity (TR)	TYPE	Power Consumption (KW)	Total Power Consumption (KW)
A Block	Nos	1	1	1	WINDOW	1.2	1.2
	Nos	24	1.5	36	WINDOW	1.8	43.2
	Nos	1	2	2	WINDOW	2.4	2.4
B Block	Nos	21	1.5	31.5	SPLIT	1.8	37.8
	Nos	2	2.2	4.4	SPLIT	2.5	5
C Block	Nos	1	1	1	WINDOW	1.2	1.2
	Nos	5	1.5	7.5	WINDOW	1.8	9
	Nos	7	1.6	11.2	SPLIT	1.9	13.3
D Block	Nos	23	1.5	34.5	SPLIT	1.8	41.4
	Nos	17	2	34	SPLIT	2.4	40.8
	Nos	10	4	40	CASSETTE	4.8	48
E Block	Nos	16	1.5	24	SPLIT	1.8	28.8
	Nos	34	2	68	SPLIT	2.4	81.6
	Nos	9	4	36	CASSETTE	4.8	43.2
	Nos	1	2.5	2.5	CASSETTE	3	3
PVR	Nos	22	1.5	33	SPLIT	1.8	39.6
AUDITORIUM	Nos	6	12	72	Package unit	11	66
	Nos	1	1	1	SPLIT	1.2	1.2
NEW BOYS	Nos	21	1.5	31.5	WINDOW	1.8	37.8
	Nos	8	1.5	12	SPLIT	1.8	14.4

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HOSTEL	Nos	1	1	1	WINDOW	1.2	1.2
OLD BOYS HOSTEL	Nos	41	1.5	61.5	WINDOW	1.8	73.8
GUEST HOUSE	Nos	8	1.5	12	WINDOW	1.8	14.4
	Nos	1	1	1	WINDOW	1.2	1.2
	Nos	1	2	2	WINDOW	2.4	2.4
GIRL HOSTEL	Nos	18	1.5	27	WINDOW	1.8	32.4
ADMIN BLOCK	Nos	1	0.8	0.8	SPLIT	1	1
	Nos	2	1	2	SPLIT	1.2	2.4
	Nos	17	2	34	SPLIT	2.4	40.8
	Nos	4	4	16	TOWER	4.8	19.2
	Nos	8	1.5	12	SPLIT	1.8	14.4
	Nos	1	4	4	CASSETTE	4.8	4.8
MAIN GATE	Nos	1	0.8	0.8	WINDOW	1	1
OLD CANTEEN	Nos	8	1.5	12	SPLIT	1.8	14.4
	Nos	4	4	16	CASSETTE	4.8	19.2
Total		**346**		**685.2**			**801.5**

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We can replace the existing ceiling fans with the energy efficient BLDC fans: Savings should be taken as when the fan is needed to be changed as when they get faulty.

Ceiling fan replacement by energy efficient ceiling fans		
Old fan wattage consumption	Wattage	60
Number of fans	Nos	1500
Running hours	hrs./Day	8
Running Days	Days/Year	300
Total load	kWh/annum	216000
Electricity Unit price	Rs./kwh	10
Annual Expenses by old fans	Rs./annum	2160000
New efficient fans Wattage consumption	Wattage	28
Total load	kWh/annum	100800
Annual Expenses by New fans	Rs./annum	1008000
Energy Saved	kWh/annum	115200
Amount Saved	Rs./annum	1152000
Investment	Rs.	4200000
Payback	Years	3.64

It is recommended to replace the girls and boys hostel fans with BLDC fans immediately and plan to replace all the other fans also with BLDC fan.

Note: We can use VRF's in place of different Split and window A.C's doing so will help us to save energy up to 50% of total consumption with AC.

9.0 Projector

The Building is having the projector for classroom as listed below.

List of Projector:

Make	Qty	Power Capacity (W)	Total Capacity (KW)
Sharp Projector	36	190	6840
Benq	46	190	8740
Dell	1	190	190
Optoma	1	190	190
Total			**15960**

Analysis of Projector replacement with LES:

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Particular	UOM	Value
Exiting Projector Power Consumption	KW	0.19
Total no of Projector	Nos	84
Operation Time	HR/Day	8
Operation Days	Days/Year	300
Exiting projector power consumption	kWh/Yea r	38304
Proposed LED power Consumption	KW	0.12
Proposed LED power Consumption	kWh/Yea r	24192
Power saving	kWh/Yea r	14112
Power Cost	Rs/kWh	11
Monitory saving	Rs/Year	155232
Investment	Rs	2500000
Payback	Year	16.10

During analysis it is found that exiting projector replacement with LED is not feasible.

It is recommended to install LED during further expansion or replacement of LED by ageing factor.

List of UPS

Building of PIET installed the UPS for uninterruptible power supply as listed below.

UPS Capacity	Qty	Total (KVA)
20 KVA	4	80
15 KVA	1	15
10 KVA	13	130
Total	**18**	**225**

10.0 AREA OF IMPROVEMENT

Energy Management has become crucial to the competitors of the facility. Rising fuel costs coupled with increased global competition is forcing industries/buildings and other facilities to slash energy costs. It was aimed at obtaining a detailed idea about the various end use energy consumption activities and identifying, enumerating and evaluating the possible energy savings opportunities. However, Energy conservation is a continuous process and there is always scope for further improvements. With this objective the Energy Audit team with the active involvement of office we have identified the following Energy Conservation Opportunities (ECO's). Implementation of the ECO's can further help improve the energy

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consumption. The following energy saving/conservation measures were identified for the institute.

Table: List of Energy saving / conservation recommendations

Sr. No.	Recommended Measure
1	Replace the boys and girls hostel ceiling fan with BLDC fan
2	Current is found unbalanced at site, it requires to balance and maintain to within 10%
3	Install VRV during future expansion of HVAC
4	It is recommended to install occupancy sensor in office cabins and toilets to save energy
5	It is observed that a few outdoor lights are fitted with the day light sensor for automation and control of the lights, their number may be increased

Some Energy Saving measure already taken by Institute as listed below:

- The institute has a very clear vision and trying to reduce the energy.
- The solar power plant is on grid which supplies the excess electricity generated in the grid during no or less load condition.
- It was observed that the building has opted the Energy efficient lighting system that is LED which was good option to save energy and we personally felt good to observe it.

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CREDENTIALS

Regn. No. EA-3926 Certificate No. 3996

National Productivity council

National Productivity Council

(National Certifying Agency)

PROVISIONAL CERTIFICATE

This is to certify that Mr. / Ms. Pankaj Chawla

son / daughter of Mr. S D Chawla

has passed the National Certification Examination for Energy Auditors held in November - 2008, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India.

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

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

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

Place : Chennai, India

Date : 24th February, 2009

Controller of Examination

CII

Confederation of Indian Industry

CII-Sohrabji Godrej Green Business Centre

Indian Green Building Council

The Indian Green Building Council

hereby certifies that

Pankaj Chawla

has successfully demonstrated knowledge on the Green Building Design & Construction, Building Standards & Codes, IGBC Resources & Processes and Green Design Strategies & their Impacts, required to be awarded the title of

IGBC Accredited Professional

K S Venkatagiri
Executive Director
CII-Godrej GBC

17-Dec-16

Dr Prem C Jain
Chairman
Indian Green Building Council

161584

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007601

The Institution of Engineers (India)

By virtue of Qualification, Professional training and Corporate Membership of this Institution

PANKAJ CHAWLA

OF

ELECTRICAL ENGINEERING DIVISION

is hereby authorised to use the style and title of

Chartered Engineer [India]

M-1457580

Dated **12-06-2018**

Secretary and Director General

DIRECTOR
PANIPAT INSTITUTE OF ENGINEERING TECHNOLOGY
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Certificate of Successful Completion

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The course meets the training requirements for individuals seeking certification under the IRCA Auditor Certification Schemes

Deputy Director General (Training), BIS

Authorised Signatory: Vyara Stoimenova

Course Dates: 1st –5th February, 2016 *Certificate Number:* 111161

For IRCA Membership Application To Be Made Within 3 Years From Last Day of Course

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